UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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Via Facsimile and Certified Mail
Return Receipt Requested

February 13, 2004

40-8907

Mr. Larry Bush, President
United Nuclear Corporation
UNC Holdings 2
State Highway 566
21 miles northeast of Gallup
Gallup, NM 87305-3077

Subject: EPA Comments on the Technical Impracticability Evaluation and Southwest Alluvium Natural Attenuation Test
United Nuclear Corporation Church Rock Superfund Site

Dear Mr. Bush:

The United States Environmental Protection Agency (EPA) has completed its review of the United Nuclear Corporation's (UNC's) submittal entitled "Final Report and Technical Impracticability Evaluation, Southwest Alluvium Natural Attenuation Test, Church Rock Site" (Report), dated November 2002. Based on its review, the EPA has several concerns regarding the Report which must be adequately addressed before the Report will be approved. Enclosed are the EPA's comments.

Please be prepared to discuss the enclosed comments at the upcoming technical meeting in Santa Fe, NM, on February 26, 2004.

If you have any questions, please contact me by telephone at 214-665-6707 or via e-mail at purcell.mark@epa.gov.

Sincerely,

Mark D. Purcell
Remedial Project Manager
Superfund Division

NMSSOI

Enclosure

Mr. Larry Bush
EPA Comments on TI Evaluation and Southwest Alluvium NA Test Report
United Nuclear Corporation Church Rock Site
February 13, 2004

cc: R. Blickwedel, GE
R. Brown, NMED
R.W. VonTill, NRC
D. Malone, Navajo EPA

February 13, 2004

EPA COMMENTS

On the

United Nuclear Corporation's
Final Report and Technical Impracticability Evaluation
Southwest Alluvium Natural Attenuation Test
Church Rock Site, November 2002

General Comments

1. The conclusions regarding natural attenuation are not necessarily supported by the results of the trend analyses provided in the United Nuclear Corporation's (UNC's) document entitled "Final Report and Technical Impracticability Evaluation, Southwest Alluvium Natural Attenuation Test, Church Rock Site" (Report). Although trend analysis is a valid tool for assessing temporal changes in water quality, the predictive value is diminished when hydrologic systems are in a state of flux such as caused by cessation of pumping. Stabilization of water levels does not necessarily imply that the system has reached pre-pumping conditions. Additional time may be needed for chemical equilibrium to be reached, especially where pumping resulted in unsaturated conditions that upon cessation of pumping revert to saturated conditions. Similarly, changes in hydraulic gradient can alter the direction and rate of flow as well as residence times. Changes in storage also occur as water levels rise in the vicinity of the wells that were used for pumping. These changes will likely affect water quality. Additional monitoring data is needed in order to use trend analysis results to predict or evaluate natural attenuation.

   Basically, fluctuations observed during the period over which conditions are stabilizing in response to the pumps being shut down should not be included in the trend analysis if the goal is to predict results of natural attenuation. The graphs of constituent concentrations versus time for many of the wells suggest that geochemical conditions were changing during the period used for post-pumping trend analysis. Estimates of ground-water flow rates provided on page 3-3 also indicate several years may be required for ground water to flow through the site.

2. A spatial analysis should be done as part of the natural attenuation evaluation (e.g., to determine if wells in the vicinity of the pumping wells were affected differently from those farther away; and to identify which wells that would not be

expected to show effects of pumping cessation (or reestablishment of plume migration) given the anticipated flow rates and time frame of the test).

3. Geochemical mechanisms supporting observed and predicted changes in water quality over time and distance should also be included in the assessment. For example, uranium concentrations show increases following cessation of pumping (e.g., figures A-8, A-12, and A-14). Increasing concentrations of ligands such as carbonate and sulfate can increase the dissolved phase uranium concentrations (see reference such as Solutions, Minerals, and Equilibria by Garrels and Christ, 1965). For example, data shown in the Appendix A graphs suggest a positive correlation between sulfate concentrations and uranium concentrations. Likewise, trends should be viewed in conjunction with hydrologic conditions such as precipitation events to ensure that observed patterns, especially when evaluating short-term data sets, are not primarily responses to factors such as increased recharge.

4. Based on the data presented in the Report, the effectiveness of active remediation and natural attenuation cannot be compared. To do so, data must be obtained for a several month (or longer) period following stabilization of the hydrologic system or geochemical models should be employed that have some predictive capability. Increases in the concentrations of uranium and other constituents need to be addressed. Data provided in the UNC's subsequent submittal entitled "*The Results of Statistical Testing for Uranium*," suggest that uranium concentrations decreased as the system stabilized.

5. Low flow rates and rock-water interactions could require several years of more of monitoring to observe effects of the natural system on contaminant levels. One recommendation is that a predictive model of flow and transport of contaminants be constructed to demonstrate natural system influences on uranium, manganese, and other contaminants. A model such as PHREEQC by D.L. Parkhurst (USGS, public domain availability) or other reaction-coupled transport model could meet this objective as well as shedding light on all the natural attenuation processes active in this system (e.g., redox, ion-pairing, rock-water interactions, as well as advection/dispersion/dilution.

6. Statistical analyses should include a determination whether there are no significant differences between the trends (i.e., relative steepness, not just up or down) within a certain confidence interval.

7. The Technical Impracticability (TI) area proposed by UNC for sulfate and total dissolved solids (TDS) on Figure 3-2 only shows the on-property area. UNC needs to discuss its rationale for excluding off-property areas from the TI proposal.

Specific Comments:

1. *Section 2-2, end of first paragraph on page 2-2:*

   The Report states "The stable to declining water levels in these wells indicate that the system has fully recovered." As previously mentioned in the General Comments section, above, stabilization of water levels does not necessarily imply that the system has stabilized with respect to geochemistry.

2. *Section 2-3, page 2-3, regarding discussion of metals:*

   a. What geochemical processes are controlling manganese concentrations? Has the pH or eH changed in response to cessation of pumping? Proposing a mechanism for the observed decreases in manganese concentrations would support the viability of natural attenuation as an alternative to treatment. In the discussion of chloride concentrations exceeding standards, mention is made of Well 623. Data for this well are not included in table 2.2 and the location is not shown on the Report's maps.

   b. Well 509 D should not be used as an example for indicating that manganese levels are decreasing since manganese is higher in this well and has exceeded the cleanup standard over the last year.

3. *Section 2.4 - Statistical Evaluation, page 2-4, third paragraph:*

   a. UNC states "...most of these trends indicate an improvement in water quality..." Based on the graphs of constituent concentrations over time (Appendix A), the claim that trend analysis indicates an improvement in water quality isn't readily apparent. For example, sulfate concentrations in well EPA 25 show no statistically significant trend for the post-pumping period but the overall concentration appears to have increased when compared to data obtained during pumping. Trends observed when the hydrologic system is responding to the cessation of pumping do not necessarily have predictive value.

   b. UNC also states "... concentrations of most of the constituents remain within the range of concentrations that is observed in the baseline data." A comparison of before and after concentrations might be a better way to describe improvement but comparing the post-pumping data to the full range of data collected during pumping isn't necessarily a valid way to claim improvement. It would be better to compare the post-pumping data

with more recent pumping data, rather than the range over the full period, to account for temporal changes in concentration associated with mitigation efforts as described on page 3-10.

4. *Section 2.4 - Statistical Evaluation, page 2-5, second paragraph:*

The statement "...the data from the final quarter demonstrate three main features in the trends:" is unclear. Does this mean that the subsequent interpretation of trends in constituent concentrations was only based on the most recent three months of data?

5. *Section 2.4 - Statistical Evaluation, page 2-5, Item 1. - Increase in Upward Trends for Bicarbonate, Chloride, and TDS:*

Interpretations provided in this section are confusing. Does this section refer to an increase in the overall number of statistically significant upward trends for these constituents or to the difference in concentration before and after pumping, or to the last quarter of data? For example, Figure A.5 suggests an increase in bicarbonate concentrations after pumping but the trends both before and after the pumps where shut down are not increasing. Patterns for well 802 (Figure A.6) does support the change from declining concentrations in bicarbonate and TDS concentrations to increasing concentrations associated with the end of pumping. However, the nonlinear relation between chloride concentration and time makes it difficult to interpret trend analysis results and, looking at the data for the final quarter, suggests a declining trend in concentration.

6. *Section 2.4 - Statistical Evaluation, page 2-6, Item 3. - No change for the trends for Manganese, Chloroform, or Uranium:*

   a. UNC states "The patterns of trends for manganese, chloroform, and uranium in the test data are similar to those in the baseline data and have remained unchanged throughout the test period." The Appendix A graphs of manganese concentrations for Wells 801and 803 show decreasing trends following cessation of pumping in contrast to increasing trends. Although the direction of the trend did not change after pumping stopped, the rate of increase in uranium concentrations in wells 802, 803, GW1, GW2, and GW3 is greater than during the period of pumping. The greatest uranium concentrations were measured after pumping stopped in several wells. This does not appear to support the statement that natural attenuation rather than pumping controls concentrations.

   b. UNC also states "The lack of change in trends for these constituents confirms that natural attenuation mechanisms...are controlling

concentrations". On the previous page (p. 2-5), it is stated "the reversal in the chloride trend may indicate that the seepage front that was moving in response to shutting off the pumps has begun to stabilize". This statement implies that the system had not stabilized during much of the post-pumping analysis upon which trend analysis was based. In order to use trend analysis to predict concentrations resulting from natural attenuation processes, the data used in the analysis should be from a period during which the system had stabilized.

7. *Section 3.3.2, page 3-4, last sentence of first paragraph:*

What is the mechanism for attenuation of radionuclides?

8. *Section 3.3.2, page 3-4 last paragraph:*

The Report states "the seepage is migrating at a rate of 77 feet per year." Specify if this rate is estimated for the period of pumping or after the pumps where shut down? Changes in hydraulic gradient due to pumping might affect flow rates.

9. *Page 3-8, table showing median concentrations for seepage impacted and unimpacted water.*

   a. Please clarify which wells are included in these groups and how many samples were used to determine the median value.

   b. This table depicts the median concentration for sulfate in both seepage-impacted water and unimpacted water is 2,480 mg/L. However, levels of sulfate shown in Figure 3-2 appear to indicate that the median concentration for unimpacted water should be lower and concentration for impacted water should be higher. Please verify and revise the figure accordingly.

10. *Page 3-12:*

   a. In the second paragraph, UNC states "The test demonstrates that the tailings seepage is naturally attenuated by the alluvium and that active remediation is no more effective than the natural system in controlling migration of constituents of concern." As stated in the General Comments, above, the EPA believes that such a conclusion has not been adequately demonstrated by UNC.

   b. In the third paragraph, UNC states "...Overall, sulfate concentrations actually exhibited a decreasing trend during the NA test." However, several of the wells downgradient from the spoil area actually show increases in sulfate concentration (*see* Appendix A graphs for GW-1,

GW-3, 632, 802 and others). Even some of the wells that showed decreasing trends for sulfate after pumping was terminated, appeared to have higher sulfate concentrations after pumping ceased than during the period immediately prior to stopping the pumps. Because the wells downgradient of the pumping wells are the ones most likely to be affected by pumping, the changes in contaminant concentrations at those wells should be most likely to indicate the changes anticipated from natural attenuation. Thus, it would be more representative to assess overall changes in the downgradient wells.

c. In the third paragraph, UNC also states "The other regulated constituents exhibited no change in trend." Uranium concentrations appear to have increased in the magnitude of trends and in concentration after pumping was stopped in several downgradient wells.

11. *Section 3.4.3 – Restoration Timeframe Analysis, page 3-15, first paragraph:*

In the last sentence, UNC states "Essentially the restoration is already complete, and any further reductions in sulfate concentrations will be determined by the chemical equilibrium within the saturated Southwest Alluvium." The EPA believes such a conclusion is premature since it is not adequately supported by the results of the trend analyses provided by UNC in this Report.

12. *Figure 3-13 - Attenuation of sulfate by natural processes:*

Are there any processes other than dilution/dispersion and gypsum precipitation that have contributed to the decrease in sulfate concentrations?

13. *Section 4.0 - Summary and Conclusions, page 4-1, paragraph 1:*

The first sentence states "The results of the natural attenuation test demonstrate that turning off the extraction wells does not have and adverse effect on water quality." This statement is not well supported by the Appendix A graphs, especially for the wells downgradient from the pumping wells. In addition, chemical equilibrium may not have been reached during the post-pumping data collection period.

14. *Appendix B – Table B.7:*

The Baseline Trend reported for Mn, U, and chloroform is different from the baseline trend reported in December 2001 and February 2002. Please explain the reasons for the differences.

15. *Results of Statistical Testing* *Well 803 Uranium Concentration*

The results of statistical testing were provided to the EPA during its performance of the Five-Year Review and included data collected after the Report was prepared and submitted. The uranium concentrations presented for Well 803 indicate that uranium concentrations are declining after an initial post-pumping increase. The large variability in constituent concentrations following the pumping period is associated with stabilization of hydrologic and geochemical conditions. However, this variability contributes to a large standard error, which makes it difficult to ascertain statistically significant trends. This is also illustrated by the large variance exhibited in the impacted wells, which makes determination of statistically significant differences unlikely. The EPA believes that data collected prior to stabilization needs to be excluded from the statistical comparisons.