5575 DTC Parkway, Suite 200, Englewood, Colorado 80111-3010

September 20, 1999

40-8907

Jane E. Gunn
Nuclear Regulatory Commission
Mail Stop T7J8
Washington, DC 20555

Re: Request to Eliminate Zone 1 Groundwater in Section 1 as a Point of Exposure
United Nuclear Corporation Church Rock Site
Gallup, New Mexico

Dear Ms. Gunn:

Telephone
303.694.6660
Facsimile
303.694.4410

Earth Tech, Inc., on behalf of United Nuclear Corporation (UNC), requests that the Zone 1 groundwater located east of the property boundary in Section 1 be eliminated from consideration as a point of exposure (POE) for use in developing alternate concentration limits (ACL). The basis for granting this request is that the quality and quantity of the Zone 1 natural water in this area precludes it from beneficial use either with or without treatment, thereby excluding it as a viable POE.

ACLs rely on natural attenuation mechanisms to reduce constituent concentrations between the point of compliance (POC) and the POE. It is not possible to develop ACLs where the POC and POE are co-located because there is no distance over which the attenuation can occur. This is the condition for Zone 1 because the POC wells are located within or immediately adjacent to Section 1, which has been considered a Zone 1 POE.

To resolve this issue and allow us to develop Zone 1 ACLs, UNC proposed that the Zone 1 POE be revised to only be the Section 36 northern property boundary and to eliminate the portion of Zone 1 in Section 1 from consideration as a POE. This approach was discussed with you and Dr. Beiling Liu of the New Mexico Environment Department during our 3 June 1999 conference call, whereupon you requested we provide supporting information for our proposal.

This letter provides the supporting information for our assertion that the Zone 1 background water is not usable and, therefore, not a viable POE. Included is a summary of the water treatment alternatives evaluation explaining why treating the background water is not feasible. While this letter focuses on the usability of the Zone 1 background water, the discussion of background water as a potable water source may also apply to Zone 3 and the Southwest Alluvium.

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WATER USABILITY AND TREATMENT EVALUATION PROCESS

ASSUMPTIONS

To evaluate the usability of the Zone 1 water as a potable water source, Earth Tech developed the following assumptions about the use of the water, volumes of water needed, starting and ending water quality for treatment, and type of treatment system.

1. **Water Use.** The water was assumed to be used for residential supply for a family of four. This use would include cooking, drinking, bathing, washing, and other incidental uses such as for gardening, pets, and livestock.

2. **Water Volume.** The water volume required was assumed to be 250 gallons per day (gpd). Two hundred gpd of this volume is based on a water supply guideline of 50 gpd for domestic use for each member of a family or household listed in the *Water Well Handbook* (Anderson 1989). An additional 50 gpd was added for incidentals such as gardening, pets, and livestock.

3. **Starting Water Quality.** Starting water quality was assumed to be the background concentrations for nitrate, sulfate, and total dissolved solids (TDS) presented by the NRC in its 1996 report on background and agreed to by the NMED and the U.S Environmental Protection Agency (EPA). Current agency accepted background concentrations are nitrate at 190 milligrams per liter (mg/L), sulfate at 2,125 mg/L, and TDS at 4,800 mg/L. These concentrations were presented by the NRC as an intentionally conservative representation of background water quality because of the technical complexities of establishing a background water quality population. On page 14 of the 1996 Background Report NRC stated that "setting background is difficult to do with confidence." The NRC 1996 Background Report also pointed out that the background concentrations could increase because the system in all three formations is "effectively drying out."

   For evaluating treatment options, some additional cations and anions in concentrations typically found in the Zone 1 background water were included. Table 1 lists the starting background water quality concentrations.

4. **Ending Water Quality.** Ending water quality was assumed to meet drinking water standards, as listed in Table 1.

5. **Type of Treatment System.** The treatment system was assumed to be one commonly used for single residence, private homeowner applications. Examples are systems provided by nationally recognized companies such as Culligan® and Rainsoft™, which have off-the-shelf components and are simple to operate.

TABLE 1. Water Quality Standards

Constituent	Starting Water Quality Background Concentration	Ending Water Quality Treatment Standard
Nitrate	190 mg/L	10 mg/L
Sulfate	2,125 mg/L	600 mg/L
Total Dissolved Solids	4,800 mg/L	1,000 mg/L
Sodium	220 mg/L	-
Potassium	8.0 mg/L	-
Calcium	500 mg/L	-
Magnesium	320 mg/L	-
Manganese	2.6 mg/L	0.05 mg/L
Bicarbonate	200 mg/L	-
Chloride	250 mg/L	250 mg/L
pH	6.6 Standard Units	6 to 9 Standard Units

VENDORS CONTACTED

Three New Mexico-based vendors who supply residential water treatment systems were requested to provide the components and costs for a system to treat the background water to the drinking water standards listed above. They were provided with the water quality data in Table 1 and were told to assume that total available water supply would be about 500 gpd, assuming conservatively that a typical treatment system would be only 50 percent efficient. In other words, 500 gpd would have to be treated to provide 250 gpd of potable water for use. The vendors contacted were:

Enchanted Waters, LLC. (Enchanted Waters), a Rainsoft™ distributor in Albuquerque, New Mexico.

Southwest Water Conditioning, Inc. (SWCI), a Culligan® distributor in Albuquerque, New Mexico.

High Desert Water Stores in Alamogordo, New Mexico.

The first two vendors responded to our request by providing information on treatment system components but not costs. The third vendor declined to respond. Both vendors who responded said that it is neither technically feasible nor cost effective to treat water of this quality for residential use. As a result, they did not provide any cost quotes. The factory representative from Enchanted Waters indicated that the water quality is indicative of wastewater, not potable water, and that we should contact a wastewater treatment contractor. The SWCI vendor categorized the water as "seriously problematic water" that is nearly impossible to effectively treat with standard commercially available residential treatment equipment. Therefore, he recommended that we seek an alternative water source. Following is a discussion of the issues associated with treating the water as presented by SWCI. A copy of SWCI's written response to our request is enclosed.

Water Treatment Issues

SWCI considered a three-stage treatment process consisting of:

- Cation exchange to reduce calcium and magnesium concentrations;
- Anion exchange to reduce sulfate and nitrate concentrations; and
- Reverse osmosis (RO) to reduce TDS concentration.

The first stage treats the water using a water softener to remove calcium and magnesium. It reduces the calcium and magnesium by ion exchange with either sodium or potassium. Sulfate and nitrate would pass through during this stage of treatment, and TDS would remain essentially the same or increase due to the process being one of ion exchange rather than ion removal.

The second stage of treatment removes nitrate and sulfate. According to SWCI, nitrate and sulfate removal is usually accomplished with an anion exchange process that uses an anionic resin (as opposed to a cationic resin that is used for a standard softener) that is regenerated with sodium chloride (NaCl) salt. In the anion exchange process, sulfate, nitrate, and other anions are removed from the water in exchange for chloride on the ion exchange resin. Because of the naturally high concentrations of nitrate and sulfate in the background water, chloride concentrations in the treated water would be about 2,500 mg/L, which is 10 times the drinking water standard of 250 mg/L. This treated water would be very corrosive, would no longer be potable, and would require treatment before it could be used or disposed.

The third stage of treatment reduces background TDS concentrations using an RO unit. The third treatment stage is required because neither the softening (cation exchange) or anion exchange processes remove TDS. However, the background TDS concentration of 4,800 mg/L is approximately 1,800 mg/L above the maximum concentration of 3,000 mg/L recommended for proper RO operation. The RO could reduce the TDS concentration but would require a booster pump and frequent filter and module changes. As a result, RO unit operations would be extremely expensive and impracticable for residential application.

Equipment and Wastewater Disposal Requirements

Based on information provided by SWCI, a hypothetical system could be designed to treat the water; however, the equipment needed to treat this water is not standard equipment that is normally provided for residential water treatment. SWCI indicated that because of the size of the equipment and the extra supplies required (such as large numbers of RO filters), the system could not be installed under the sink but would have to be housed in a large area such as a garage or a separate, weatherproof building. Also, the system would require a lot of maintenance, particularly for the RO unit, that would be well beyond what a typical homeowner is expected to handle.

The system would also generate at least 250 gpd of wastewater that would have to be handled by the homeowner. Because of potentially high salt concentrations, this wastewater could not be discharged to the ground surface. As a result, the wastewater would require at least temporary storage until it could be transported for disposal. Therefore, cost and operation requirements are far beyond those normally expended for a residential water supply.

Water Volume Requirements

Assuming a treatment system could be installed and successfully operated by a homeowner, a sufficient supply of water would still be needed to provide the 250 gpd of treated potable water. The water volume needed would depend on the efficiency of the treatment system. The efficiency of these systems, particularly the RO unit, is typically much less than 100 percent, which means that additional water volume would be required to provide sufficient potable water.

For example, the efficiency of the RO unit with the high concentration of TDS in the background water would probably be no more than 50 percent. This means that for every gallon of water processed, half would be wastewater and half would be potable water. Therefore, a well installed in this portion of Zone 1 would have to produce about 500 gpd. This volume equates to an average pumping rate of 0.35 gallons per minute (gpm).

Based on average Zone 1 corrective action pumping rates for the past five years (shown in Table 2), the 0.35-gpm average pumping rate cannot be achieved in this portion of Zone 1. Also, the corrective action wells are located along the western edge of Section 1 closest to the recharge area where the saturated thickness is greatest. The saturated thickness declines to the east in Section 1, indicating that a well located through most of Section 1 will have even less water available to pump.

TABLE 2. Average Pumping Rates for Zone 1 Extraction Wells

Well No.	1994	1995	1996	1997	1998	Average
615	0.20	0.21	0.19	0.16	0.15	0.18
616	0.18	0.15	0.19	0.12	0.58	0.24
617	0.10	0.13	0.11	0.10	0.09	0.11
EPA 7	0.21	NA	NA	NA	NA	NA

Note:
NA = Well EPA 7 is no longer pumping because it was plugged by mineral precipitation.

Additional water volume would be needed to account for the inefficiency of the other parts of the treatment system. Therefore, the productivity of Zone 1 in this area of Section 1 would not be sufficient to supply the total volume of water needed, with treatment, to supply a household of four.

SUMMARY

In summary, the natural ground water quality in this portion of Zone 1 is not suitable for a potable water supply even with the use of maximum treatment technology. Groundwater supply development in Section 1 would require drilling a well into an aquifer beneath Zone 1 of the Gallup Formation, such as the Dakota Formation, where it is possible to tap potable quality water with yields sufficient to support a domestic water supply. Neither of these conditions exist in Zone 1 of the Gallup Formation in Section 1. In fact, the quality of the background water in this portion of Zone 1 is so poor that after treatment it would not produce an adequate supply to meet domestic requirements.

Therefore, UNC requests an NRC determination that Zone 1 groundwater in Section 1 be eliminated from consideration as a POE in an ACL application; and, instead, that the northern property boundary of Section 36 be established as the first possible POE for Zone 1.

If you have any questions or need additional information, please call me at (303) 804-2367.

Very truly yours,
Earth Tech, Inc.

Suzie du Pont, CEM

Enclosure

cc: Levon Benally, Navajo Superfund
Roy Blickwedel, General Electric
Larry Bush, UNC
Ken Hooks, NRC
Beiling Liu, New Mexico Environment Department
Greg Lyssy, U.S. Environmental Protection Agency

REFERENCES

Anderson, Keith E., ed. 1989. *Water Well Handbook, Fifth Edition, Second Printing, Revised.* Missouri Water Well & Pump Contractors Association, Inc. with Cooperation of the Missouri Geological Survey and Water Resources, Baldwin, Missouri.

NRC. 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.*

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FAX TRANSMITTAL SHEET

SOUTHWEST WATER CONDITIONING, INC.
7801 MENAUL BLVD. N.E.
ALBUQUERQUE, NM 87110
505-299-9581
505-299-9584 - FAX

YOUR
DEALER

DATE: 8/20/99

FROM: Dallas Wiley

TRANSMIT TO:

FAX NO: (303) 694-4410

ATTN: John Ansted

COMPANY: Earth Tec

REFERENCE: Request for water treatment recommendations.

TOTAL PAGES (INCLUDING TRANSMITTAL SHEET) 3

IF THERE ARE ANY PROBLEMS IN RECEIVING THIS TRANSMISSION PLEASE CALL THE OFFICE.

SOUTHWEST WATER CONDITIONING, INC.

Culligan®

CULLIGAN WATER CONDITIONING
7801 Menaul Blvd., N.E.
Albuquerque, New Mexico 87110
1-505-299-9581
N.M. 1-800-545-4132

8/20/99

EARTHTEC
ENGLEWOOD, CO
ATTN: JOHN ANSTED

JOHN:

AFTER FURTHER SCRUTINY OF THE WATER ANALYSIS YOU PROVIDED AS WELL AS DICK RAYMOND'S SUGGESTIONS TO YOU (12" PREMIER SOFTENER & AC-30 "GOOD WATER MACHINE" RO SYSTEM) I WOULD CONCUR WITH HIS SUGGESTIONS FOR EQUIPMENT APPLICATIONS. THERE ARE OTHER CONSTITUENTS IN YOUR WATER, HOWEVER, THAT DO CAUSE SOME CONCERN:

CONSTITUENT	LEVEL	STANDARD
NITRITE	190 mg/L	10 mg/L
SULFATE	2,125 mg/L	600 mg/L
TDS	4,800 mg/L	1,000 mg/L

AS THE SOFTENER WILL BE EFFECTIVE IN REDUCING THE Ca & Mg IN YOUR WORKING WATER, IT WILL BE INTRODUCING EITHER Na OR K INTO THE WATER THROUGH THE ION EXCHANGE PROCESS DEPENDING ON WHICH TYPE OF SALT YOU CHOOSE TO REGENERATE WITH. THEREFORE THE TDS LEVEL (OF 4800 mg/L) WILL NOT BE REDUCED AND ACTUALLY WILL INCREASE A LITTLE.

NITRITES & SULFATES DO NOT AFFECT YOUR WORKING WATER, HOWEVER SHOULD BE REDUCED FOR INGESTION WATER PURPOSES. REDUCING THESE CONSTITUENTS ARE GENERALLY DONE WITH AN ANION EXCHANGE PROCESS. THIS PROCESS USES ANION RESIN VS. CATION RESIN (AS IN A SOFTENER), AND IS ALSO REGENERATED WITH NaCl. IN THE ANION EXCHANGE PROCESS SULFATES & NITRATES ETC. ARE PULLED OUT OF THE WATER IN EXCHANGE FOR THE Cl (i.e. THE NaCl REGENERANT SALT). THEREFORE, BY REDUCING THE

NITRATES & SULFATES WE REPLACE THEM, ABOUT 1-1, WITH THE CHLORIDES IN THE REGENERANT. CONSIDERING YOUR WATER ANALYSIS, YOUR EXISTING 250mg/L Cl LEVEL WOULD INCREASE TO ≈ 2565 mg/L !! THIS IS VERY CORROSIVE AS WELL AS MUCH FURTHER ABOVE THE STANDARDS.

THROUGHOUT BOTH PROCESSES; SOFTENING TO REDUCE Ca & Mg BY EXCHANGING FOR EITHER Na or K, ANION EXCHANGE TO REDUCE NITRATES AND SULFATES BY EXCHANGE FOR Cl HAVE NOT & WILL NOT REDUCE THE TDS LEVEL WHICH IS ALREADY AT 4800 mg/L. THE TDS LEVEL IS 1800 mg/L ABOVE THE RECOMMENDED 3000 mg/L TDS LEVEL FOR PROPER RO OPERATION. RO WILL REDUCE THE TDS LEVEL, BUT DUE TO THE VERY HIGH LEVELS WILL PUT AN EXTREME STRAIN ON THE FILTER CARTRIDGES & RO MODULE, REQUIRING A BOOSTER PUMP TO THE RO AND QUITE FREQUENT FILTER & MODULE CHANGES.

SO, AS YOU CAN SEE, JOHN, THE WATER WE ARE ATTEMPTING TO TREAT CERTAINLY FALLS WITHIN THE "SERIOUSLY PROBLEM WATER" CATEGORY & NEARLY IMPOSSIBLE TO EFFECTIVELY TREAT FOR BOTH WORKING & DRINKING WATER PURPOSES.

MY RECOMMENDATION IS TO SEEK AN ALTERNATE WATER SOURCE, AS THIS WATER SOURCE WILL BE EXTREMELY EXPENSIVE (IF AT ALL POSSIBLE) TO TREAT FOR BOTH UTILITY & POTABLE PURPOSES TO MEET MCL LEVELS.

CC: DICK RAYMOND

SINCERELY,

DALLAS WILEY
SALES MGR.
(505) 299-9581

Culligan.
Dallas Wiley
Customer Service Manager
SOUTHWEST WATER CONDITIONING, INC.
7801 MENAUL BLVD. NE • ALBUQUERQUE, NM 87110 • 299-9581