GE Corporate
Environmental Programs

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March 10, 2006

Mark Purcell
Superfund Division (6SF-LP)
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: United Nuclear Corporation Church Rock Site
Gallup, New Mexico
Docket 40-8907

Dear Mr. Purcell:

Please find enclosed for your information a copy of a document entitled: *Regulatory significance of the Occurrence and Distribution of Dissolved Uranium in Groundwaters of the Southwest Alluvium, Church Rock Site, New Mexico.* It was prepared to assist USEPA in deliberations about applying the current maximum contaminant level (MCL) for uranium as a formal cleanup criteria in the Southwest Alluvium target area at the Church Rock National Priority List (NPL) site.

As of September 1997 United Nuclear Corporation became a wholly-owned, indirect subsidiary of General Electric Company. GE Corporate Environmental Programs has been retained through a separate administrative services agreement to assist United Nuclear both technically and administratively with environmental issues at the Church Rock site. Please contact me if you have any questions.

Sincerely,

Roy S. Blickwedel

Roy S. Blickwedel
Remedial Project Manager

cc: Larry Bush, UNC
Paul Michalak, NRC
Mark Jancin, N.A. Water Systems

Enclosure

REGULATORY SIGNIFICANCE OF THE OCCURRENCE AND DISTRIBUTION OF DISSOLVED URANIUM IN GROUNDWATERS OF THE SOUTHWEST ALLUVIUM, CHURCH ROCK SITE, NEW MEXICO

by
Roy S. Blickwedel
General Electric Company

1.0 Purpose and Scope

The cleanup objective for uranium in groundwater at the Church Rock site was established in the 1989 Record of Decision (ROD) to be 5 mg/L, which was the New Mexico water quality standard. The Nuclear Regulatory Commission (NRC) adopted a uranium concentration of 0.3 mg/L as the groundwater protection standard for the Church Rock Source Materials License. It is the NRC groundwater protection standard that currently drives cleanup goals at Church Rock because it is the more stringent of the two standards.

USEPA established a maximum contaminant level (MCL) for uranium in 2003, at a concentration of 0.03 mg/L. While EPA has not formally revised the Church Rock ROD to incorporate either of the lower values, a revision is under consideration. This technical report considers the adoption of the new MCL and its effect on groundwater corrective actions in the Southwest Alluvium.

2.0 Background

Groundwater corrective actions in the Southwest Alluvium at Church Rock were intended to remediate the impact of tailings-seepage from the Church Rock mill tailings impoundments. A map of the tailings cells and the region impacted by tailings-seepage is shown in Figure 1. The Southwest Alluvium is a narrow band of unconsolidated sediments that borders Pipeline Arroyo, eventually joining with the Rio Puerco several miles to the south. The U.S. Environmental Protection Agency (USEPA) believes that some saturation existed in the alluvium in the site vicinity prior to mining (ROD, 1989); just how much or how little has not been determined by USEPA or others. This investigator is not aware of any direct evidence of the existence of a natural, pre-mining zone of saturation in the Southwest Alluvium near the site.

Whether or not a pre-mining water table existed, USEPA has correctly concluded that mine water infiltration produced artificially high water tables. It is known and accepted that mine dewatering operations from two mines discharged approximately 3000 gpm to Pipeline Arroyo from 1969 to 1986, and that a significant amount of that water infiltrated into the Southwest Alluvium. The infiltrated mine water has been draining out of the alluvium ever since mine water discharges ceased, as is evidenced by a steadily lowering

water table elevation (N.A. Water Systems, December 2005). There has not been a contention that mine water discharges adversely affected a pre-existing aquifer; and in fact, for the purposes of EPA's remedy decision, the post-mining/pre-tailings water quality is the established background condition. Tailings-seepage was later superimposed on the post-mining/pre-tailings water, and it is the tailings-seepage water that is subject to CERCLA remediation and a Nuclear Regulatory Commission (NRC) Source Materials License.

Tailings fluids are made up in large part by strong, sulfuric acid; however, the alluvial materials through which the tailings fluids leaked have a strong acid neutralizing capacity owing to the presence of calcite. By the time that the low-pH tailings fluid reached and co-mingled with the post-mining/pre-tailings water, it had a neutral pH and high alkalinity (Earth Tech, 2002) via the reaction:

$$\underset{\text{(calcite)}}{CaCO_3} + \underset{\text{(sulfuric acid)}}{H^+ + SO_4^{=}} + \underset{\text{(water)}}{2H_2O} \longrightarrow \underset{\text{(gypsum)}}{CaSO_4 \cdot 2(H_2O)} + \underset{\text{(bicarbonate)}}{HCO_3^-}$$

Geochemical calculations verified that seepage-impacted water is in equilibrium with calcite and gypsum (Earth Tech, November 2002).

3.0 Data Presentation

Figure 2 is a plot of the analytical results for dissolved uranium in the Southwest Alluvium groundwater for all available monitoring wells since the remedy was implemented in 1989. The uranium analyses are plotted in relation to their associated alkalinity values for reasons that will be discussed shortly. Open symbols represent post-mining/pre-tailings analyses; solid symbols are from wells that contain seepage-impacted groundwater. There are several reports that explain how the waters are designated into one or the other category; the reader is referred to N.A. Water Systems (December, 2005 and February, 2006) for the most recent examples from the 2005 Annual Report and a proposed Source Materials License amendment for radium, respectively. Figure 3 is the same data, grouped solely into the post-mining/pre-tailings or seepage-impacted categories. Polynomial trend lines have been fit to each data set in Figure 3.

There are two important observations that can be made from a quick inspection of Figures 2 and 3. First, post-mining/pre-tailings waters occupy a relatively narrow range of alkalinity that is less than 1000 mg/L, and the uranium concentrations are fairly insensitive to alkalinity as exemplified by the shallow trend. Second, seepage-impacted waters exhibit a range of uranium concentration similar to that of the background waters, but the uranium concentrations are more sensitive to the higher and more variable alkalinity values. Several linear regression lines are also plotted on Figure 2 to illustrate that the relationship between dissolved uranium and alkalinity may be within wells as well as between them.

There also tends to be distinguishable, albeit overlapping regions that each well occupies on the uranium versus alkalinity plot in Figure 2. To remove some of the clutter for better visual representation, a plot showing only the average alkalinity and uranium value for each monitoring well is shown in Figure 4a and 4b. The dependence of uranium concentration on alkalinity between wells becomes even more striking. In Figure 4a, separate trend lines are shown for post-mining/pre-tailings waters (lower, light-weight line) and seepage-impacted waters (upper, heavy-weight line). In Figure 4b the four post-mining/pre-tailings wells that are furthest upstream (642, 644, 645, and 639) have been removed. Their removal reveals an even clearer association between alkalinity and dissolved uranium in the immediate site vicinity that is independent of water type (i.e. post-mining/pre-tailings background or seepage-impacted conditions).

To better illustrate the "within well" relationship between dissolved uranium and alkalinity, Figures 5 and 6 show plots of dissolved uranium and alkalinity versus time for wells EPA-25 and GW-1, respectively. As alkalinity varies so too does the dissolved uranium concentration. Other wells show similar patterns or have maintained steady alkalinity and uranium concentrations over time.

4.0 Geochemistry

The relationship between alkalinity and dissolved uranium concentrations in the data is not surprising. Uranium is most soluble in its hexavalent form, and in the presence of carbonate, it predominately forms soluble uranyl-carbonate complexes. Thus it can be said that alkalinity will enhance the ability of an aqueous solution to maintain uranium in a dissolved form. An example of this principle is found in the practice of solution mining for uranium. It is common practice in such in-situ leach mining operations to inject carbonate-rich solutions (along with oxidants that convert U_{IV} to U_{VI}) to enhance the dissolution and uranium-carrying capacity of the lixiviant solutions (U.S. Geological Survey, June 2005).

In Figure 7, MINTEQ (USEPA, 1991) simulations are shown for a theoretical solution that is equilibrated with an assemblage of calcite; gypsum; and the common, secondary uranium mineral schoepite. The sensitivity of dissolved uranium concentration to alkalinity is readily apparent. This example is meant to illustrate the principle that the dissolution of uranium-bearing minerals is favored by higher alkalinity; it is not meant to suggest which uranium-bearing phases may be present or to predict the aqueous concentration of uranium in the Southwest Alluvium. When comparing Figure 7 to Figure 2, it can be seen that the magnitude of the uranium concentration changes as a function of alkalinity are similar between the MINTEQ simulations and the observed data, but their absolute concentrations are orders-of-magnitude different. This is not unexpected considering that MINTEQ assumes an infinite supply of solids in a closed system, whereas the Southwest Alluvium is an open system that is not likely to contain significant uranium mineralization. Similar results occur for a variety of other uranium-

bearing minerals; and as an accepted principle, it can be said that higher alkalinity solutions favor higher dissolved uranium concentrations in the presence of uranium-bearing solids.

In addition, solutions with greater alkalinity lower the capability of materials to adsorb uranium. Pacific Northwest National Laboratories (July 2005, Figure 2.26) report studies that show the hexavalent uranium distribution coefficient (K_d) as a function of alkalinity. Alkalinity favors the partitioning of uranium from the adsorbed phase to the aqueous phase because it lowers the K_d. Adsorption processes in the open system of the Southwest Alluvium are likely to be more important than dissolution reactions. The Southwest Alluvium certainly has no primary uranium mineralization given its origin by clastic deposition. There may be some secondary mineralization as uranium-bearing solutions from mine dewatering permeated the alluvium. It is probable that sorption processes would occur, and as we shall see below, some combination of adsorption and/or precipitation is necessary to explain the observed reductions in uranium concentration as mine water discharges carrying up to 2mg/L uranium migrated through the alluvial materials. While mineral dissolution and sorption reactions can both account for the magnitude of dissolved uranium variation as a function of alkalinity, sorption-desorption reactions might perhaps better explain the absolute changes in uranium concentration with alkalinity.

5.0 Discussion

Referring again to Figure 2 and 3, the bulk of dissolved uranium concentrations are less than the NRC groundwater protection standard for uranium, but they are usually greater than the new MCL. This is true for both post-mining/pre-tailings samples as well as seepage-impacted samples. Applying the new MCL to the groundwater corrective program in the Southwest Alluvium therefore requires much more than a simple replacement of the old value with the new one. The proper cleanup value to be applied should drive the cleanup of seepage-impacted water, but it should not drive an unnecessary or unwanted cleanup of post-mining/pre-tailings water. The ROD-selected remedy, groundwater pumping and evaporation, would result in the attainment of the new uranium MCL only upon the removal and evaporation of all of the water (both the post-mining/pre-tailings and seepage-impacted) in the alluvium.

The post-mining/pre-tailings water exhibits the same overall range in uranium concentration as seepage-impacted water despite there being much less variation in alkalinity among the post-mining/pre-tailings water samples. A close inspection of the data in Figures 2 and 3 compared to the well locations shown in Figure 1 suggests that for post-mining/pre-tailings water, uranium concentrations tend to decline with distance down and away from the arroyo. Well 639 is the furthest upstream, and the closest to the arroyo, and has the highest uranium concentration. Wells EPA-22A and EPA–25 are intermediate in location and concentration; while wells EPA-27 and 627 are the furthest downgradient and the furthest from the arroyo centerline, and contain the lowest

background uranium concentrations. There are exceptions; however, the evidence indicates that, in general, there are processes occurring that tend to remove some uranium from solution as the mine water discharge seeped into the alluvium and moved along and away from Pipeline Arroyo.

Attenuation of uranium has definitely taken place because releases of mine water to Pipeline Arroyo were permitted for uranium concentrations up to 2 mg/L and post-mining/pre-tailings groundwater contains no more than about 0.3 mg/L of uranium. NPDES permit documentation and some example water analyses for the Northeast Church Rock Mine, its post-IX plant discharge, and surface water quality analyses in Pipeline Arroyo (upstream and downstream of the site) are contained in Appendix A. While the precise mechanisms of attenuation are not known, for the purposes of this report it is important to understand that such mechanisms must have reduced the original uranium concentrations from the mine water discharge; otherwise, there would be higher concentrations of dissolved uranium in the Southwest Alluvium groundwater. It is likely that attenuation occurs via precipitation and/or adsorption because there is very little natural recharge and no on-going tailings-seepage (U S Filter, January 2004) for mixing to be significant.

In the part of the Southwest Alluvium where post-mining/pre-tailings waters were invaded by higher-alkalinity tailings-seepage fluids (Figure 8), the resultant solutions have once again become capable of carrying higher uranium loads via aqueous complexation between uranium and carbonate. The net result is that uranium concentrations in seepage-impacted groundwater may attain levels that are equivalent to those of the post-mining/pre-tailings groundwater. There is no indication that additional uranium loading to the southwest Alluvium is occurring via the tailings-seepage (i.e. more loading than has taken place from the mine water discharge); rather it is the alkalinity of the seepage-impacted water that determines how much uranium will be partitioned between the aqueous and solid phase. At low alkalinity, the uranium concentration in seepage-impacted water mimics the lower attenuated concentrations of the post-mining/pre-tailings water. At high alkalinity, the uranium concentration in seepage-impacted water mimics the higher concentrations of the post-mining/pre-tailings water.

6.0 Conclusion and Recommendation

In conclusion, a primary source of uranium loading to the Southwest Alluvium was the permitted mine water discharges. Up to 2 mg/L of dissolved uranium infiltrated from mine water discharge into the Southwest Alluvium. Attenuation of the uranium has taken place, and the concentration of uranium in post-mining/pre-tailings water typically ranges from a little less than 0.01 to slightly more than 0.3 mg/L in waters that exhibit fairly uniform alkalinity. Tailings seepage resulted in the introduction of higher alkalinity solutions into the Southwest Alluvium groundwater. Remobilization of the uranium is facilitated by aqueous complexation between uranium and carbonate species. The

concentration of dissolved uranium in seepage-impacted groundwater is a function of the alkalinity, and has been empirically found to lie within the same concentration range as the post-mining/pre-tailings water.

A decision to adopt the new MCL for uranium as a cleanup objective for the Southwest Alluvium groundwater would be have to be modified for site-specific conditions because background uranium concentrations approach the existing groundwater protection standard set by the NRC. If not adjusted to take into consideration the character of post-mining/pre-tailings water and the geochemistry of uranium in the Southwest Alluvium, the adoption of the new MCL would result in the complete dewatering of the saturated part of the Southwest Alluvium, both seepage-impacted and non-impacted waters, in an ill-fated attempt to attain the new MCL. This was not the intent of the ROD or its selected remedy. In fact the ROD anticipated reaching the point when no further improvement in groundwater quality could occur for most regulated constituents, and it contains provisions to cease active groundwater recovery. The NRC confirmed the limitations that were espoused in the ROD in their technical re-evaluation of background water quality and other processes that limit remedy performance (NRC, 1996). Annual Reports for the past several years present data that verify the technical limitations that were recognized in the ROD; the reader is referred to the most recent annual report by N.A. Water Systems (December 2005).

An alternative remedial approach would involve acidifying alluvial groundwater to reduce alkalinity, but this would trigger other undesirable consequences such as the mobilization of heavy metals. It is not recommended.

The recommended approach is to continue applying the technical principles that were stated in the ROD. USEPA should adopt a cleanup standard that takes into account the full range of post-mining/pre-tailings water quality, and the geochemical reactions that take place independent of any uranium that might have been contributed by the tailings-seepage. In practical terms, the revised standard could essentially be lowered from the current value of 5 mg/L to the 0.3 mg/L groundwater protection standard that was established by NRC in the Source Materials License. For the Southwest Alluvium, the NRC groundwater protection standard is consistent with the expressed objectives of the ROD, which were specifically directed at remediating tailings-seepage. This recommendation also brings the EPA and NRC cleanup standards into agreement.

7.0 References

Earth Tech, November 2002, Final Report and Technical Impracticability Evaluation, Southwest Alluvium Natural Attenuation Test, Church Rock Site.

N.A. Water Systems, December 2005, Annual Review Report – 2005 Groundwater Corrective Action, Church Rock Site, Church Rock, New Mexico.

N.A. Water Systems, February 2006, Technical Analysis Report in Support of License Amendment Request for Changing the Method of Determining Exceedances of the Combined Radium Groundwater Protection Standard in Source Materials License SUA-1475, Ground Water Corrective action Program, Church Rock Site, Church Rock, New Mexico.

NRC, June 1996, Evaluation of the Statistical Basis for Establishing Background Levels and Remediation Standards at the United Nuclear Corporation Church Rock Uranium Mill Tailings Disposal Facility, Gallup, New Mexico.

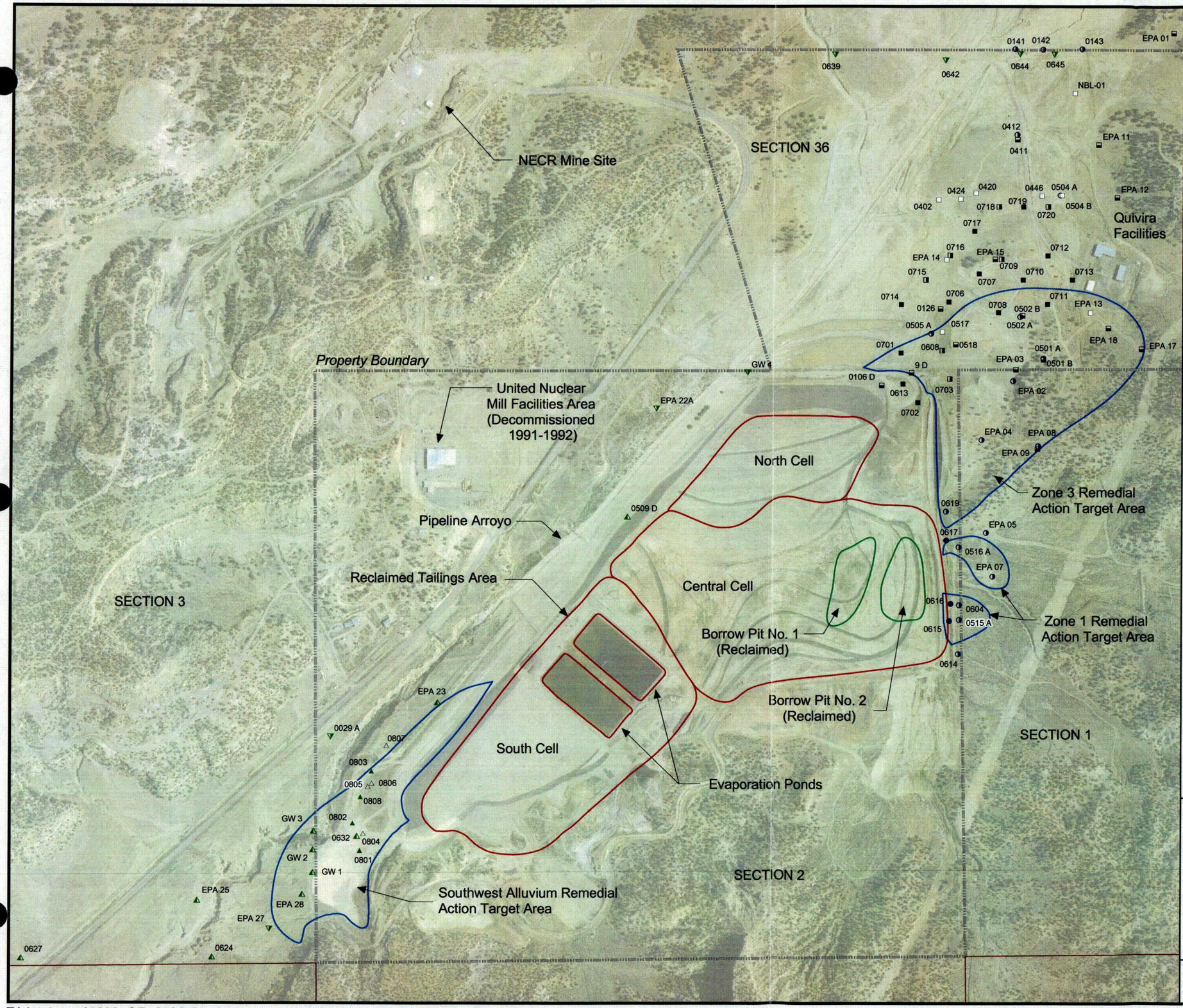
Pacific Northwest National Laboratories, July 2005, Uranium Geochemistry in Vadose Zone and Aquifer Sediments from the 300 Area Uranium Plume: U.S. Department of Energy, PNNL-15121.

USEPA, 1991, MINTEQA2/PRODEFA2, A geochemical assessment model for environmental systems: Version 3.0: USEPA Office of Research and Development, EPA/600/3-91/021.

U S Filter, January 2004, Rationale and Field Investigation Work Plan to Evaluate Recharge and Potential Cell Sourcing to the Zone 3 Plume, Church Rock site, Gallup, New Mexico.

U.S. Geological Survey, June 2005, Consideration of Geochemical Issues in Groundwater Restoration at Uranium In-Situ Leach Mining Facilities; U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, NUREG/CR-6870.

FIGURES



Legend

Southwest Alluvium

- Idled Extraction Well
- Monitoring Well
- Water Level Monitoring Well
- Dry Monitoring Well

Zone 3

- Idled Extraction Well Used for Monitoring
- Decommissioned or Idle Extraction Well
- Monitoring Well
- Dry or Decommissioned Monitoring Well

Zone 1

- Decommissioned Extraction Well
- Decommissioned Monitoring Well
- Monitoring Well

0 400 800 1,600
Feet

FIGURE 1

Site Layout and Performance Monitoring Well Locations 2005 Operating Year

United Nuclear Corporation Church Rock Site, Church Rock, New Mexico

NA WaterSystems

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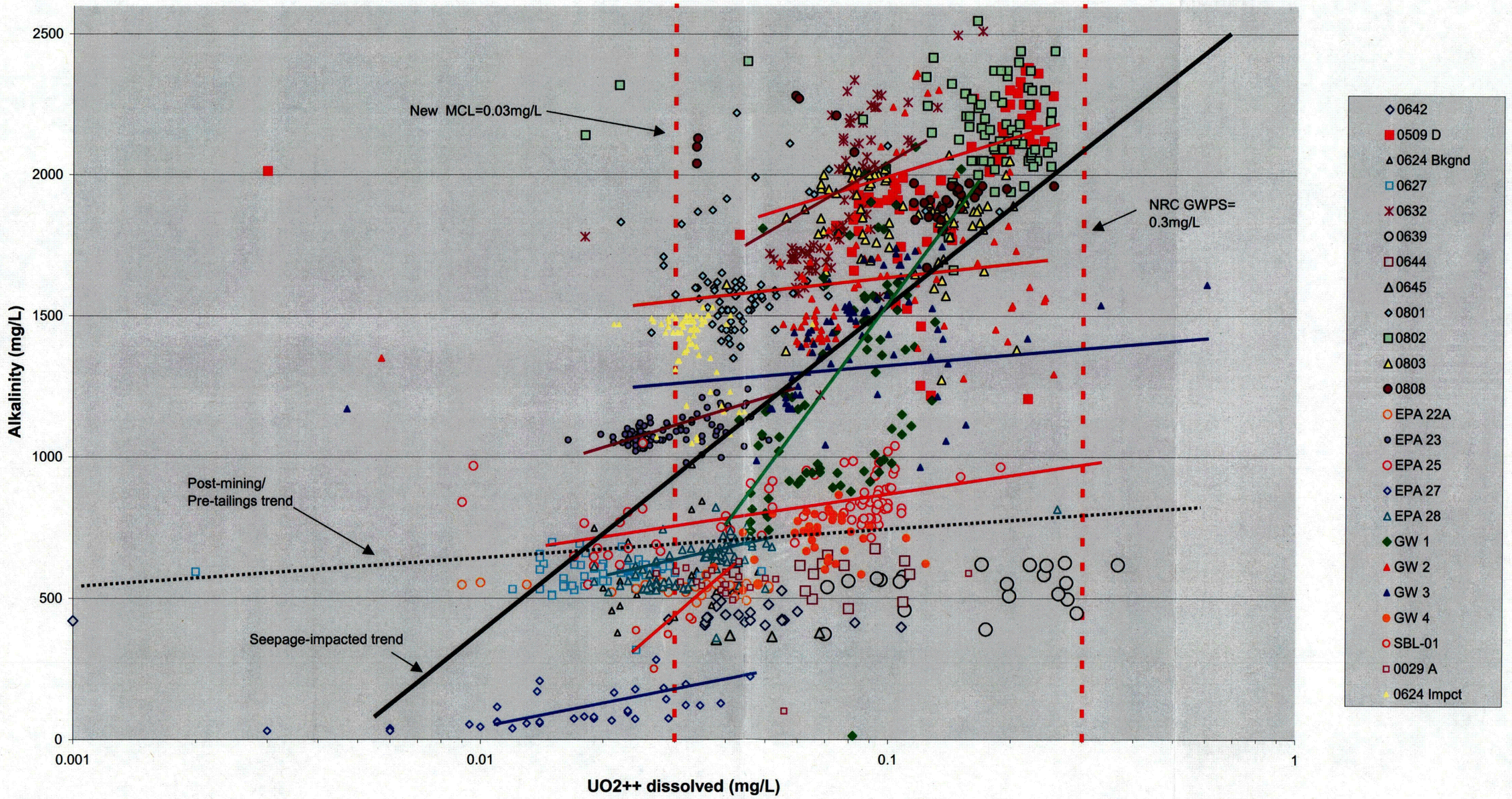
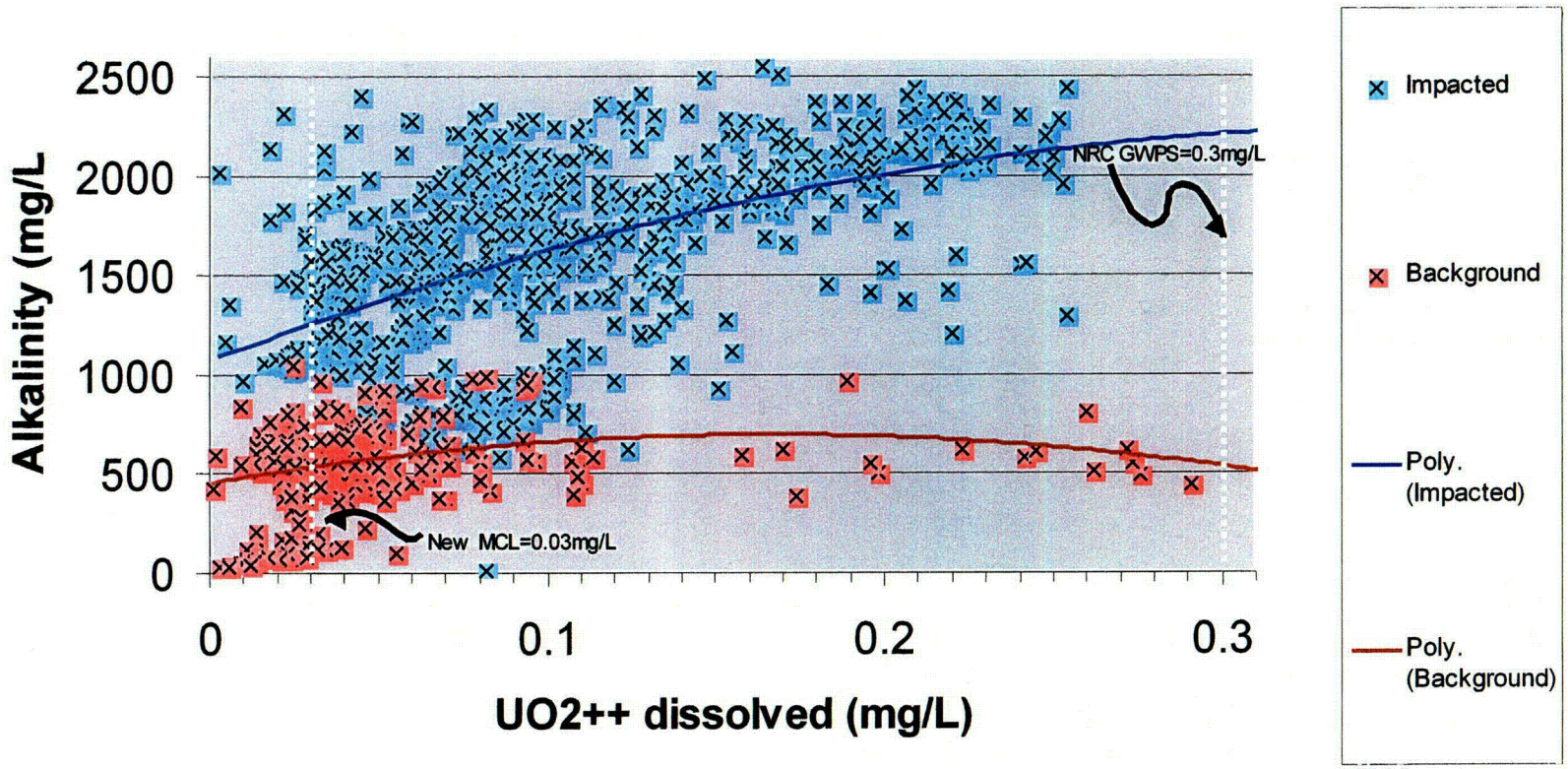
C1

FIGURE 2
Dissolved Uranium vs Alkalinity
Southwest Alluvium



C2

Figure 3. Dissolved Uranium vs Alkalinity for Impacted and Background Water in the Southwest Alluvium



C3

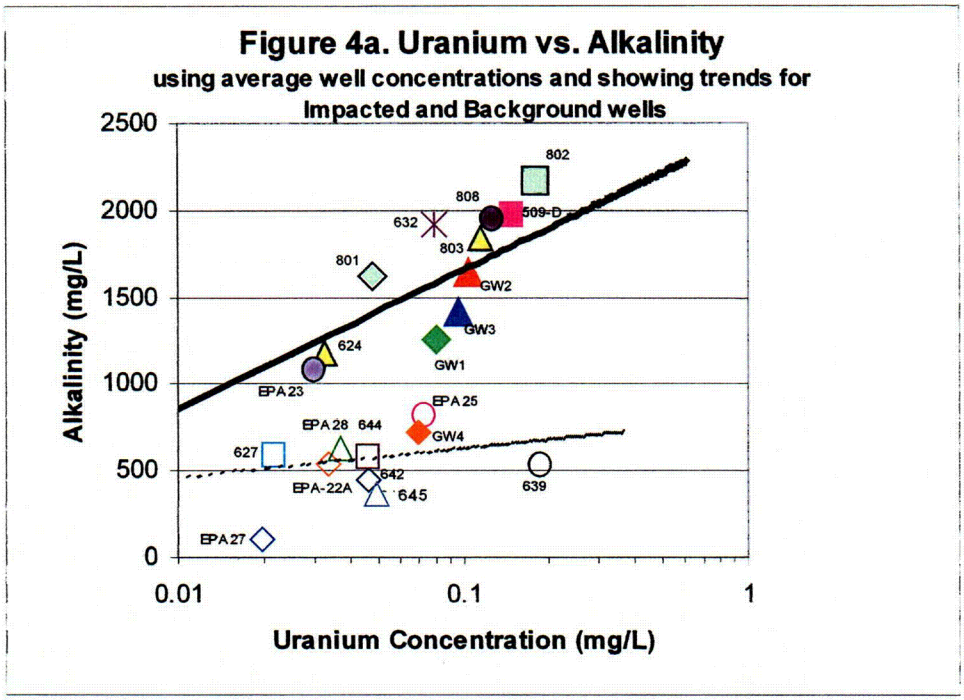


Figure 4a. Uranium vs. Alkalinity
using average well concentrations and showing trends for Impacted and Background wells
Alkalinity (mg/L)
Uranium Concentration (mg/L)
2500
2000
1500
1000
500
0
0.01
0.1
1
802
808
509-D
632
803
801
GW2
GW3
624
GW1
EPA23
EPA25
EPA28
644
GW4
627
642
EPA-22A
645
639
EPA27

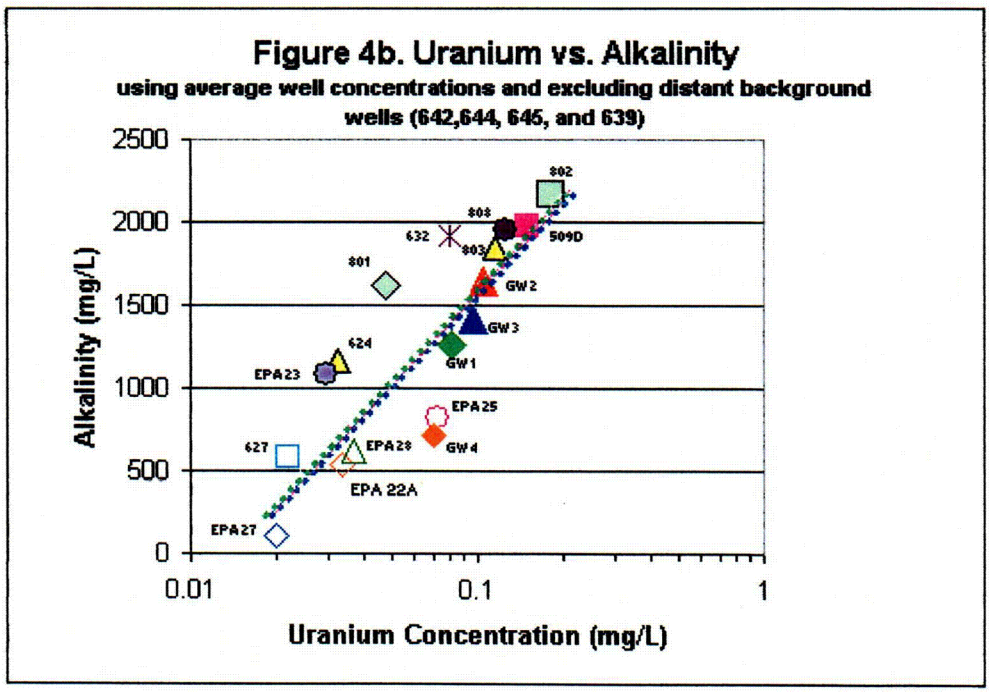
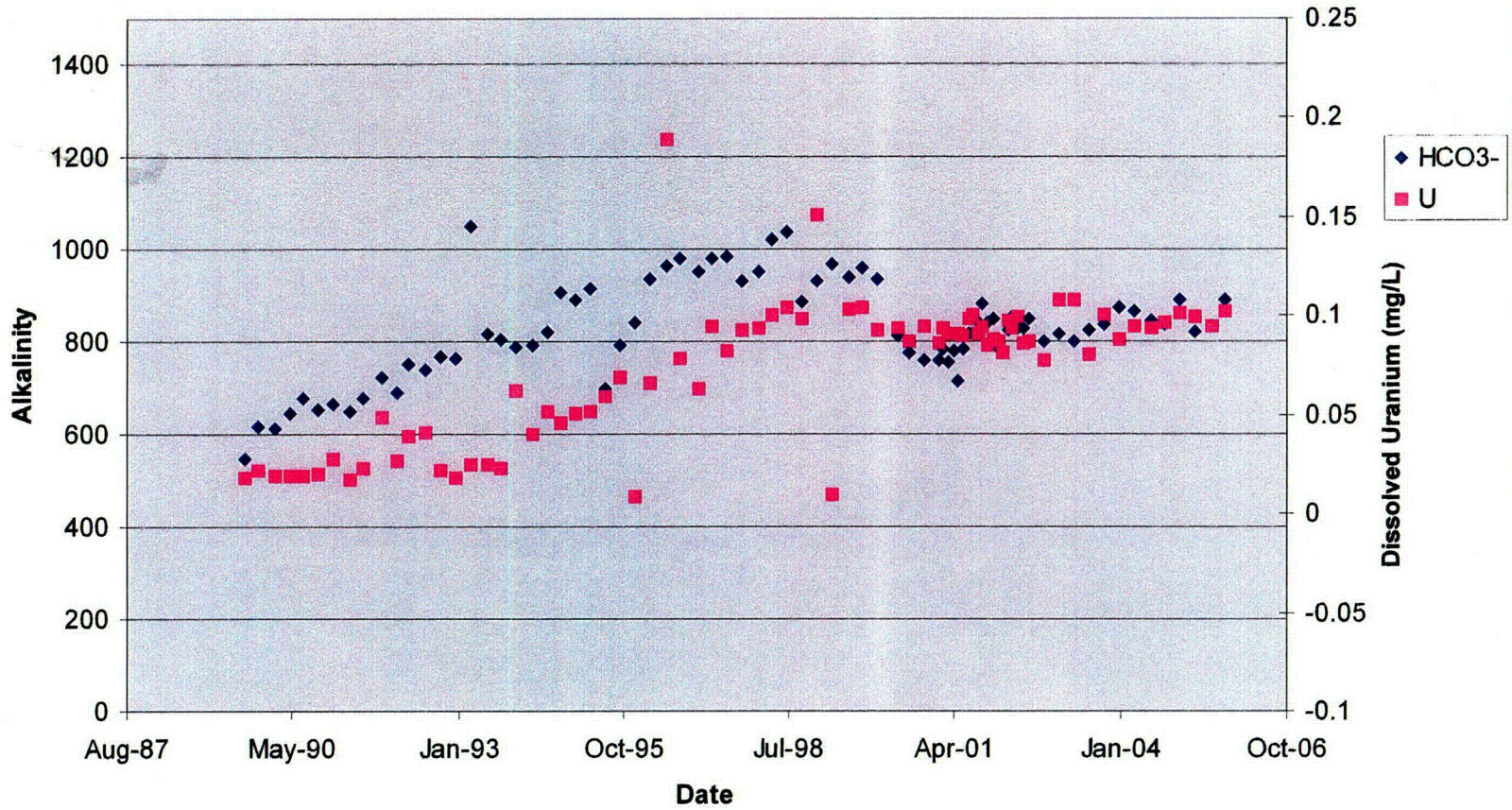


Figure 4b. Uranium vs. Alkalinity
using average well concentrations and excluding distant background wells (642,644, 645, and 639)
Alkalinity (mg/L)
Uranium Concentration (mg/L)
2500
2000
1500
1000
500
0
0.01
0.1
1
802
808
509D
632
803
801
GW2
GW3
624
GW1
EPA23
EPA25
627
EPA28
GW4
EPA 22A
EPA27

C4

Figure 5. EPA 25 - Uranium and Alkalinity variation with Time



65

Figure 6. GW 1 - Uranium and Alkalinity Variation with TIme

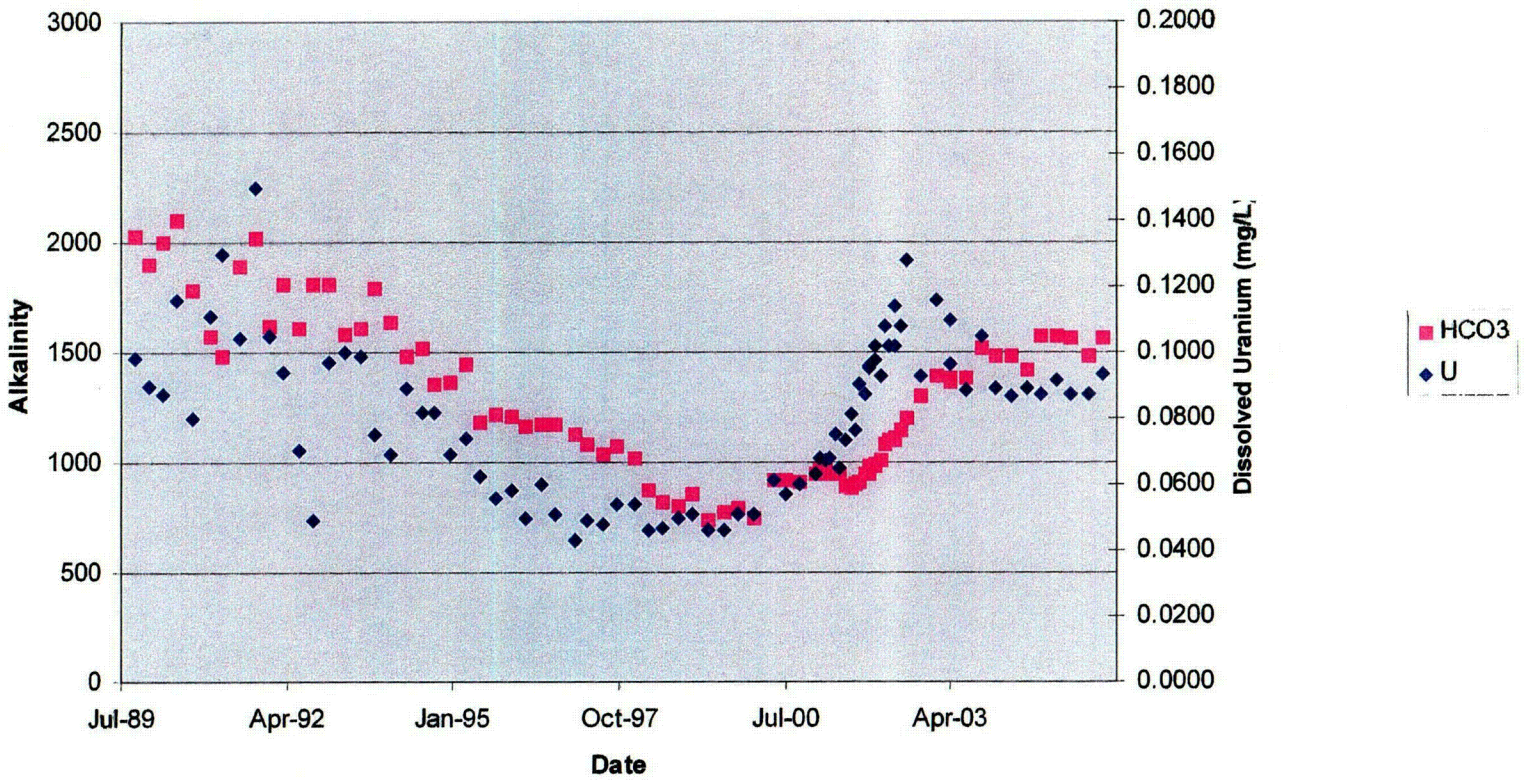


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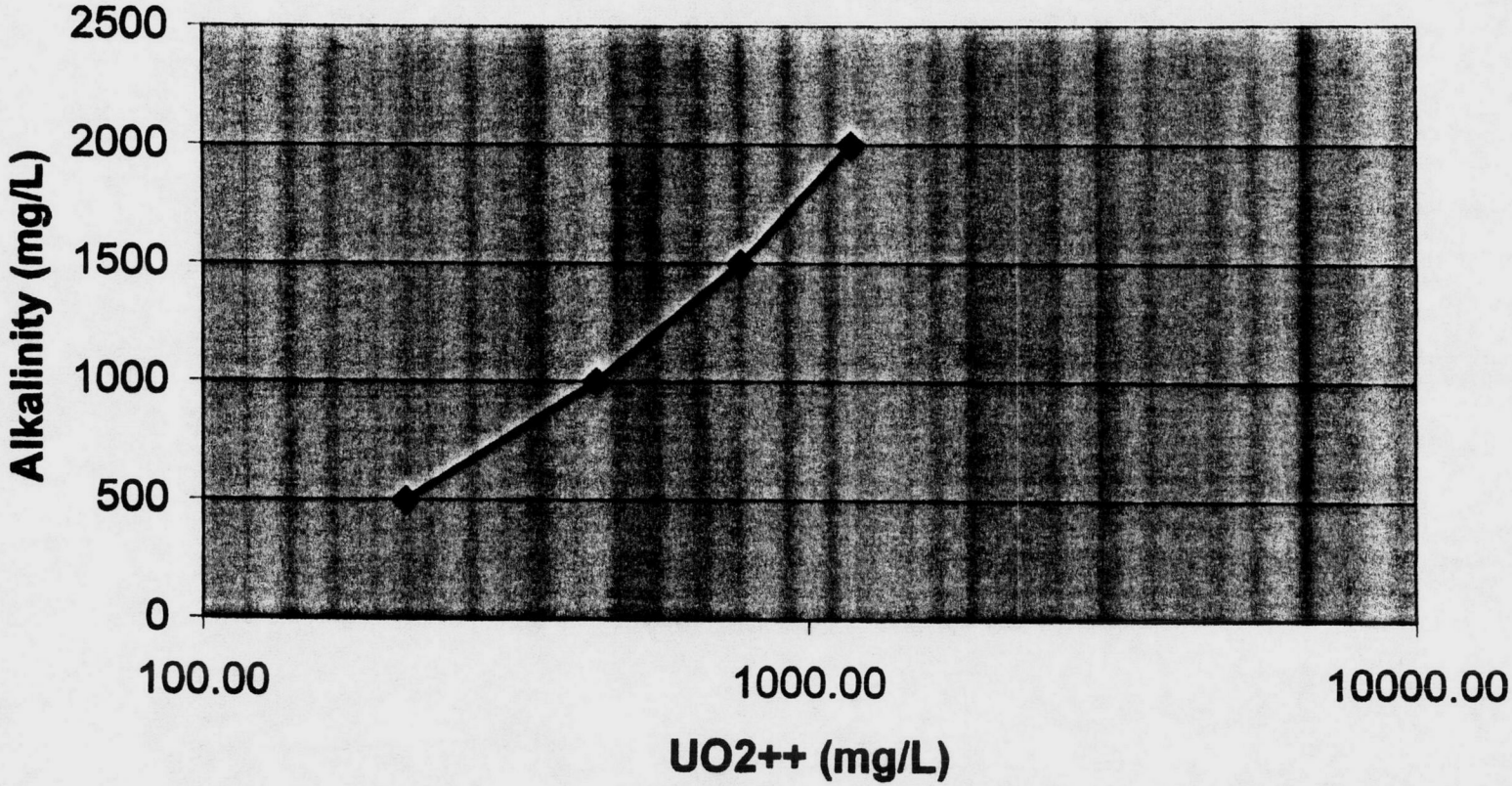
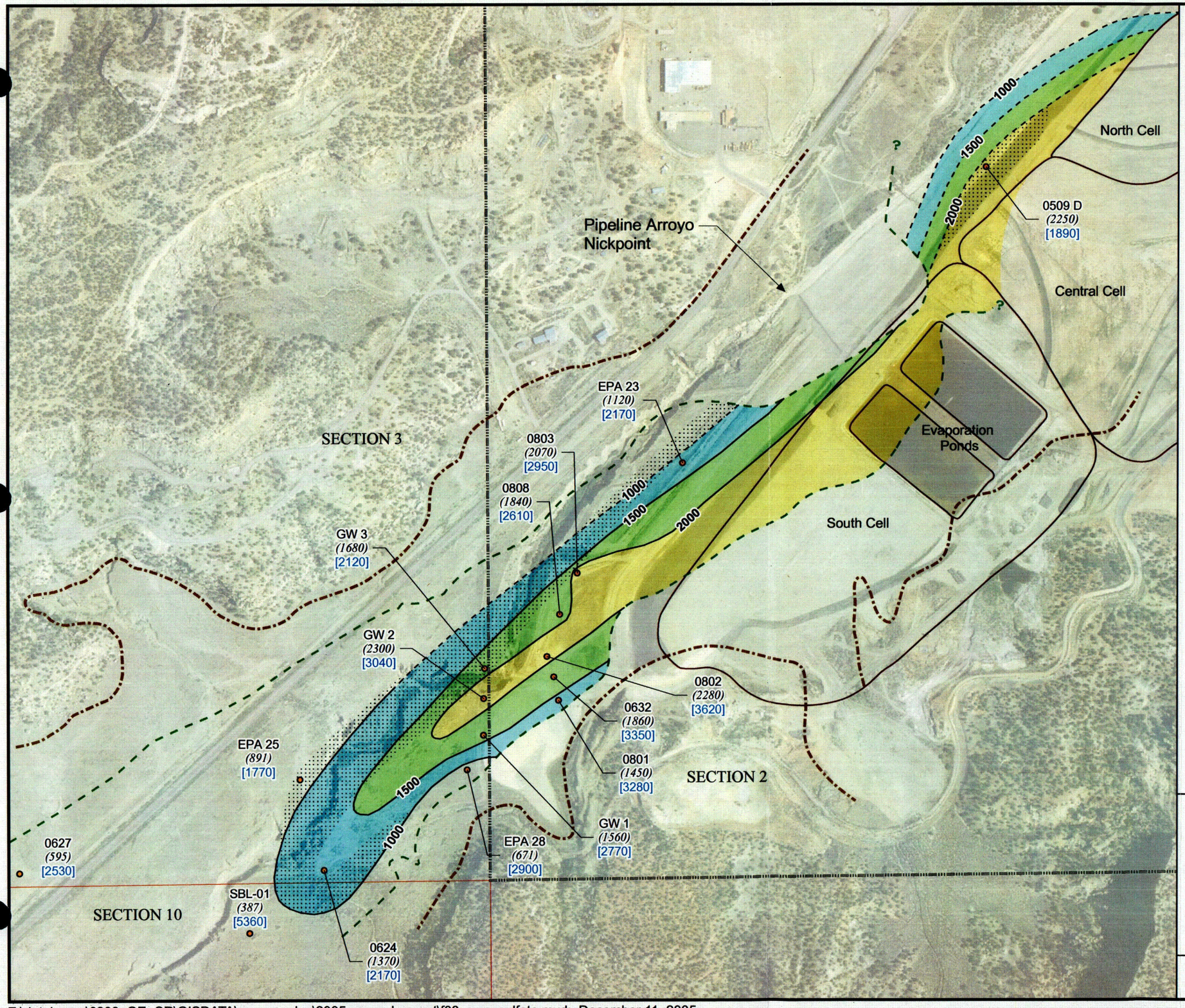
Figure 7. Theoretical Uranium Concentration from MINTEQ

(for the mineral Schoepite)





Legend

- Southwest Alluvium Well
- Approximate Extent of Saturated Alluvium
- Approximate Extent of Alluvium
- Bicarbonate Isoconcentration Contour in mg/L
- Inferred Bicarbonate Isoconcentration Contour in mg/L

Bicarbonate Concentrations (mg/L)

- 1000 - 1500
- 1500 - 2000
- >2000
- Property Boundary
- Section Boundary
- Tailings Pond
- Sulfate Below 2125 mg/L
- (2350) Bicarbonate result in mg/L
- [3580] Sulfate result in mg/L

Notes:

1. Well names are displayed with black text.
2. Aerial photo taken on August 1, 1996.

0 250 500 1,000
Feet

FIGURE 8

Southwest Alluvium Bicarbonate Isoconcentration Map and Distribution of Sulfate Below 2125 mg/L, October 2005

United Nuclear Corporation Church Rock Site, Church Rock, New Mexico

NA WaterSystems

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C7

APPENDIX A

NPDES PERMIT and ANALYTICAL DATA
for
MINE WATER DISCHARGES

DEC 26 1979

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

FACT SHEET

For proposed National Pollutant Discharge Elimination System (NPDES) permit to discharge No. NM0020401 to waters of the United States.

Issuing office: Environmental Protection Agency
Region VI
1201 Elm Street
First International Building
Dallas, Texas 75270

Applicant: United Nuclear Corporation
Mining and Milling Division
P. O. Box 3951
Albuquerque, New Mexico 87190

1. The applicant currently operates the Church Rock Operation for the mining of uranium ore.

2. As described in the application, the plant site is located in McKinley County, New Mexico. Discharge is to an unnamed arroyo and thence to the Puerco River in the Little Colorado Basin.

3. The known uses of the receiving waters are recreation and support of desirable aquatic life presently common in New Mexico waters.

Stream standards are: The General Standards are found on pages two through five of Water Quality Standards for Interstate and Intrastate Streams in New Mexico, as revised March 14, 1978.

4. The following is a quantitative description of the discharge described in the application:

a. Outfall No. 001

Flow Frequency	Avg. Daily, MGD	Max., MGD	Min., MGD
Continuous	2.0	2.0	2.0

b. Outfall No. 001

Temp., Deg. F	Avg. Summer	Avg. Winter	Max.	Min.
	75°F	N/A	N/A	N/A

UNCa .044351

c. Outfall No. 001

Effluent Characteristics	Daily Avg. mg/l	Daily Max. mg/l
Total Suspended Solids	330	N/A
Chemical Oxygen Demand	N/A	N/A
Total Zinc	N/A	N/A
Total Uranium	N/A	N/A
Total Molybdenum	N/A	N/A
Total Selenium	N/A	N/A
Total Vanadium	N/A	N/A

5. On the basis of preliminary staff review, the Environmental Protection Agency, after consultation with the State of New Mexico has made a tentative determination to issue a permit for the discharge described in the application.

The proposed effluent limitations for those pollutants proposed to be limited are as follows (attached):

Outfall 001 Begin the effective date;
End the expiration date

Effluent Characteristics	Discharge Limitation 30-day Avg.	Discharge Limitation Daily Max.
Total Suspended Solids	20 mg/l	30 mg/l
Chemical Oxygen Demand	100 mg/l	200 mg/l
Total Zinc	0.5 mg/l	1.0 mg/l
Dissolved Radium 226	N/A	3.3 pCi/l
Total Radium 226	10.0 pCi/l	30.0 pCi/l
Total Uranium	N/A	2.0 mg/l

6. A brief explanation of the express statutory or regulatory provisions on which permit requirements are based, including appropriate supporting references to the Administrative Record required by 40 CFR §124.45.

1. Ore Mining Point Source Category, 40 CFR, Part 440, dated July 11, 1978, Subpart E.

2. Water Quality Standards for Interstate and Intrastate Streams in New Mexico, Revised March 14, 1978.

3. NPDES Application NM0020401, Standard Form C, dated June 19, 1974.

4. NPDES Application NM0020401, Short Form C, dated May 4, 1979.

7. The following is an explanation of calculations or other necessary explanation of the derivation of specific effluent limitations and conditions, including a citation to the applicable guidelines of standard provisions as required under 40 CFR §122.15 and reasons why these are applicable.

Effluent limitations based on Subpart E of 40 CFR, Part 440, are Mining Point Source Category, dated July 11, 1978.

8. The permit is in the process of certification by the State Agency. A draft permit and draft public notice will be sent to the District Engineer, Corps of Engineers and to the Regional Director of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service prior to the publication of that notice.

9. The public notice describes the procedures for the formulation of final determinations.

DEC 26 1979

Permit No. NM0020401
Application No. NM0020401

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"),

United Nuclear Corporation
Mining and Milling Division
P.O. Box 3951
Albuquerque, New Mexico 87190

is authorized to discharge from a facility located at

Church Rock Operation
Gallup, McKinley County, New Mexico

to receiving waters named

unnamed arroyo and thence to the Puerco River

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective on March 22, 1980

This permit and the authorization to discharge shall expire at midnight, December 31, 1980

Signed this 21st day of December 1979

for W. B. Hathaway
Diana Dutton, Director
Enforcement Division(6AE)
Environmental Protection Agency
Region VI

UNCa .044354

EPA Form 3320-4 (10-72)

A-1 **EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS**

During the period beginning the effective date and lasting through the expiration date the permittee is authorized to discharge from outfall(s) serial number(s) 001 mine dewatering of mine shaft No. 1.
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	N/A	N/A	(*)	(*)	Continuous	Record
Temperature	N/A	N/A	*°F	*°F	1/week	Grab
Total Suspended Solids	N/A	N/A	20 mg/l	30 mg/l	1/week	24-hr composite**
Chemical Oxygen Demand	N/A	N/A	100 mg/l	200 mg/l	1/week	24-hr composite**
Total Zinc	N/A	N/A	0.5 Mg/l	1.0 mg/l	1/week	24-hr composite**
Dissolved Radium 226	N/A	N/A	* pCi/l	3.3 pCi/l	2/week	24-hr composite**
Total Radium 226	N/A	N/A	10.0 pCi/l	30.0 pCi/l	1/week	24-hr composite**
Total Uranium	N/A	N/A	* mg/l	2.0 mg/l	2/week	24-hr composite**
Total Molybdenum	N/A	N/A	* mg/l	* mg/l	1/week	24-hr composite**
Total Selenium	N/A	N/A	* mg/l	* mg/l	1/week	24-hr composite**
Total Vanadium	N/A	N/A	* mg/l	* mg/l	1/week	24-hr composite**

* Report
** See Part III, Paragraph C.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week by grab.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s):
At the discharge pipe from the ion exchange plant.

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

   NONE

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

C. MONITORING AND REPORTING

1. *Representative Sampling*

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. *Reporting*

Monitoring results obtained during the previous 3 months shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on April 28, 1980 . Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and the State at the following addresses:

Diana Dutton, Director
Enforcement Division (6AE)
Environmental Protection Agency
First International Building
1201 Elm Street
Dallas, Texas 75270

Mr. Charles Nylander, Acting Program Mgr.
Permits & Regulations Unit
Water Pollution Control Section
New Mexico Environmental
Improvement Division
P.O. Box 968
Santa Fe, New Mexico 87503

3. *Definitions*

a. The "daily average" discharge means the total discharge by weight during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required by this permit, the daily average discharge shall be determined by the summation of all the measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made.

b. The "daily maximum" discharge means the total discharge by weight during any calendar day.

4. *Test Procedures*

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(g) of the Act, under which such procedures may be required.

5. *Recording of Results*

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

6. *Additional Monitoring by Permittee*

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form (EPA No. 3320-1). Such increased frequency shall also be indicated.

7. *Records Retention*

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the State water pollution control agency.

A. MANAGEMENT REQUIREMENTS

1. *Change in Discharge*

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new NPDES application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

2. *Noncompliance Notification*

If, for any reason, the permittee does not comply with or will be unable to comply with any daily maximum effluent limitation specified in this permit, the permittee shall provide the Regional Administrator and the State with the following information, in writing, within five (5) days of becoming aware of such condition:

a. A description of the discharge and cause of noncompliance; and

b. The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

3. *Facilities Operation*

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. *Adverse Impact*

The permittee shall take all reasonable steps to minimize any adverse impact to navigable waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

5. *Bypassing*

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall promptly notify the Regional Administrator and the State in writing of each such diversion or bypass.

6. *Removed Substances*

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

7. *Power Failures*

In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall either:

a. In accordance with the Schedule of Compliance contained in Part I, provide an alternative power source sufficient to operate the wastewater control facilities;

or, if such alternative power source is not in existence, and no date for its implementation appears in Part I,

b. Halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

B. RESPONSIBILITIES

1. *Right of Entry*

The permittee shall allow the head of the State water pollution control agency, the Regional Administrator, and/or their authorized representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any discharge of pollutants.

2. *Transfer of Ownership or Control*

In the event of any change in control or ownership of facilities from which the authorized discharges emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Regional Administrator and the State water pollution control agency.

3. *Availability of Reports*

Except for data determined to be confidential under Section 308 of the Act, all reports prepared in accordance with the terms of this permit shall be available for public

inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act.

4. *Permit Modification*

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

5. *Toxic Pollutants*

Notwithstanding Part II, B-4 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

6. *Civil and Criminal Liability*

Except as provided in permit conditions on "Bypassing" (Part II, A-5) and "Power Failures" (Part II, A-7), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. *Oil and Hazardous Substance Liability*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. *State Laws*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. *Property Rights*

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. *Severability*

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

OTHER REQUIREMENTS

A. The "daily average" concentration means the arithmetic average (weighted by flow value) of all the daily determinations of concentration made during a calendar month. Daily determinations of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily determination of concentration shall be the arithmetic average (weighted by flow value) of all the samples collected during that calendar day.

The "daily maximum" concentration means the daily determination of concentration for any calendar day.

B. Provisions shall be made to assure the elimination of all seepage, overflow or other sources which may result in any direct or indirect discharge to surface water other than that authorized by this permit.

C. The term "24-hour composite sample" means a sample consisting of a minimum of eight samples of effluents collected at regular intervals over a normal operating day and combined proportional to flow, or a sample continuously collected proportional to flow over a normal operating day.

D. The conditions applicable to all permits under 40 CFR 122.14 (as promulgated in the June 7, 1979, Federal Register) are hereby incorporated into this permit and prevail over any inconsistent requirements of this permit.

E. Noncompliance notifications for any daily maximum effluent limitation violation, shall be submitted in writing within five days of the permittee becoming aware of such violation.

F. Test Procedures

a. The effluent characteristics "soluble radium 226" and "total radium 226" shall be measured by Method 706 "Radium 226 and Water" in accordance with the procedures discussed for soluble radium 226 and total radium 226 in Standard Methods for the Examination of Water and Wastewater, 14th Edition, 1975, pg. 667, or an equivalent method.

b. The effluent characteristic "Total Uranium" shall be measured by the procedure discussed in the HASL Procedure Manual, edition by John H. Harley, HASL 300 Health and Safety Laboratory, U.S. Atomic Energy Commission, 1973, pg. EU-03, or an equivalent method.

G. The permittee shall develop a program to ensure compliance with the "Policy for Implementation of the Colorado River Salinity Standards Through the NPDES Permit Program" prepared by the Colorado River Salinity Control Forum, February 28, 1977; and shall provide for full implementation of salinity control measures, if needed, as soon as practicable but in no case later than July 1, 1983. The development of the compliance program shall be on the following schedule:

Submission to EPA and NMEID of a complete report on existing effluent conditions and, if needed, an associated schedule.	June 30, 1980

Note: The succeeding permit to be issued January 1, 1981, would contain, if needed, a construction schedule for implementation of a compliance program satisfactory to EPA and NMEID.

H. This permit shall be modified, or alternatively, revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under sections 301(b)(2)(C), and (D), 304(b)(2), and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

(1) Contains different conditions of is otherwise more stringent than any effluent limitation in the permit; or

(2) Controls any pollutant not limited in the permit.

The permit as modified or reissued under this paragraph shall also contain any other requirements of the Act then applicable.

RE: United Nuclear Corporation
Church Rock Operation
(Applicant's Name)

NM0020401 March 22, 1980
(Number and Date of Proposed Permit

U.S. Environmental Protection Agency
(Licensing or Permitting Agency)

DATE: March 14, 1980

Environmental Protection Agency
1201 Elm Street
First International Bldg.
Dallas, TX 75270

Attention:

CERTIFICATION - WATER QUALITY

Whereas, the New Mexico Environmental Improvement Division has

(X) examined the permit proposed to be issued to the applicant named above and bases its certification upon an evaluation of the information contained in such proposed permit which is relevant to water quality considerations;

( ) verified the information contained in the permit proposal by on-site inspection;

( ) examined information furnished by the applicant in addition to or in place of the proposed permit, sufficient to permit the Division to make the following statement:

After appropriate public participation, the Environmental Improvement Division hereby certifies, (1) that the discharge(s) set forth in the proposed permit will comply with published information on secondary treatment (40 CFR 133, FR Vol. 38, No. 159 - August 17, 1973) pursuant to Section 301(b) (1) (B) and Section 304(d) (1) of the FWPCA amendments of 1972, (2) that as of this date there exists no effluent limitations or other limitations under Section 301(b) (within the meaning of Section 304) and 302 of the Federal Water Pollution Control Act Amendments of October 18, 1972, nor any standard under Sections 306 and 307 of those Amendments, applicable to the discharge(s) set forth in the referenced proposed permit other than applicable Water Quality Standards, and (3) that the discharge(s) set forth in the proposed permit will comply with all applicable Water Quality Standards provided the applicant's discharge(s) do not exceed the parameters set forth in the referenced proposed permit.

We request that the following additional conditions be imposed on the permit:

See attached page

Joseph A. Pierce, Chief
Water Pollution Control Bureau

UNCa .044365

March 14, 1980
DATE

Page 2, A.

	Daily Avg.	Daily Avg.
Chemical Oxygen Deman	125 mg/l	125 mg/l

	Measurement Frequency
Total Molybdennum	1/month
Total Selenium	1/month
Total Vanadium	1/month

The pH shall not be less than 6.6 standard units nor greater than 8.6 standard units...

Page 4, C.2.

Mr. Charles Nylander, Program Manager
Surface Water Section
Water Pollution Control Bureau

CUSTOMER	United Nuclear Corp.
ADDRESS	P.O. Box QQ
CITY	Gallup, NM 87501
ATTENTION	Todd Miller
INVOICE NO.	807034

REPORT OF ANALYSIS

SAMPLES RECEIVED 6/21/78 | CUSTOMER ORDER NUMBER

TYPE OF ANALYSIS Water Analysis - Collected 6/19/78

Sample Identification	Analysis	mg/l
Vent Shaft 475' Bottom	Aluminum	< 0.1
	Arsenic	< 0.01
	Barium	< 0.1
	Boron	0.6
	Cadmium	< 0.001
	Chemical Oxygen Demand	12.5
	Chloride	15.
	Chromium	0.001
	Cobalt	< 0.01
	Copper	< 0.001
	Fluoride	1.5
	Iron	< 0.01
	Lead	< 0.001
	Manganese	0.025
	Total Mercury	< 0.0004
	Molybdenum	0.005
	Nickel	< 0.01
	Ammonia Nitrogen	0.06
	Selenium	< 0.01
	Silver	< 0.01
	Sodium	320
	Total Dissolved Solids	1066
	Sulfate	392
	Vanadium	0.02
	Zinc	0.02

UNCa .025924

APPROVED BY Bud Summers

Bud Summers, Environmental Sciences Mgr.

7/10/78

Controls for Environmental Pollution, Inc.
P.O. Box 5351 • 1925 Rosina • Santa Fe, New Mexico 87502
Telephone 505/982-9841

454012

CUSTOMER	United Nuclear Corporation
ADDRESS	P. O. Box QQ
CITY	Gallup, NM 87301
ATTENTION	Todd Miller
INVOICE NO.	807034

REPORT OF ANALYSIS

SAMPLES RECEIVED	6/21/78	CUSTOMER ORDER NUMBER	
TYPE OF ANALYSIS	Water - Collected 6/15/78		

Sample Identification	Analysis	pCi/1
Vent Shaft Surface	Gross Alpha	1540 ± 70
	Radium-226	67.0 ± 2.4
	Radium-228	< 1.
	Thorium-230	< 0.6
	Total Uranium	1.05 mg/1
Vent Shaft 475' Bottom	Gross Alpha	3470 ± 110
	Radium-226	99.3 ± 3.7
	Radium-228	1. ± 1.
	Thorium-230	0.8 ± 0.3
	Total Uranium	1.90 mg/1
400'	Gross Alpha	855 ± 55
	Radium-226	71.7 ± 3.1
	Radium-228	< 1.
	Thorium-230	2.3 ± 1.0
	Total Uranium	0.565 mg/1
450'	Gross Alpha	752 ± 52
	Radium-226	47.3 ± 2.5
	Radium-228	2. ± 1.
	Thorium-230	< 0.6
	Total Uranium	0.695 mg/1
500'	Gross Alpha	793 ± 53
	Radium-226	72.6 ± 3.3
	Radium-228	1. ± 1.
	Thorium-230	1.3 ± 0.4
	Total Uranium	0.683 mg/1

UNCa .025925

APPROVED BY Bud Summers, Environmental Sciences Mgr.

Controls for Environmental Pollution, Inc.
P.O. Box 5351 • 1925 Rosina • Santa Fe, New Mexico 87502
Telephone 505/982-9841

7/10/78 PAGE 1 OF 1 PAGE 454013

CUSTOMER United Nuclear Corporation
ADDRESS P. O. Box QQ
CITY Gallup, NM 87301
ATTENTION Todd Miller
INVOICE NO. 807034

REPORT OF ANALYSIS

SAMPLES RECEIVED 6/21/78	CUSTOMER ORDER NUMBER
TYPE OF ANALYSIS Water - Collected 6/15/78	

Sample Identification	Analysis	pCi/l
800'	Gross Alpha	805 ± 54
	Radium-226	71.1 ± 2.9
	Radium-228	2. ± 1.
	Thorium-230	0.6
	Total Uranium	0.564 mg/l

UNCa .025926

APPROVED BY Bud Summers, Environmental Sciences Mgr.
7/10/78

Controls for Environmental Pollution, Inc.
P.O. Box 6351 • 1925 Rosina • Santa Fe, New Mexico 87502
Telephone 505/982-9841

454014

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO

Church Rock Mill

TO Todd Miller AT NECR DATE December 28, 1978

FROM Kenneth Ho K Ho, M. Wilson AT NECR COPY TO G. Swanquist
E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	12-26-78
Date of Analysis	:	12-26-78

ANALYSIS

PH Units	:	8.16
Total Uranium	:	0.6 mg/L
Dissolved Radium-226	:	<0.6 pCi/L
Total Suspended Solids	:	5.27 mg/L

UNCa .025927

454015

UNITED NUCLEAR CORPORATION

INTER-OFFICE MEMO

Church Rock Mill

TO Todd Miller AT NECR DATE December 8, 1978

FROM Kenneth Ho K Ho AT NECR COPY TO G. Swanquist, E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	12-5-78
Date of Analysis	:	12-5-78

ANALYSIS

PH Units	:	7.75
Total Uranium	:	1.41 mg/L
Dissolved Radium-226	:	<0.6 pCi/L
Total Suspended Solids	:	3.0 mg/L

UNCa .025930

454018

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO

Church Rock Mill

TO Todd Miller AT NECR DATE December 1, 1978

FROM Kenneth Ho KH AT NECR COPY TO G. Swanquist
E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	11-28-78
Date of Analysis	:	11-28-78

ANALYSIS

PH Units	:	8.13
Total Uranium	:	0.8 mg/L
Dissolved Radium-226	:	< 0.6 pCi/L
Total Suspended Solids	:	:3.8 mg/L

UNCa .025931

454019

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO

Church Rock Mill

TO Todd Miller AT NECR DATE November 22,1978

FROM Kenneth Ho KHo AT NECR COPY TO G. Swanquist
E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	November 21, 1978
Date of Analysis	:	November 21,1978

ANALYSIS

PH Units	:	7.97
Total Uranium	:	1.18 mg/L
Dissolved Radium-226	:	1.0 pCi/L
Total Suspended Solids	:	9.5 mg/L

UNCa .025932

454020

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO Church Rock Mill

TO Todd Miller AT NECR DATE November 17,1978

FROM Kenneth Ho KHo AT NECR COPY TO G. Swanquist, E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	11-14-78
Date of Analysis	:	11-14-78

ANALYSIS

PH Units	:	8.38
Total Uranium	:	1.34 mg/L
Dissolved Radium-226	:	<0.6 pCi/L
Total Suspended Solids	:	5.65 mg/L

UNCa .025933

454021

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO

Church Rock Mill

TO Todd Miller AT NECR DATE November 10,1978

FROM Kenneth Ho KHo AT NECR COPY TO G. Swanquist
E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	11-7-78
Date of Analysis	:	11-7-78

ANALYSIS

PH Units	:	8.22
Total Uranium	:	0.57 mg/L
Dissolved Radium-226	:	<0.6 pCi/L
Total Suspended Solids	:	1.2 mg/L

UNCa .025934

454022

UNITED NUCLEA
CORPORATION

INTER-OFFICE MEMO

Church Rock Mill

TO Todd Miller AT NECR DATE November 2, 1978

FROM Kenneth Ho AT NECR COPY TO G. Swanquist
E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	10-31-78
Date of Analysis	:	10-31-78

ANALYSIS

PH Units	:	8.36
Total Uranium	:	0.87 mg/L
Dissolved Radium-226	:	1.2 pCi/L
Total Suspended Solids	:	0.9 mg/L

UNCa .025935

454023

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO

Church Rock Mill

TO Todd Miller AT NECR DATE October 27,1978

FROM Kenneth Ho KHo AT NECR COPY TO G. Swanquist
E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	10-24-78
Date of Analysis	:	10-24-78

ANALYSIS

PH Units	:	8.36
Total Uranium	:	1.44 mg/L
Dissolved Radium-226	:	0.6 pCi/L
Total Suspended Solids	:	1.4 mg/L

UNCa .025936

454024

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO

Church Rock Mill

TO Todd Miller AT NECR DATE October 18, 1978

FROM Kenneth Ho KHo AT NECR COPY TO G. Swanquist
E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	10-18-78
Date of Analysis	:	10-18-78

ANALYSIS

PH Units	:	8.24
Total Uranium	:	0.99 mg/L
Dissolved Radium-226	:	1.5 pCi/L
Total Suspended Solids	:	1.6 mg/L

UNCa .025937

454D25

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO Church Rock Mill

TO Todd Miller AT NECR DATE October 12, 1978

FROM Kenneth Ho KHo AT NECR COPY TO G. Swanquist, E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	10-10-78
Date of Analysis	:	10-10-78

ANALYSIS

PH Units	:	8.41
Total Uranium	:	1.25 mg/L
Dissolved Radium-226	:	2.0 pCi/L
Total Suspended Solids	:	1.2 mg/L

UNCa .025938

454026

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO

Church Rock Mill

TO Todd Miller AT NECR DATE October 6, 1978

FROM Kenneth Ho K.Ho AT NECR COPY TO G. Swanquist, E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	10-3-78
Date of Analysis	:	10-3-78

ANALYSIS

PH Units	:	7.89
Total Uranium	:	1.50 mg/L
Dissolved Radium-226	:	1.0 pCi/L
Total Suspended Solids	:	14.9 mg/L

UNCa .025939

454027

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO

Church Rock Mill

TO Todd Miller AT NECR DATE September 29,1978

FROM Kenneth Ho K. HO AT NECR COPY TO G. Swanquist
E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	9-26-78
Date of Analysis	:	9-26-78

ANALYSIS

PH Units	:	8.11
Total Uranium	:	0.97 mg/L
Dissolved Radium-226	:	1.8 pCi/L
Total Suspended Solids	:	19.4 mg/L

UNCa .025940

454028

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO Church Rock Mill

TO Todd Miller AT NECR DATE September 22, 1978

FROM Kenneth Ho KH AT NECR COPY TO G. Swanquist, E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	9-19-78
Date of Analysis	:	9-20-78

ANALYSIS

PH Units	:	7.99
Total Uranium	:	0.32 mg/L
Dissolved Radium-226	:	<0.6 pCi/L
Total Suspended Solids	:	6.9 mg/L

UNCa .025941

454029

UNITED NUCLEAR
CORPORATION

INTER-OFFICE MEMO

Church Rock Mill

TO Todd Miller AT NECR DATE September 15,1978

FROM Kenneth Ho KHo AT NECR COPY TO G. Swanquist
E. Morales

SUBJECT Results of IX Weekly Composite:

SAMPLE IDENTIFICATION	:	IX WEEKLY COMPOSITE
Date of Collection	:	September 12, 1978
Date of Analysis	:	September 13, 1978

ANALYSIS

PH Units	:	8.43
Total Uranium	:	0.27 mg/L
Dissolved Radium-226	:	1.3 pCi/L
Total Suspended Solids	:	3.5 mg/L

UNCs .025942

454030

TAILINGS DAM BREACH

HISTORICAL SURFACE WATER DATA

Sampling Location: 1.5 mi. upstream at Ford.

PARAMETERS	12-12-75	6-11-76	12-22-76	8-18-77	10-11-77	1-25-78	4-4-78	7-28-78	10-23-78	1-31-79	6-15-79
Aluminum (mg/l)					0.5	<0.7	<0.7	<0.7	<0.7	<0.2	0.432
Arsenic (mg/l)	<0.01	<0.01	0.01	0.01	<0.01	0.01	0.02	<0.01	0.02	<0.01	0.0196
Barium (mg/l)				0.6	2.28	2.3	0.8	<0.3	<0.02	0.2	0.1829
Cadmium (mg/l)	<0.001	<0.001	<0.001		0.005	<0.01		<0.01	<0.01	<0.01	0.0031
Calcium (mg/l)	11.8	10.2	27.3								
Chloride (mg/l)				8.0	11.07	11.1	22.0	31.5	10.0	17.7	15.4
Chromium (mg/l)				0.002	0.01		<0.1	<0.04	<0.04	<0.02	0.0364
Cobalt (mg/l)				<0.01	<0.01		<0.05	<0.05	<0.05	<0.05	<0.0001
Conductivity (umhos/cm) 25°C								750	550	650	700
Copper (mg/l)	<0.001	<0.001	0.004				<0.04	<0.04	<0.04	<0.01	0.0036
Cyanide (mg/l)											
Fluoride (mg/l)				0.39	0.17	0.24	0.41	0.34	0.34	0.30	0.27
Iron (mg/l)				1.24	0.01	<0.04	0.15	<0.04	0.07	0.18	0.0919
Lead (mg/l)	<0.001	<0.001	0.004	0.003		-	<0.05	<0.05	<0.05	<0.05	0.0011
Magnesium (mg/l)	7.6	44.0	8.89	3.7		1.7	3.6	9.7	3.4	14.9	95.5
Manganese (mg/l)				0.029	<0.01	<0.03	<0.03	<0.03	<0.03	<0.01	0.0881
Molybdenum (mg/l)		0.001	<0.001	0.003	0.07	<0.10	<0.1	0.2	<0.1	0.24	0.1342
Mercury, Total (mg/l)	<0.0004	<0.0004	0.0009								<0.001
Nitrogen (Nitrate) (mg/l)	0.2	0.3	0.71	1.1	2.06	1.1	2.5	1.90	1.20	2.6	<0.1
Potassium (mg/l)	1.91	1.40	2.47								
pH (mg/l)	8.54	8.71	8.80	8.7	9.0	8.87	8.86	9.09	8.86	8.36	8.57
Selenium (mg/l)	<0.01	0.02	<0.01	0.02	0.01	0.02	0.029	0.01	0.016	0.02	0.150
Silver (mg/l)							<0.05	<0.05	<0.05	<0.01	0.0059
Sodium (mg/l)	116	169	135	107	64.5	64.5	109	42.4	80.1	525.5	59.8
Sulfate (mg/l)	87	77	80	82	103	101	140	133	142.0	129.3	138.1
Total Dissolved Solid (mg/l)				364	338	512	600	437	429.8	485.0	470.8
Nickel (mg/l)				<0.01	0.03	<0.05	<0.05	<0.05	<0.05	<0.01	0.1047
Vanadium (mg/l)		0.02	0.05	0.01	0.06	<0.1	<0.1	20.1	<0.1	<0.1	0.046
Zinc (mg/l)	0.05	0.008	0.009		<0.01	<0.02		<0.02	0.02	<0.01	0.0440
Total Uranium (mg/l)	1.943	2.55	2.34	0.850	0.99	0.96	1.43	0.64	0.88	0.76	0.66
Radium-226 (pCi/l)	17.0	48.6	74.3	17.2	17.71	4.7	3.31	3.7	3.1	2.3	6.7
Thorium-230 (pCi/l)	72.7	26.7	38.2	8.0		11.7	1.67	4.9	<0.6	2.9	
Gross Alpha (pCi/l)	857	937	968	945	295	235	380	133	210.6	37.5	350.1
Hardness (mg/l)	43.6	44.0	48.6								

UNCa .026540

466001

TAILINGS DAM BREACH

HISTORICAL SURFACE WATER DATA

Sampling Locations: 5 mi. downstream at 566 bridge

PARAMETERS	12-12-75	6-11-76	12-22-76	8-18-77	10-11-77	1-25-78	4-4-78	7-28-78	10-23-78	1-31-79	6-15-79
Aluminum (mg/l)					0.4	<0.7	0.7	40.7	<0.7	<0.2	0.963
Arsenic (mg/l)	<0.01	<0.01	0.024			0.01	<0.01	<0.01	0.015	<0.01	0.0226
Barium (mg/l)				0.2	1.48	1.5	0.3	0.2	<0.2	0.2	0.0386
Cadmium (mg/l)	0.002	<0.001	<0.001		0.005	<0.01		<0.01	<0.01	<0.01	0.0036
Calcium (mg/l)	21.2	39.0	34.9								
Chloride (mg/l)				6.0	10.07	10.1	27.0	41.5	11.0	41.7	17.4
Chromium (mg/l)				0.002	<0.01		<0.1	<0.04	<0.04	<0.02	0.0378
Cobalt (mg/l)				<0.01	0.01		<0.05	<0.05	<0.05	0.14	<0.0001
Conductivity (umhos/cm) 25°C								890	600	1000.	950
Copper (mg/l)	<0.001	0.003	0.006				<0.04	<0.04	<0.04	<0.01	0.0080
Cyanide (mg/l)											
Fluoride (mg/l)				0.31	0.28	0.37	0.49	0.45	0.37	0.35	0.41
Iron (mg/l)				1.36	0.02	<0.06	0.15	<0.04	0.07	<0.04	0.338
Lead (mg/l)	<0.001	0.002	0.005				<0.05	<0.05	<0.05	<0.05	0.0011
Magnesium (mg/l)	7.3	3.73	5.21			1.8	3.8	9.7	3.3	35.2	83.5
Manganese (mg/l)				0.023	<0.01	<0.03	<0.03	<0.03	0.05	<0.01	0.0360
Molybdenum (mg/l)		<0.001	<0.001		0.04	<0.10	<0.10	<0.10	<0.10	0.24	0.1492
Mercury,Total (mg/l)	<0.0004	<0.0004	0.0010						<0.0004		<0.001
Nitrogen (Nitrate) (mg/l)	0.4	0.4	0.74			1.7	2.7	3.0	1.1	44.3	11.5
Potassium (mg/l)	3.02	2.90	2.42								
pH (mg/l)	8.73	8.18	8.63		8.35	8.64	8.35	8.61	8.42	8.26	8.32
Selenium (mg/l)	<0.01	0.01	<0.01			0.02	0.024	0.02	0.01	0.01	0.0273
Silver (mg/l)							<0.05	<0.05	<0.05	<0.01	0.0050
Sodium (mg/l)	111	176	126				112	46.0	79.9	510.9	93.0
Sulfate (mg/l)	81	90	85		135	131	160	172	102	221.9	207.6
Total Dissolved Solids (mg/l)				562	447	666	650	340	495.5	830.0	688.2
Nickel (mg/l)				<0.01	0.03	<0.05	<0.05	<0.05	<0.05	<0.01	0.1315
Vanadium (mg/l)		0.01	0.03			<0.1	<0.1	<0.1	<0.1	<0.1	0.22
Zinc (mg/l)	0.13	0.022	0.009		<0.01	<0.02		0.04	<0.02	<0.01	0.0130
Total Uranium (mg/l)	1.272	2.44	2.36			1.04	1.24	0.72	1.30	0.87	0.72
Radium-226 (pCi/l)	6.18	11.1	52.6	2.5	3.6	1.3	3.21	2.2	2.3	1.5	2.4
Thorium-230 (pCi/l)	255	81.9	40.6	<0.6		10.8	0.72	6.7	5.4	3.7	15.5
Gross Alpha (pCi/l)	381	1440	1160	131	223	326	415	239	479.5	273	345.2
Hardness (mg/l)											

UNCa .026541

466002

TABLE 2.9-1

MINE AND SURFACE WATER QUALITY

Date Collected	Alpha dpm/liter	Beta dpm/liter	Th-230 pCi/liter	Ra-226 pCi/liter	Natural U µg/liter	Sampling Location[b]
5-28-71				107		1700 ft level
5-28-71				32		1500 ft level
5-28-71				1251 [a]		1500 ft level
5-28-71				62		1200 ft level
5-28-71				2.5		1700 ft level
5-28-71				2		1500 ft level
5-28-71				67.2		1500 ft level
5-28-71				2.2		1200 ft level
5-28-71				10.4		Settling pond #1 inlet
11-8-71				6.1		Settling pond #1 inlet
10-24-72					51	Settling pond #1 inlet
12-22-72					2100	Settling pond #1 inlet
12-22-72					5500	1500 ft level
12-22-72					400	1700 ft level
12-22-72					25	1700 ft level
12-22-72					17	1700 ft level
12-22-72					400	1700 ft level
12-29-72			.1			1700 ft level
12-29-72				1.6		1700 ft level
12-29-72			5			1700 ft level
12-29-72			4	8.2	1400	Settling pond #1 inlet
4-2-74			225			Settling pond #1 inlet
10-10-74	3431	1041	75	11	1126	Settling pond #2 outlet
10-10-74	4443	1279	80	20	1466	Figure 6.1-1 site #2
10-10-74	3667	768	5	18	1494	Figure 6.1-1 site #3
10-10-74	6825	1354	60	7	1636	Figure 6.1-1 site #4
10-10-74	5396	678	2	4	1664	Figure 6.1-1 site #5
11-27-74				18	1343	Settling pond #1 outlet
3-3-75	1132			5	1013	Settling pond #1 outlet
3-4-75	18			10	805	Settling pond #1 outlet
3-5-75	98			32	743	Settling pond #1 outlet
6-4-75	3729	1028	36	41	2310	Figure 6.1-1 site #1
6-3-75	1410	189	78	0.53	1600	Figure 6.1-1 site #2
6-3-75	557	64	14	3.9	920	Figure 6.1-1 site #3
6-4-75	1341	160	56	13	1540	Figure 6.1-1 site #4
6-4-75	1068	151	10	64	1450	Figure 6.1-1 site #5
Average	2543	670	46	22	1426	

(a) Datum not included in average.
(b) The levels presented are for mine depths.

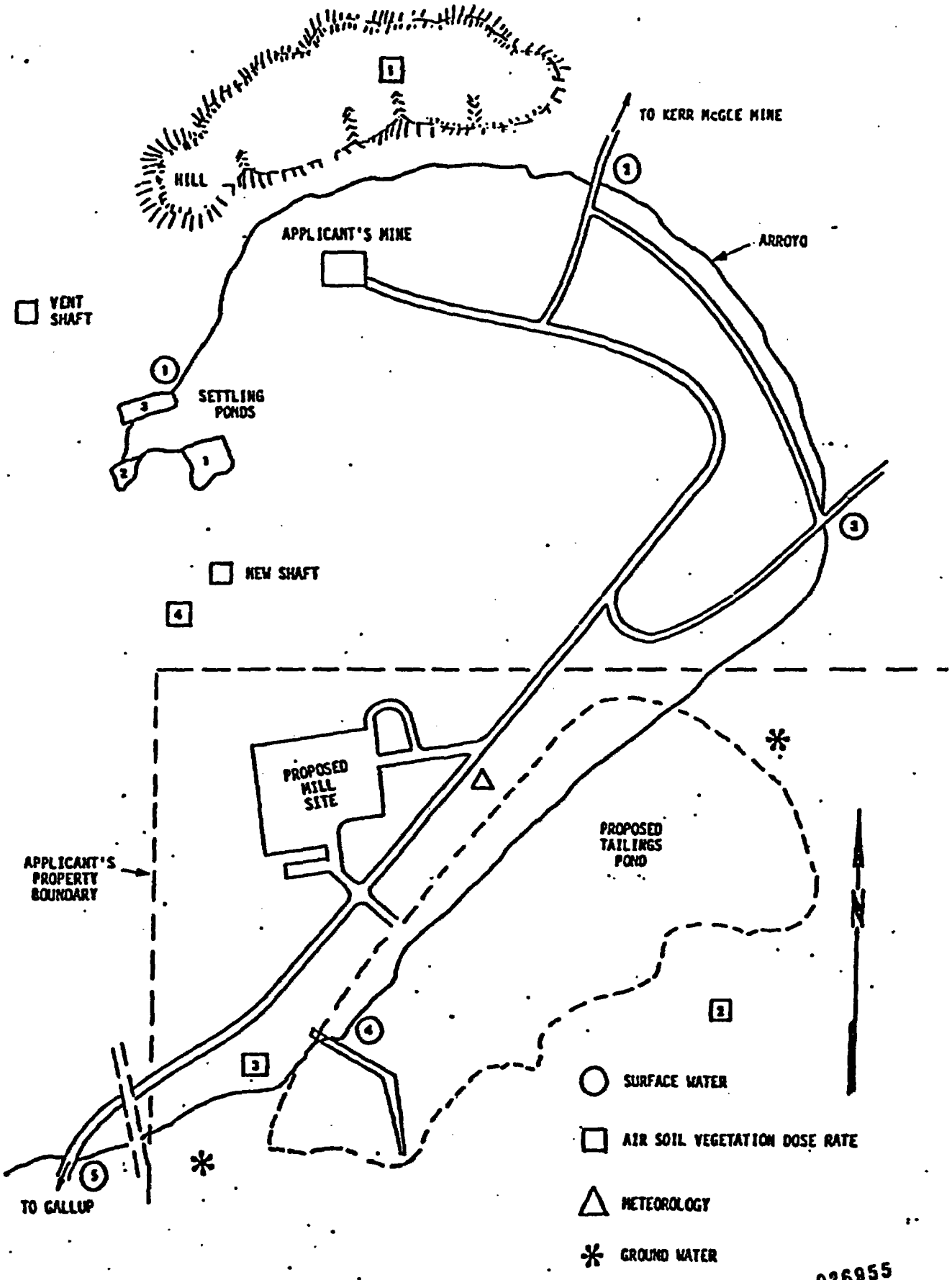

FIGURE 6.1-1 ENVIRONMENTAL SAMPLING SITES

UNCa .026955

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