

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

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DEPUTY SECRETARY

JOSEPH F. JOHNSON
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

May 23, 1983

Mr. Thomas F. Bailey
UNC Mining and Milling
P. O. Drawer QQ
Gallup, New Mexico 87301

Dear Mr. Bailey:

Enclosed is an Order to Cease and Desist which is a result of the administrative hearing conducted on February 1, 1983. The order results from my finding that United Nuclear Corporation (UNC) has released Th-230 to an unrestricted area in violation of your license and other legal requirements.

The order is based on the record of the hearing of February 1. In particular, I have adopted the summary and conclusions of the hearing officer; and the proposed findings of fact, conclusions of law, and the recommendations of the Division which were submitted to the hearing record.

Should you have any questions concerning this matter, please feel free to contact my office.

Sincerely,

Russell F. Rhoades
Director

Enclosure

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BEFORE THE
ENVIRONMENTAL IMPROVEMENT DIVISION
STATE OF NEW MEXICO

IN THE MATTER OF:)
)
ADMINISTRATIVE HEARING BEFORE)
THE DIRECTOR, UNITED NUCLEAR)
CHURCH ROCK MIL, NM-UNC-ML-GA.)
February 1, 1983)

ORDER TO CEASE AND DESIST

The Director has reviewed the hearing record, including the exhibits, the post hearing submittals, the proposed findings and the briefs submitted by the parties and based on that record finds that:

United Nuclear Corporation (UNC) has released Th-230 to an unrestricted area in violation of Radiation Protection Regulation (RPR) 4-160A and in violation of UNC's license, RPR 3-100, and §§ 74-3-9, 11 and 12 NMSA 1978 and;

It is appropriate under § 74-3-11 A NMSA 1978 and RPR 1-201 to issue this order to cease and desist.

IT IS ORDERED THAT:

1. By June 1, 1983, the licensee shall commence construction of new extraction wells, and modification of existing wells, in conformance with UNC's proposal at the February 1, 1983 hearing (T. 65-67, UNC Exhibit 1) as modified by comments 1, 2 and 3 of the Environmental Improvement Division March 2, 1983 Post Hearing Comments, and more specifically set forth below:

Wells 610 (124 reamed), 600, and proposed well 608 shall be used in a zone 3 seepage extraction system. Gallup 3 shall be reamed and properly developed and used in a zone 3 seepage extraction system. Proposed well 608 shall be placed approximately 75 feet further northwest of the location shown on UNC Exhibit 1. One additional monitoring and pumpback well shall be located in zone 3 within 500 feet of TWQ-124.

Wells 611 (450-A reamed), proposed well 612, and an additional monitoring and pumpback well within 500 feet of TWQ-124 shall be established for Zone 1 extraction.

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

The company shall investigate through field tests and other appropriate measures the feasibility of using open boreholes in Zones 3 and 1 of the Gallup Sandstone and shall employ open boreholes where increased yield of fluids will result.

The company shall investigate well development procedures used by other consulting firms, state and federal agencies, and private firms in developing wells in fractured sandstones. Fractures shall be developed to obtain maximum yield from seepage extraction wells.

Careful studies of the grain size of sandstones of Zones 1 and 3 shall 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.

2. By July 1, 1983, the licensee shall submit complete and detailed proposals to the EID for the ultimate disposal of seepage captured by extraction wells, in conformance with comment 7 of the Environmental Improvement Division March 2.

1983 Post Hearing Comments and UNC Exhibit 11, p. 20. The licensee's proposals shall comply with all applicable statutes and regulations.

3. By July 2, 1983, the licensee shall commence aquifer testing, sampling, and measurements in conformance with comments 4, 5, and 6 of the Environmental Improvement Division March 2, 1983 Post Hearing Comments. Major cations and anions shall be defined as Ca, Mg, Cl, Na, K, CO₃, HCO₃ and SO₄, and field pH shall also be included in the analyses (SWRIC third statement, p. 3). This data should be collected to aid in the interpretation of radiological analyses and to more clearly indicate the success or failure of the seepage extraction system in abating the Thorium violation. At the completion of aquifer testing, the licensee shall commence pumping of seepage extraction wells in conformance with UNC's proposal at the February 1, 1983 hearing (T. 65-67) as modified by paragraph 1 above.

4. By November 15, 1983, the licensee shall complete construction of an ultimate disposal system for captured seepage as submitted under paragraph 2 above and approved by the EID.

5. By December 15, 1983 the licensee shall present an interpretive report analyzing all data collected from the aquifer testing, sampling and measurements required by paragraph 3 above. This report and subsequent quarterly reports shall include an evaluation of the effectiveness of UNC's seepage extraction system, proposal of specific modifications where necessary to achieve and maintain compliance with the New Mexico Radiation Protection Regulations, Part 4, and procedures for ongoing operation and monitoring programs.

6. By January 15, 1984 and quarterly thereafter, the licensee shall implement any modifications in its seepage monitoring, extraction and disposal system necessary to

achieve and maintain continuing compliance with the New Mexico Radiation Protection Regulations, Part 4.



RUSSELL F. RHOADES

Director

Environmental Improvement Division

May 23, 1983

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

RECEIVED

MAR 2 1983

Office of General Counsel
Health and Environment Department

UNC submitted two written reports prepared by Billings and Associates, Inc. (E.A.I.) to the hearing record on February 1, 1983. The report, "Effectiveness 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 a zone 3 extraction system. *Wells 610 and 600 have been 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 integrated 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.
- defining major aquifer*
- a*

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.

*discovery of new
operating procedures*

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 capabilities 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 important wells, such as 149, 401, and 148, have been omitted from the diagram; 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 10, "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

<u>WELL</u>	<u>AQUIFER</u>
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 encountered 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.

UNITED NUCLEAR
CORPORATION

MINING AND MILLING DIVISION
P. O. BOX 3951
ALBUQUERQUE, NEW MEXICO 87110
(505) 345-5661

June 28, 1976

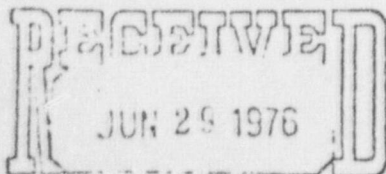
Mr. John Dudley
Water Quality Division
Environmental Improvement Agency
P.O. Box 2343
Santa Fe, NM 87503

Dear Mr. Dudley:

After considerable discussion with you, other members of the Agency, and our hydrological advisors, we wish to present the following additional efforts to protect groundwater at the Churchrock uranium mill.

1. We have considered compaction of clayey fill at certain locations within the tailings pond construction site. We find that such a step will not definitely stop seepage to either the alluvium or the Dilco sandstones under the alluvium. Our estimate of cost is \$300,000 to \$400,000. Because compaction does not adequately protect groundwater even at these costs, we propose not to take this step.
2. We propose to immediately establish the monitor program described in the attached report (SER, June 1976). Said monitor system to be available for sampling by the EIA provided that UNC may request and be given splits of the EIA samples and may be present during EIA sampling and that prior notice of sampling be given by EIA.
3. We hereby agree that should seepage reach the monitor sites at any time up to two years after cessation of mill operations, it will be collected and disposed of in such a manner that it will not contaminate groundwater.

*This commitment incorporated by
reference as condition of NM-UNC-ML-6A-2*



WATER QUALITY SECTION 980413002 288

Mr. Dudley
Page Two
June 28, 1976

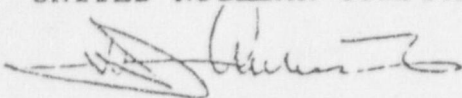
4. Both the seepage collection and the monitor program will be operated for a period of two years after cessation of mill operation. Our estimate of two years to complete the seepage cycle is supported by the effects of our program to cover and revegetate the tailings pile.
5. We will line the small toe dam impoundment, which catches seepage from the toe of the tailings dam with various clay material such as betonite.

We hope that the above program meets with your approval and that you will express your satisfaction to pertinent Agency members so that our mill application may be approved.

If we may provide any further information please let us know as we are anxious to finalize this matter.

Sincerely,

UNITED NUCLEAR CORPORATION



H. John Abbiss
Director - Technical Services

HJA:mc

Enclosure

cc: G.A. Swanquist
D.D. Turberville