Al Topp Radiation
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HEALTH ENVIRONMENT department

STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION
P.O. Box 968, Santa Fe, New Mexico 87504-0968
(505) 984-0020
Russell F. Rhoades, MPH, Director

TONEY ANAYA
GOVERNOR

ROBERT McNEILL
SECRETARY

ROBERT L. LOVATO, M.A.P.A.
DEPUTY SECRETARY

JOSEPH F. JOHNSON
DEPUTY SECRETARY

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

March 4, 1983

Mr. Thomas M. Hill
UNC Mining and Milling
Church Rock Operations
P.O. Drawer QQ
Gallup, N.M. 87301

Dear Mr. Hill:

In a review of information previously submitted to the New Mexico Environmental Improvement Division, it has been noted that data exists concerning wells designated GW-5 and GW-6. We are aware that information collected from these wells includes TDS, pH, chloride, sulfate, molydbdenum, selenium, total uranium, radium-226, radium-228, thorium-230, aluminum, arsenic, barium, boron, cadmium, chromium, cobalt, conductivity, copper, fluoride, iron, lead, magnesium, manganese, nitrogen (ammonia and nitrate), nickel, silver, sodium, total mercury, vanadium, zinc, and water level analyses. We are aware that the data for GW-5 exists for the period approximately between February of 1977 and September of 1979 and GW-6 for February of 1977 to May of 1979.

This information will be useful in background water quality and other analyses of the hydrology at the Church Rock site. The NMEID requests that this information be submitted as soon as possible.

Sincerely,

Charles Nylander

Charles Nylander
Chief, Water Pollution Control Bureau

CN:RR:jba

cc: William Bennett, EID District I Manager, Albuquerque
Ray Madson, Field Office Milan
Bruce Garber, EID Legal Bureau
Al Topp, EID Radiation Bureau

BEFORE THE

ENVIRONMENTAL IMPROVEMENT DIVISION

STATE OF NEW MEXICO

IN THE MATTER OF:	)
	)
ADMINISTRATIVE HEARING FOR EID	)
DIRECTOR, UNITED NUCLEAR	)
CHURCH ROCK MILL, NM-UNC-MC-	)
6A-02.	)

ENVIRONMENTAL IMPROVEMENT DIVISION MARCH 2, 1983 POST HEARING COMMENTS

UNC submitted two written reports prepared by Billings and Associates, Inc. (B.A.I.) to the hearing record on February 1, 1983. The report, "Effectivness of the 400 Series Wells in Establishing Drawdown in Zone 3 of the Upper Gallup Formation," supports the accompanying report, "Design of a Seepage Control System for Zone 3 (Upper Gallup) Northeast of the North Pond." The latter report proposes the installation and operation of a string of pumping and monitoring wells across the contaminant plume in the vicinity of TWQ-124, as well as the reactivation of the 400 Series of pumping wells to the north. While the NMEID does not consider a cross examination of Dr. Billings on these reports to be required, a discussion of the reports is included in these comments.

UNC also presented verbally at the February 1 hearing a proposal to install and operate a cluster of Zones 1 and 3 pumping and monitoring wells in the vicinity of TWQ-124. This verbal proposal did not include the reactivation of the 400 series of pumping wells.

The intent of including the 400 series in the written proposal may have been to address the long range goal of collection of non-radiological contamination. The NMEID, however, is of the opinion that, for reasons to be discussed below, implementation of UNC's written proposal could well impede achievement of that goal. The following comments are offered on UNC's verbal proposal:

1. Wells 610 (124 reamed), 600, and proposed well 608 should be used in overlooked as a possible seepage collection well. If Gallup 3 were reamed and properly developed, its yield of contaminated fluids might make it a viable component of a seepage pumpback system. Proposed well 608 might be better placed 75 feet further northwest so the well is located closer to the more concentrated portion of the plume. One additional monitoring pumpback well should be located between wells 126 and 127 and one between well 127 and 502A to find more precisely the location of greatest contaminant concentration and flow in Zone 3.

2. Wells 611 (450A reamed) and additional well 612 should be drilled for Zone 1 extraction as outlined in the verbal proposal.

3. In the past, completion and development procedures for many wells at the Church Rock site were not designed with adequate information of the characteristics of the surrounding formation, potentially resulting in well inefficiency. This fact, in addition to low aquifer permeability, may be the reason for low well yields.

   a. The company should investigate the well completion and construction including screen slot size and gravel pack design, for at least 10 other wells in the Gallup Sandstone. This information should be tabulated, assessed, and copies sent to the EID.
   b. The company should investigate the feasibility of using open

boreholes in Zones 3 and 1 of the Gallup Sandstone.

c. The company should investigate well development procedures used by other consulting firms, State or Federal Agencies, and private firms in developing wells in fractured sandstones. The fractures must be developed to obtain maximum yield from these wells.

d. Careful studies of the grain size of sandstones of Zones 1 and 3 should be made in all boreholes prior to selection of screen slot size or gravel pack design if wells with screens and gravel packs are used.

4. To facilitate the assessment of progress toward its goals, UNC should monitor baseline water quality in all wells to be used for extraction purposes. This includes analyses for major cations and anions, nitrate, ammonia, TDS, Th-230, Unat, Ra-226, and Pb-210.

5. To obtain aquifer parameters and characteristics required to determine capabilities and success of the system, aquifer tests should be performed in both Zones 1 and 3. Static water levels should be noted at all pumping and observation wells every day for one week prior to each test to establish baseline data. An intergrated one-month aquifer test should be performed using Zone 3 wells 610, 600, 608, and possibly Gallup 3 (reamed). During the pumping of these wells, nearby Zone 3 and Zone 1 observation wells, including several 400 Series wells, should be monitored for drawdown effects. A second one month test should be performed one month after the end of the first test using pumping wells 611, 612, and possibly a new Zone 1 well near Gallup 3. Wells 448, 505A, 120, 122, 506A and several nearby Zone 3 wells could be used as observation wells. Recovery data should be recorded for one month after each test. These tests will provide important information on aquifer properties, the potential extent of contaminant recapture, and interaquifer communication.

6. During aquifer testing, pH and electrical conductivity of the pumping wells should be taken daily. At the end of each test, all pumping wells should be analyzed for major cations and anions, nitrates, ammonia, TDS, Th-230, Unat, Ra-226, and Pb-210.

7. Recycling collected seepage to the North Pond or Borrow Pit 2 may result in postponing aquifer cleanup indefinitely. Additional seepage through the tailings pile due to the additional head of collected seepage could reduce and even overpower the benefits of collection. Seepage would be somewhat contained, but not cleaned up. UNC should dispose of collected seepage through evaporation in a lined pond or treatment and discharge to surface or ground water. During testing and while a lined pond or treatment facility is being constructed, UNC may temporarily dispose of collected seepage into Borrow Pit 2, which should be neutralized to pH 7.

8. All data collected from the above investigations (sampling, measurements, and aquifer tests) should be analyzed and an interpretive report provided to the NMEID 2 months after the completion of aquifer testing. At this time the company should evaluate the feasibility of the system and propose specific modifications if necessary.

The following comments are offered on the report, "Effectiveness of the 400 Series Wells in Establishing Drawdown in Zone 3 of the Upper Gallup Formation".

9. During the operation of the extraction system, pH and electrical conductivity should be taken weekly. All pumping wells should be sampled for major cations and anions, TDS, nitrates, ammonia, and Th-230 on a monthly basis and reported monthly to the NMEID.

10. B.A.I states on p.4 of the report, "The five months of pumping of the 400 Series wells indicated they could serve as a hydraulic barrier and collection system in their area of influence." While the volume of flow of contaminated liquid to the northeast may have been reduced by pumping the 400 Series, it was not eliminated. Fluids to the east of the 504 wells could not be collected by the 400 Series. In order to completely stop the flow of contaminated liquid across the 400 Series barrier, the natural northeast gradient in the aquifer would have to be reversed. This has not been achieved.

11. B.A.I. continues to p.4 that, due on the pumping of the 400 Series,".....contamination was moved to the eastern end of the 400 Series," Water quality data accumulated prior to the beginning of pumping also indicates that the eastern portion of the 400 Series was contaminated before the Series was pumped.

12. B.A.I. states on p.6, "The piezometric surface on plate 1 indicates a northeast gradient for ground-water flow existed prior to pumping. Flow lines across the piezometric contours indicate that contamination from the North Pond should not be present in the western half of the 400 Series unless the Series is pumped." However, this report does not consider the dispersive properties of an aquifer or structural control of contaminant movement. These aquifer characteristics also determine the direction and movement of the plume and affect whether or not contamination should be present at any particular point in the 400 Series wells. UNC should investigate these aquifer properties and use this information in evaluating the effectiveness of the 400 Series.

13. It is important to recognize that the consultant agrees that the 400 Series wells are not sufficient for total collection and total blockage of flow from the North Pond. It is difficult to determine from existing data how far east of well 504B that Zone 3 is saturated and potentially contaminated. Thus, it can not at this time be determined what percentage of flow from the North Pond can be captured by the 400 Series. UNC should locate additional wells east and northeast of 504B to monitor water levels and water

quality, which could serve as pumping wells if required.

14. The use of the water levels in the pumping wells in the construction of Plate 2, and the depth to water in the pumping wells in the construction of Plate 3, have totally distorted these figures. It is inappropriate and incorrect to use these measurements in the construction of maps of piezometric surfaces or maps of the depth to the water table. These levels represent not only drawdown in the well due to the formation losses but also due to well losses. Well losses should not be considered. These maps are sensitive hydrologic tools to be used to determine aquifer properties and characteristics. Important conclusions which could have been drawn from a proper construction of Plates 2 and 3 have not been included in this report. For example, a major fault lying between wells 402 and 422, which has had an important impact on aquifer response, could not have been inferred from plates 2 and 3 as presented. The plates could also be better interpreted if they were at five (5) foot contour intervals and at a scale of one (1) inch equals 100 feet. Proper interpretation of these figures is essential to understanding the Zone 3 flow system.

15. On pages 12-16, data is presented in tabular form showing changes in TDS and sulfates over the period of pumping the 400 Series. Presentation of pH and other data vs. time, preferably in graphic rather than tabular form, and chemical contour maps at the beginning and end of the pumping record, might stimulate new interpretations of the effectiveness of the 400 Series in reducing contamination. Presentation and analysis of semi-log plots of drawdown and recovery vs. time in some of the 400 Series wells would indicate the rate at which the cone of depression was spreading at the end of the pumping period. and would help to determine the long term pumping cababilities of the Series.

To summarize, the above report indicates that further study is required prior to reactivation of the 400 Series. The 400 Series appears to be a necessary, but not a sufficient, component to a seepage collection system. For a comprehensive understanding of the problem at hand. more knowledge must be gained of dispersive and structural properties of the contaminated aquifer (or aquifers). Additional monitoring wells should be placed to more precisely locate the contaminant plume. Existing data should be organized as requested in comments 14 and 15 above. To reactivate the 400 Series now could interfere with necessary preliminary investigations.

The following comments are offered on the second report, "Design of a Seepage Control System for Zone 3 (Upper Gallup) Northeast of the North Pond":

16. B.A.I., on p.4 of the second report attributes a variation in hydraulic conductivity in the Zone 3 aquifer to variation in grain size of the sandstone. No evidence has been submitted to the NMEID concerning variations in grain size in Zone 3. The NMEID staff has previously requested grain size evaluations and received no information for the area northeast of the North Pond. Data and a technical evaluation should be presented to substantiate claims that a depositional pattern is responsible for variations in hydraulic conductivity of two orders of magnitude.

17. B.A.I. states on p.4 that, "The results of the slug tests performed by Science Applications, Inc., were reanalyzed as errors in the analysis procedure were noted by Billings and Associates, Inc., in the preparation of the report." Without further explanation, this statement casts doubt on the validity of B.A.I.'s transmissivity calculations. UNC should present a report showing the mistakes in the results documented in the Discharge Plan submitted in December of 1980. Also, the assumptions made with the new calculations and the changes made in the derivation of the new numbers should be submitted. It must be pointed out that when wells 9D, 10D, 106, 118, 124, 126, and 127 were drilled, very little was known about the grain size of Zone 3. Thus the construction and development of these observations wells is questionable, as is their use in determining aquifer properties. Drawdown-recovery or step-drawdown tests should be performed to distinguish well efficiency from aquifer properties.

18. B.A.I. states on page 5 of the second report that during the pump test conducted at well 600, "recharge and discharge barriers were encountered. These barriers are indicated by the water level response of observation well 517 and by the response of the pumping well 600." However, since no drawdown was noted in well 518 to the east, there is an indication of anisotropic aquifer conditions. The transmissivity distribution for areas A and B, which appears in Plate 1, may be based on inconclusive data.

19. On page 7 of the second report, B.A.I. introduces Plate 4, which show TDS and sulfate levels at various wells around the seepage plume. Some improtant wells, such as 149, 401, and 148, have been omitted from the d gram; some of the data is outdated, and the restricted use of TDS and sulfates to define the extent of contamination is misleading. The inclusion of most recent data and the data omitted would show contamination is more extensive than Plate 4 indicates.

20. The statement on Page 7,, "Without clear and undebatable background water quality data existing at the UNC site, the determination of the degrees of contamination is based on professional judgement and opinion," is inaccurate. The EID considers analyses from the wells listed in Table 1 below to represent background. The data is contained in various UNC submittals or EID field data on file.

TABLE 1

WELL	AQUIFER
338	Zone 1
122	Zone 1
138	Zone 1
139	Zone 1
140	Zone 1
141	Zone 1
142	Zone 1
143	Zone 1
144	Zone 1
147	Zone 1
151	Zone 1
14K 303	Zone 1 & 3
145	Zone 1
137	Zone 1

UNC needs to examine available data more thoroughly to determine background water quality. Also, other parameters should be used along with TDS and sulfates in background analyses.

21. This report should provide more evidence to indicate that "The northeast extraction system will prevent any additional migration of contamination from the North Pond in this area of known contamination based on current drilling", as stated on page 11. A barrier system must reverse the gradient in order to prevent migration. The test at well as 600 did not demonstrate that this could be accomplished. It is not readily apparent that wells pumping 1 gpm could ever accomplish this task. A proposal such as this needs much more in the way of detailed calculations and analyses to determine its feasibility.

22. There is discussion on page 13 of how the flow system will be altered by the combined pumping of the 400 Series and the proposed system. However, there are no calculations and analyses to show the composite effect and give evidence to the claim. This scenario should not be accepted without more thought and technical support. The proposed 600 pumping series is near and approximately parallel to the Zone 3 subcrop. If pumping of this system continued, the cone of depression would intercept a hydrogeologic boundary. Based on interpretations of the response of the

400 Series and the position of the North Pond, a recharge boundary could be encounted which would affect the aquifer response. There are no long-term aquifer tests in this area to predict how the flow system would change. The data available has not been applied to this problem.

23. Appendices A and B of the second report deal with well construction and development, respectively. In order to avoid gaps in well gravel packing, gravel should be placed with a tremie pipe rather than poured from the surface. To minimize well efficiency losses due to screen clogging, formation grain size at the screened interval of any well should be used to size screen slots.

In summary, before activating the 400 Series, UNC should perform comprehensive, documented investigations of formation characteristics, of well completion and development designs, and of the extent of contamination.

The information derived from these investigations should be used in technical evaluations presented to substantiate the features of a feasible seepage collection design.