



To: Roy Blickwedel
Larry Bush

Date: August 3, 2004

From: Jed Thompson

Job No: 1010139.011802

Subject: Groundwater Quality in the Westwater Canyon Member at the Northeast Church Rock Mine

This memorandum was prepared in response to comments to the Northeast Church Rock (NECR) Mine Closeout Plan received from the State of New Mexico, Mining and Minerals Division (MMD) in their memo dated June 23, 2004. This memorandum presents available information about:

- Regional groundwater quality within the Westwater Canyon Member, Dakota Sandstone and Gallup Formation near the NECR Mine site (the Site),
- Historic groundwater quality analyses of NECR mine water; and,
- Comparisons of regional and historic water quality data to the groundwater sample collected at the Site on May 17, 2004.

HISTORIC AND REGIONAL DATA

Historic and regional groundwater quality data sources used in this report are listed below.

- *Water Quality Impacts of Uranium Mining and Milling Activities in the Grants Mineral Belt, New Mexico.* (EPA, 1975)
- *Water Quality Data for Discharges from New Mexico Uranium Mines and Mills.* (NMEID, 1980)
- *Hydrogeology and Water Resources of San Juan Basin, New Mexico. Hydrologic Report 6.* (Stone, 1983)
- *Reclamation Engineering Services, Geohydrologic Report.* (Canonie, 1987)
- *Five-year Review Report, United Nuclear Corporation Ground Water Operable Unit McKinley County, New Mexico.* (USEPA, 1998)
- Discharge Permit (DP) 63 sampling results

The primary aquifers in the Church Rock region are the Dakota Sandstone and Westwater Canyon Member. Higher geologic units, including the Gallup Formation and the alluvium are not historic aquifers (Canonie, 1987).

The alluvium and Gallup Formation at the Northeast Church Rock mine and mill were unsaturated. Occurrences of groundwater in both units are derived from mine dewatering seepage from multiple mines (USEPA, 1998), and are hydraulically separated from the Dakota Sandstone and Westwater Canyon Member by the Upper D-Cross Tongue Member of the Mancos Shale which is a very

Source: Discharge Monitoring Reports (NMDR)

Source	Date	Flow			
		Avg.	Max.		
UNC/Old Church Rock NM 0028550	1983	3	No Discharge		
		2	No Discharge		
		1	Flow Not Reported		
	1982	12	288	586	GPM (gallons per minute)
		11	316	487	"
		10	378	860	"
		9	233	264	"
		8	333	1116	"
		7	443	650	"
		6	238	297	"
		5	227	267	"
		4	204	282	"
		3	212.0	269.3	"
		2	272.0	348.7	"
		1	293.0	316.0	"
	1981	12	262	319.2	"
		11	376.8	445	"
		10	321	820.6	"
		9	361	1189	"
		8	193	419	"
	7	273	277	"	
	6	204	288	"	
	5	218	252	"	
	4	222	234	"	
	3	388	550	"	
	2	306.7	400	"	
	1	141.2	190	"	

Source

Date

Flow

Avg. Max.

NM 0028550

		Avg.	Max.	
1980	12	227	325	@ PNI
	11	373	462	"
	10	335	500	"
	9	130(?)	180	"
	8	186.7	250	"
	7	171.2	200	"
	6		150	} Intermittent flow
	5		150	
	4		150	
	3		4.52 x 10 ⁶ gallons (21 days)	
	2		2.57 x 10 ⁶ " (12 days)	
	1		2.79 x 10 ⁶ " (13 days)	

1979 12

11

10

9

8

7

6

5

4

3

2

1

No Discharge

No Discharge

SOURCE: NPDES DISCHARGE MONITORING REPORTS

UNCL APPRS: 0 0 7/36 0 16/36

SOURCE	NPDES NO.	YEAR	MONTH	TOTAL URANIUM			TOTAL RADIUM - 226			DISSOLVED RADIUM - 226				
				Min	Avg	Max	Min	Avg	Max	Min	Avg	Max		
UNCL NM0028550 Old Church Rock	1982 Round		12	-	0.9	1.3	4	-	10	3.0	-	10	3	10
			11	-	0.9	1.1	-	6.6	8.1	-	4.7	9.2	-	9.2
			10	-	1.1	1.6	-	5.16	7.82	-	3.2	4.0	-	4.0
			9	-	0.7	1.0	-	4.04	4.97	-	3.3	3.8	-	3.8
			8	-	0.8	1.0	-	3.5	4.5	-	2.5	3.6	-	3.6
			7	-	0.9	1.1	-	7.1	12.8	-	5.0	6.2	-	6.2
			6	-	0.77	1.01	-	7.8	9.8	-	3.9	6.5	-	6.5
			5	-	0.82	1.17	-	7.46	8.51	-	5.2	6.8	-	6.8
			4	-	1.10	1.48	-	8.28	10.4	-	6.42	8.50	-	8.50
			3	-	0.98	1.52	-	8.46	9.94	-	5.85	7.97	-	7.97
			2	-	0.78	1.21	-	10.41	14.41	-	3.47	8.60	-	8.60
			1	-	0.95	1.06	-	12.87	22.90	-	1.28	1.62	-	1.62
UNCL NM0028550 Old Church Rock	1981		12	-	1.04	1.68	-	7.71	10.79	-	2.27	3.58	-	3.58
			11	-	1.42	1.84	-	4.01	5.33	-	2.05	4.95	-	4.95
			10	-	0.87	1.39	-	3.01	6.06	-	1.66	3.06	-	3.06
			9	-	1.11	1.72	-	8.95	17.47	-	2.73	6.32	-	6.32
			8	-	0.82	1.24	-	12.93	22.60	-	3.94	7.63	-	7.63
			7	-	0.86	1.41	-	4.69	7.26	-	1.49	1.76	-	1.76
			6	0.55	1.13	2.00	-	9.20	11.85	0.70	3.94	5.51	-	5.51
			5	0.90	1.5	2.39	-	8.36	10.98	0.91	2.09	3.25	-	3.25
			4	0.72	1.13	1.51	-	9.27	14.36	0.65	2.84	7.48	-	7.48
			3	0.64	0.95	1.44	-	8.19	13.78	0	0.98	2.49	-	2.49
			2	0.79	0.99	1.21	-	6.59	14.65	0.53	1.73	3.56	-	3.56
			1	0.35	0.80	1.57	-	10.7	18.60	1.08	3.79	6.54	-	6.54
UNCL NM0028550 Old Church Rock	1980		12	1.00	1.09	1.20	-	12.39	27.46	0.14	1.1	4.64	-	4.64
			11	0.99	1.33	1.65	-	13.82	24.40	1.85	6.42	8.07	-	8.07
			10	0.86	1.09	1.36	-	9.61	18.96	3.24	5.14	7.41	-	7.41
			9	0.37	0.64	1.20	-	3.03	4.48	1.97	3.198	4.01	-	4.01
			8	0.32	0.45	0.86	-	3.568	8.98	3.36	4.51	7.99	-	7.99
			7	0.64	0.874	1.26	-	4.68	6.67	3.89	4.88	6.0	-	6.0
			6	0.67	0.938	1.25	-	2.9	3.9	2.0	3.0	4.5	-	4.5
			5	0.50	0.767	1.16	-	2.4	4.7	0.6	1.6	3.5	-	3.5
			4	0.31	0.423	0.88	-	3.4	4.9	1.0	2.1	3.2	-	3.2
			3	0.18	0.2025	0.35	-	2.125	3.8	0.8	1.65	2.8	-	2.8
			2	0.13	0.22	0.43	-	4.0	7.1	0.7	1.4	2.4	-	2.4
			1	0.14	0.22	0.41	-	2.6	7.1	0.1	1.25	2.7	-	2.7

Source: NPDES Discharge Monitoring Reports

Source

Date

Flow

Avg. Max.

Source	Date	Avg.	Max.	
NC/ North East Church Rock NM0020401	1983 3	No Discharge		
	2	534	977	@ PM (gallons per minute)
	1	794	973	"
	1982 12	965	995	"
	11	965	1016	"
	10	1012	1116	"
	9	1063	1166	"
	8	1148	1624	"
	7	1262	2930	"
	6	870	1136	"
	5	776	1042	"
	4	688	869	"
	3	901.0	1136.0	"
	2	846.0	1027.0	"
	1	882.0	1113.0	"
	1981 12	901.7	1088.2	"
	11	1082.3	1806	"
	10	831.8	1570.4	"
	9	869	1228	"
	8	552	1113	"
	7	913	1246	"
	6	826	1010	"
	5	1025	1076	"
	4	1015	1096	"
	3	1038.5	1099	"
	2	1067.4	1115	"
	1	1054.9	1095	"

Source

Date

Flow

Avg. Max.

NM0020401

		Avg.	Max.	
1980	12	1038	1080	LPM
	11	1039	1096	"
	10	1013	1076	"
	9	1029.4	1069	"
	8	1076.6	1103	"
	7	1097.2	1147	"
	6	1104.8	1134	"
	5	1050	1102	"
	4	1082.6	1152	"
	3	1002	1008	" (3/11/80 - 3/29/80)
		-	1074	(3/22/80 - 3/31/80)
	2	1028.5	1077	"
	1	1069	1113	"
1979	12	1082.5	1109	"
	11	1007.2	1061	"
	10	932.2	1058	"
	9	1082.5	1131	"
	8	1105.8	1163	"
	7	976.2	1091	"
	6			
	5	} DATA MISSING		
	4	}		
	3	^{Min.} 50	447	1288
	2	1288	1338	1355
	1	1324	1356	1423

SOURCE: NPDES DISCHARGE MONITORING REPORTS

13 of 36 months

445

WALTONS

2/33 1/33

10/45

SOURCE	NPDES NO.	YEAR	MONTH	TOTAL URANIUM Mg/L			TOTAL RADIUM - 226 pCi/L			DISSOLVED RADIUM - 226 pCi/L							
				Min	Avg	Max	Min	Avg	Max	Min	Avg	Max					
UNC	NM0020401	1982	NE Church Rock	report	2.0			10				report	3.3				
				UNC	NM0020401	1981	N.E. Church Rock										
UNC	NM0020401	1980	NE Church Rock														

*Data reflects monitoring period March 1, 1980 thru March 29, 1980. Additional data submitted for monitoring period March 29, 1980 thru March 31, 1980 is presented on page 2 of this report.

SOURCE: NPDES DISCHARGE MONITORING REPORTS

SOURCE	NPDES NO.	YEAR	MONTH	TOTAL URANIUM mg/l			TOTAL RADIUM - 226 pCi/l			DISSOLVED RADIUM - 226 pCi/l			
				Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	
UNIC NMC000401 N.E. Church Rock		1979	12	0.61	0.755	0.95				<0.6	0.82	1.3	
			11	0.63	0.72	0.85				<0.6	0.92	1.5	
			10	0.65	1.006	1.60				<0.6	0.94	1.3	
			09	0.38	0.57	0.93				<0.6	1.3	1.9	
			08	0.49	0.69	0.94				<0.6	0.82	1.4	
			07	0.56	0.74	1.04				<0.6	1.52	2.4	
			06										
			05										
			04										
			03	0.44	0.74	1.28				<0.6	0.9	1.3	
			02	0.30	0.75	1.63				<0.6	<0.6	0.8	
			01	0.30	0.95	1.87				<0.6	0.8	1.2	
			UNIC NMC000401 N.E. Church Rock		1980								
Additional data for period March 22 thru March 31			03	0.58	0.57	0.60			10.6	<0.6	<0.6	<0.6	

Source: NPDES Discharge Monitoring Reports

Source	Date	Flow		MED	(Million gallons per day)
		Avg.	Max.		
rr McGee-Church Rock I NM 0020524	1982 12	3.27	3.50		
	11	3.42	3.79	"	
	10	3.36	3.80	"	
	9	3.46	3.72	"	
	8	3.43	3.80	"	
	7	3.45	3.69	"	
	6	3.59	3.82	"	
	5	3.71	3.96	"	
	4	3.71	4.06	"	
	3	3.59	3.86	"	
	2	3.56	3.85	"	
	1	3.46	3.81	"	
	<hr/>				
	1981 12	3.38	3.90	"	
	11	3.48(?)	3.77	"	
	10	3.20	3.56	"	
	9	3.67	4.42	"	
	8	3.78	4.54	"	
	7	3.72	3.95	"	
	6	3.4	3.4	"	
	5	3.5	3.5	"	
	4	3.5	3.5	"	
	3	5.5	5.5	"	
	2	5.5	5.5	"	
	1	5.5	5.5	"	

Source

Date

Flow

Avg. Max.

NM0620524

		Avg.	Max.	
1980	12	5.5	5.5	MCD ²¹ EST
	11	5.5	5.5	"
	10	5.5	5.5	"
	9	5.5	5.5	"
	8	5.5	5.5	"
	7	5.5	5.5	"
	6	5.5	5.5	"
	5	5.5	5.5	"
	4	-		
	3	-		
	2	-		
	1	-		

SOURCE: NPDES DISCHARGE MONITORING REPORTS

OF VIOLATIONS / # OF MONTHS **5/32**

1/32

SOURCE	NPDES NO.	YEAR	MONTH	TOTAL URANIUM mg/l.e			TOTAL RADIUM - 226 Pci/l.e			DISSOLVED RADIUM - 226 Pci/l.e				
				Min	Avg	Max	Min	Avg	Max	Min	Avg	Max		
Kerr-McGee Church Rock I	NM0020524	1982	PERMIT LIMIT:			2.0						3.3		
			12			1.5							0.40	
			11			2.1							0.59	
			10			2.1							0.45	
			09			1.98							0.40	
			08			1.75							1.23	
			07			2.0							0.69	
			06			1.5							2.25	
			05			1.4		1.5					0.62	
			04			1.4		1.5					0.30	
			03			1.4		1.5					0.29	
			02			1.4		1.6					0.24	
			01			1.5		1.7					0.39	
			12			1.1		1.3					0.62	
			11			1.1		1.3					0.42	
			10			1.18		1.3					1.04	
			09					1.2						0.51
			08					1.4					0.44	
			07					1.4						1.48
			06					1.3						0.93
05					1.4						2.85			
04					1.4						1.0			
03					1.6						0.60			
02					1.35						3.2			
01					1.3						0.94			
12					1.1						1.5			
11					1.6						1.60			
10					1.0						1.7			
09					1.2						1.8			
08					1.2						1.4			
07					1.3						2.4			
06					1.34						1.23			
05					1.36						1.54			
04														
03														
02														

Kerr-McGee NM0020524 1981
Church Rock I

Kerr-McGee NM0020524 1980
Church Rock I

NPDES # NM 0020401

EID SAMPLING RESULTS
 CSI
 UNITED NUCLEAR CORPORATION
 North East Church Rock
 July 20 - 21, 1982

NM 0020401

<u>Outfall</u>	<u>Parameter</u>	<u>NPDES Requirements</u>		<u>NMEID Sampling Results</u>
		<u>Daily Avg.</u>	<u>Daily Max</u>	
001	Temp	Report °F	Report °F	24 °C
	TSS	20 mg/l	30 mg/l	2.6 mg/l
	COD	100 mg/l	200 mg/l	12.0 mg/l
	Tot Zn	0.5 mg/l	1.0 mg/l	<0.05 mg/l
	Diss Ra-226	Report pCi/l	3.3 pCi/l	1.35+0.07 pCi/l
	Tot. Ra-226	10.0 pCi/l	30.0 pCi/l	1.14+0.10 pCi/l
	Tot. U	Rpt mg/l	2.0 mg/l	0.87 mg/l
	Tot. Mo	Rpt mg/l	Rpt mg/l	0.014 mg/l
	Tot Se	Rpt mg/l	Rpt mg/l	0.043 mg/l
	Tot. V	Rpt mg/l	Rpt mg/l	0.010 mg/l
	pH 6.0 - 9.0 SU			8.16

NPDES # NM0028550

EID SAMPLING RESULTS
CSI
United Nuclear Corporation
Old Church Rock Mine
July 20 - 21, 1982

NM0028550

<u>Outfall</u>	<u>Parameter</u>	<u>NPDES Requirements</u> Daily Avg. Daily Max		<u>NMEID</u> <u>Sampling Results</u>
001	Temp	N/A	N/A	24°C
	TSS	20mg/l	30mg/l	4.8 mg/l
	COD	100mg/l	200mg/l	27.9 mg/l
	Ra-226 diss	3pCi/l	10pCi/l	5.37+0.12pCi/l
	Tot. Ra-226	10pCi/l	30pCi/l	5.49+0.11pCi/l
	Tot. U	2.0mg/l	4.0mg/l	1.16 mg/l
	Tot. Zn	0.5mg/l	1.0mg/l	< 0.05 mg/l
	Tot. Mo	N/A	N/A	< 0.01 mg/l
	Tot. Se	N/A	N/A	0.015 mg/l
	Tot. V	N/A	N/A	0.028 mg/l
	pH 6.0 - 9.0 SU			9.03 SU

EID SAMPLING RESULTS

On November 30, 1982 the EID sampling team set up an ISCO Model 1680 twenty-four hour automatic sampler. The iced sampler was secured in an insulated, wooden box. The sampler was set to collect one aliquot once every sixty minutes starting at 09:25 a. m. . A flow-weighted 24-hour composite sample was not obtained due to a damaged Manning Dipper. A composite sample was collected by combining equal aliquots from the twenty-four hour automatic sampler.

Table II lists the results of the November 30-December 1, 1982 CSI at Kerr McGee's Church Rock I Mine. The table lists the results of NPDES-required parameters.

TABLE II

<u>Outfall</u>	<u>Parameter</u>	<u>NPDES Requirements</u>		<u>NMEID Sampling Results</u>
		Daily Avg	Daily Max	
001	Temp	-	-	13.5°C
	TSS	20 mg/l	30 mg/l	3 mg/l
	Tot. U	N/A	2 mg/l	1.40 µg/ml
	Diss.Ra-226	N/A	3.3 pCi/l	0.32 ± 0.04 pCi/l
	Tot. Mo.	N/A	N/A	0.47 µg/ml
	Tot. Se	N/A	N/A	0.027 µg/ml
	Tot. V	N/A	N/A	0.012 µg/ml
	pH 6.0-9.0SU			8.76 SU

EID's Surface Water Section is currently proposing extensive revisions to Part 2 of the New Mexico Water Quality Control Commission Regulations. Part 2 of the Regulations deal with discharges to surface waters. In order to gather background data concerning discharges from uranium mines, permission was requested from Mr. Brekhus for the sampling of non-NPDES parameters. Permission was granted. Table III contains the results of the sampling.

TABLE III

<u>Outfall</u>	<u>Parameter</u>	<u>NMEID SAMPLING Results (mg/l)</u>	<u>TYPE OF Sample</u>
001	As	0.008	24-hour composite
	Ba	0.25	24-hour composite
	Cd	0.001	24-hour composite
	Cr	< 0.005	24-hour composite
	Cu	< .05	24-hour composite
	Pb	< 0.005	24-hour composite
	Hg	< 0.0005	24-hour composite
	Mo	0.47	24-hour composite
	Ni	< 0.05	24-hour composite
	Se	0.027	24-hour composite
	Ag	< 0.001	24-hour composite
	Zn	< 0.05	24-hour composite
	B	0.27	Grab
	Tot. Fe	0.11	Grab
	Mn	0.05	Grab
	Fluoride	0.34	24-hour composite
COD	10.1	24-hour Composite	