ADDENDUM 1-A

SUMMARY OF ROCKY MOUNTAIN ENERGY'S PILOT PLANT OPERATIONS

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1 SUMMARY OF ROCKY MOUNTAIN ENERGY'S PILOT PLANT OPERATIONS

This addendum summarizes Rocky Mountain Energy's (RME) research and development (R&D) in-situ leaching operations at the Reno Creek Site. Rocky Mountain Energy's Demonstrated Restoration Report dated November 1981 for Pattern 2 is included toward the end of this addendum.

Included within this addendum are correspondence and reports describing the operational results and restoration process to and from RME and regulatory agencies. NRC's letter to RME dated June 1983, states that restoration of Pattern 2 was restored to a level that would support an application for a commercial scale license. A second letter from WDEQ LQD dated May 4, 1983 states that restoration met applicable use classification standards.

The building which housed the R&D ion exchange facility, the evaporation pond, and the in-situ leaching test wells for Pattern 1 were located in the northwest corner of Section 27, Township 43 North, Range 73 West on property currently controlled by AUC LLC. Pattern 2 is located approximately 500 feet northeast of Pattern 1 in the southwest corner of Section 22, Township 43 North, Range 73 West. Figure 1A-1 displays the site layout for the historical RME R&D facility. Note that well locations in Pattern 2, Figure 1A-1 are different at three well sites as shown by the Rocky Mountain Energy Company "Pilot Plan Site Plan" on page Addendum 1A-64. RME's map has been annotated to show the correct well numbers.

1.1 PATTERN 1

By the mid 1970's, RME delineated a significant mineral resource at Reno Creek and a decision was made to bring the property to full-scale production using the ISR method. In January 1979, an ISR testing program commenced with the completion of a 100 gallon per minute (gpm) pilot plant (shown in ER Figure 1-2). Two test patterns were installed and operated. The first pattern (Pattern 1) utilized sulfuric acid lixiviant because of the higher recoveries indicated in the amenability tests. Pattern I was operated with H_2SO_4 at a pH of 1.7.

Pattern 1 was operated from February 1979 to November 1979 when it was terminated because results from this pattern were unsatisfactory. It employed a sulfuric acid lixiviant and hydrogen peroxide as the oxidant. Pattern 1 wells were located in a typical five-spot pattern with the production well in the center. Well spacing was 40 feet from the injectors to the producing well. The target injection rate was 40 gpm total but the production rate is unknown.

Circulation problems were reported due to chemical reaction of the sulfuric acid with naturally occurring calcium carbonate within the ore zone. Severe permeability loss resulted from high levels of calcium mobilized by the acid precipitating as gypsum within the ore sand, sealing off the formation to the point operations had to be curtailed. In addition to significant calcium levels in the pregnant solution, a fungus strain propagated, causing fouling of the ion exchange columns. Analysis indicated that over 20 pounds of calcium were being mobilized from dissolution of calcareous material in the formation for each pound of uranium recovered.

Decreased flows resulted and were assumed to be caused by gypsum precipitation and fungal growth. Uranium recovery from the pattern was not successful. Due to unfavorable results of the acid leaching process in Pattern 1, RME ended further R&D work with acid leaching at Reno Creek. Despite attempts to improve recovery and injectivity, the acid pattern ultimately proved that this formation cannot be leached effectively using acid lixiviants. Restoration began in November 1979 until March 1981. Stabilization of the groundwater of Pattern 1 was acknowledged and signed off by the NRC in March of 1986 (Accession #8604040293/Docket #04008697).

1.2 PATTERN 2

Unfavorable results with Pattern 1 testing led to the installation and operation of a second pattern (Pattern 2) in October 1980 using a $Na_2CO_3/NaHCO_3$ lixiviant and H_2O_2 oxidant. Pattern 2 was constructed as a modified 5-spot, consisting of two recovery wells, four injection wells, and six monitor wells. Pattern 2 was operated from October 1980 to December 1980. The results, coupled with the column leach test results, led RME to the decision to switch to carbonate lixiviant for further testing and commercial development. Uranium recovery and average head grade were especially encouraging.

Leaching at Pattern 2 was started on October 7, 1980 and continued through December 21, 1980. The pattern was operated at a 23-25 gpm production rate and a 20 gpm injection rate. Approximately 10 pore volumes were circulated through the wells during the leaching phase (one pore volume = 259,000 gallons).

Sodium bicarbonate was employed as the lixiviant and hydrogen peroxide was used as the oxidant. H_2O_2 was an effective oxidant due to low concentrations of pyrite and carbonaceous material in the formation.

Uranium levels peaked at 65 mg/L and approximately 1,200 pounds of U_3O_8 were recovered. In order to demonstrate restoration, leaching was stopped while U_3O_8 concentrations were still at 15 mg/L.

Recirculation of fluid was initiated after injection of refortified lixiviant ceased, and continued until February 22, 1981, constituting a total of 6.6 pore volumes.

Restoration followed and continued until April 16, 1981, constituting a total of 6.6 additional pore volumes through the pattern.

A 12-month stabilization period followed including six rounds of monthly samples, followed by six months of quarterly sampling.

Pattern 2 utilized five-inch diameter wells, arranged in a modified five spot with two production wells in the center. Four injection wells were located approximately 50 feet away from the production wells at the corners of the pattern. Six monitoring wells (including one overlying aquifer well and one underlying well) were employed. No excursions were indicated in any well, demonstrating successful fluid control within the PZA and hydrologic isolation of the upper and lower zones.

A brief discussion of conditions regarding the PZA and the injection and producing wells follow:

- Groundwater table depth: 255-256.8 feet bgs
- Groundwater elevations: 4927.04 to 4927.21 feet MSL
- Under ream (ore) depth: 285-293 feet bgs
- Saturated thickness above under reamed zone: 30 feet head
- PZA top: 244-245 feet bgs
- PZA thickness: 121 feet
- Approximate thickness of unsaturated PZA sand above water table: 10-12 feet

See Table 1A-1 reproduced from RME's report "Hydrologic Analysis of the Reno Creek - Pattern 2 Property for In Situ Uranium Recovery", June, 1981.

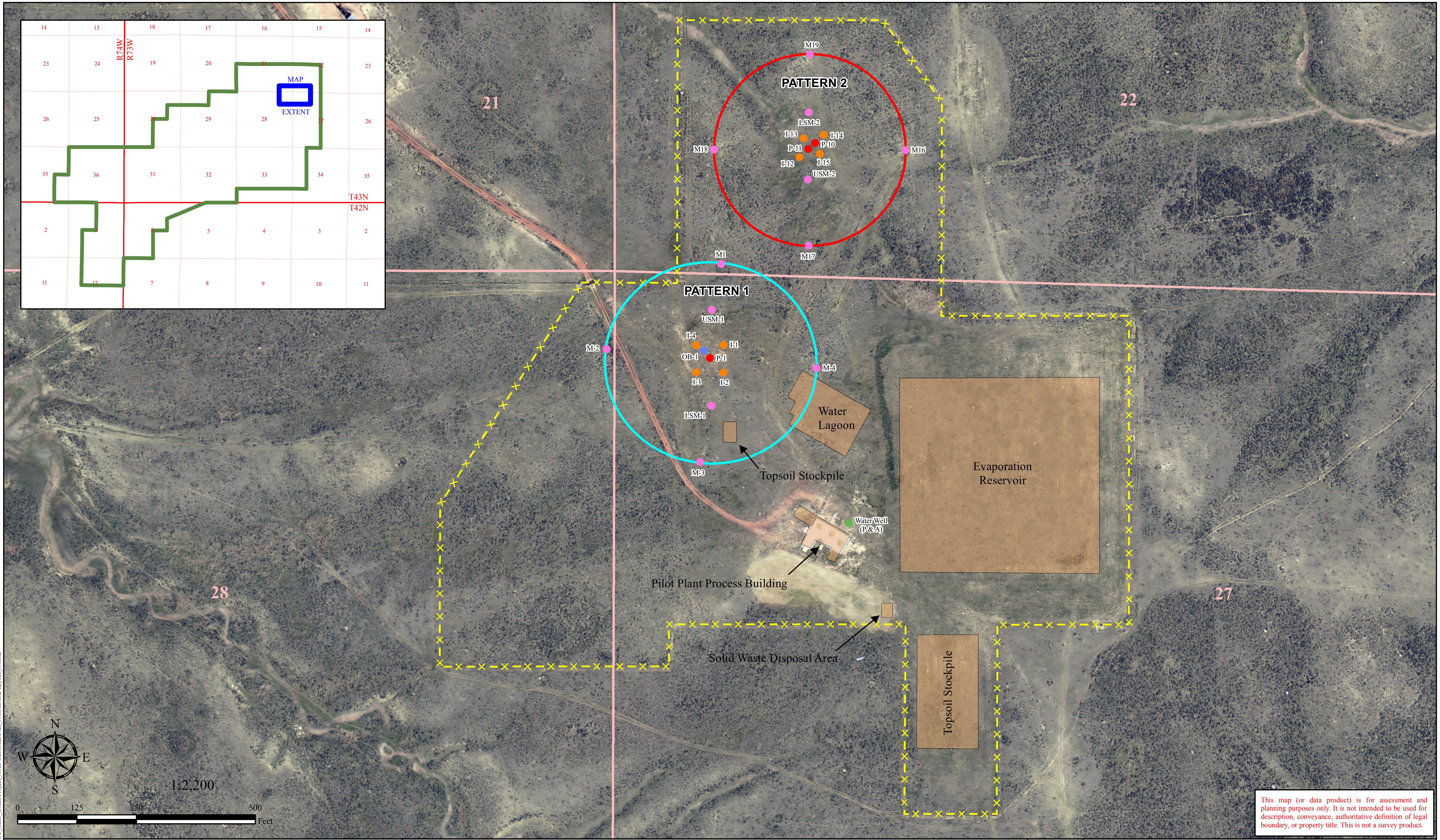
Analysis of water quality data following completion of the restoration program indicate that restoration of groundwater affected during ISR was successful. All parameters returned to baseline ranges with the exception of pH, uranium and vanadium. Of these parameters, all are either below Wyoming Department of Environmental Quality (WDEQ) Class I Groundwater Standards (domestic use) or do not have Class I maximum concentration limits (WDEQ, 1980). Pattern 2 pilot testing culminated in regulatory signoff in June 1983 with the approval of carbonate leaching for commercial operations at Reno Creek under Materials License Number SUA-1338 as part of NRC Docket #04008697/Accession #8306200160.

Table 1A-1: Reno Creek Well Pattern #2 Data

	Coordinates (ft.)		Top of Casing	Ground	Casing	(Perforated Interval)	Under-Reamed	Total Thickness	Top	Bottom	Depth to Water	Piezometric
Well Name & Number[1]	N(Y)	E(X)	Elevation (ft.)	Elevation (ft.)	TD (ft.)	# Perforations (ft.)	Interval (ft.)	Reamed/Perforated Interval (ft.)	Sand[2]	Sand[2]	Level (ft.)[3]	Surface Elevation (ft.)[4]
Production Wells												
P10	1,098,013.3	379,461.6	5,182.41	5,181.03	400		(285-310) (330-335)	25 5	244	370	255.20	4,927.21
P11	1,098,000.0	379,447.1	5,182.17	5,181.22	400		(285-310)	25	244	370	255.00	4,927.17
Injection Wells												
I-12	1,097,982.9	379,428.8	5,183.78	5,181.43	400		(290-303)	13	244	370	256.74	4,927.04
I-13	1,098,022.7	379,437.6	5,182.26	5,180.31	400		(288-301)	13	244	370	255.18	4,927.08
I-14	1,098,030.3	379,479.2	5,183.89	5,182.21	400		(293-304) (332-338)	11 6	245	373	256.80	4,927.09
I-15	1,097,989.5	379,471.2	5,183.74	5,182.24	400		(292-305)	13	245	370	256.66	4,927.08
Monitor Wells												
M16	1,097,998.2	379,651.3	5,192.09	5,190.62	400	(262-374) 336		112	259	375	264.80	4,927.29
M17	1,097,796.8	379,448.6	5,192.48	5,191.10	400	(269-377) 324		108	266	378	265.21	4,927.27
M18	1,097,998.7	379,248.5	5,188.12	5,186.77	400	(258-378) 360		120	252	379	261.10	4,927.02
M19	1,098,199.6	379,450.0	5,186.25	5,184.85	400	(257-353) 288		96	258	353	259.16	4,927.09
USM-2	1,097,936.21	379,446.15	5,185.17	5,183.30	190		(150-190)	40	151	190	152.75	5,032.42
LSM-2	1,098,077.14	379,447.75	5,183.03	5,181.00	400		(400-440)	40	410	440	260.40	4,922.63

[1] Five-inch well
[2] From ground elevation; average aquifer thickness - 121 ft.
[3] From top of casing
[4] Measured on May 27, 1980

Source: Hydrologic Analysis of the Reno Creek Pattern 2 Property for In-situ Uranium Recovery, Rocky Mountain Energy, June 1981



PREPARED FOR

AUC LLC
LAKEWOOD, CO

PROPOSED RENO CREEK PROJECT
CAMPBELL COUNTY, WY

TREC, Inc.
Engineering & Environmental Management
900 Werner Court
Suite 150
Casper, WY 82601
Phone (307) 265-0696
Fax (307) 265-2498
www.treccorp.com

Legend

- Proposed Reno Creek Project Boundary
- RME Features
- Fenced Area

Well Type

- Injection
- Monitor
- Observation
- Production
- Water Well

ISR Pattern

- Pattern 1
- Pattern 2

DRAWN BY: RHK
CHECKED BY: RMD
APPROVED BY: JEY

Historical RME Site Layout

REV #	DESCRIPTION	BY	DATE	FIGURE
0	Draft for Review	RHK	01/06/12	1A-1
1	Final	RHK	01/09/12	
2	Revised per RAI	EGS	04/03/14	

Regulatory Correspondence

RECEIVED JUN 22 1983

UNITED STATES

NUCLEAR REGULATORY COMMISSION

REGION IV

URANIUM RECOVERY FIELD OFFICE
BOX 25325
DENVER, COLORADO 80225

JUN 17 1983

URFO:FWR
Docket No. 40-8797
04008797090E

Rocky Mountain Energy Company
10 Longs Peak Drive
Box 2000
Broomfield, Colorado 80020

Gentlemen:

The NRC staff has reviewed your July 16, 1982 submittal on final groundwater stabilization data for test Pattern II at the Reno Creek R&D facility. Based on your data and the analytical results from confirmation samples taken by the WDEQ in February 1983, the staff concluded that, with the exception of uranium, the restoration objective of returning all parameters to within baseline ranges has been met. Although uranium concentrations within the wellfield exceed baseline, they are at levels which meet all WDEQ water use class standards.

The restoration of Pattern II demonstrates your ability to restore groundwater within the ore zone aquifer at Reno Creek using sodium-based carbonate lixiviant to a level that would support an application for a commercial scale license. However, if commercial scale mining is pursued at this site, it is expected that at the completion of commercial-scale operations, uranium can be returned to concentrations lower than those currently in Pattern II.

RME may abandon all Pattern II wells using methods approved by the State of Wyoming.

Sincerely,

R. Dale Smith, Director for
Uranium Recovery Field Office
Region IV

M.A. Kaucman

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Department of Environmental Quality

LAND QUALITY DIVISION

401 WEST 19TH STREET

TELEPHONE 307-777-7756

CHEYENNE, WYOMING 82002

May 4, 1983

MAY 11 1983

J.A. Yellich
Rocky Mountain Energy Corp.
10 Longs Peak Drive
Box 2000
Broomfield, CO 80020

RE: Reno Creek Project, Permit No. 479

Dear Mr. Yellich:

On the basis of information supplied by your company and on the basis of confirmation water samples taken by Land Quality Division staff on February 8 and 9, 1983, the Land Quality Division finds that restoration of the groundwater within the Pattern II well field has met applicable groundwater use classification standards as required by the permit.

Therefore, Rocky Mountain Energy is released from any further aquifer and groundwater restoration for the Pattern II well field and the bonding requirements thereof.

The Department of Environmental Quality and the Land Quality Division recognizes that although the Reno Creek Project was permitted as a regular mining permit, the intent of the project was research and development on the feasibility of various well patterns and lixiviants in a Wasatch ore body.

The restoration results for Pattern II show that pre-mining baseline conditions have been achieved for all parameters except uranium and that element's concentration has been reduced to a level within Water Quality's classification of use standards.

It is felt that during commercial-scale operations, mining will be carried further to completion and uranium levels will be reduced to levels below those presently found in Pattern II.

Accordingly, the Land Quality Division acknowledges that the feasibility of groundwater restoration using a carbonate-based lixiviant has been demonstrated at the Reno Creek Project's Pattern II. From this test, it would appear that a properly designed in-situ leach operation of commercial scale would be environmentally acceptable if it used a carbonate-based lixiviant.

I have contacted the NRC on this decision and they have indicated that they will be taking concurrent action.

Please be advised that any changes you desire to make to Bond No. 3427761 should be coordinated through Rick Chancellor of the Sheridan District Office.

Sincerely,

Robert E. Sundin

Robert E. Sundin
Director
Department of Environmental Quality

RES:dlw
cc: Rick Chancellor
Bill Garland
John Linehan

~~CEIVED~~ ...

MEMORANDUM

TO FILE: Rocky Mountain Energy - Reno Creek, Pattern II, TFN 1 4/192

FROM: Paula Schmittdiel, Hydrologist PMS

DATE: March 21, 1983

SUBJECT: Final Groundwater Restoration - Pattern II

Checked By:

I. Introduction

A uranium in-situ leach test was conducted at the Reno Creek Site, Pattern 2 between October 7, 1980 and December 21, 1980. Recirculation continued until February 22, 1981 followed by restoration using methods of ion exchange and several groundwater sweeps. Active restoration was concluded on April 16, 1981 and a 12 month period of stabilization began with the collection of monthly samples for the first six months and two quarterly samples collected during the second six-month period. The Department reviewed the stabilization data for Pattern II, for the first six month period (re: memos to file April 22, 1982, and April 27, 1982 and letter to RME - May 5, 1982) and requested two additional quarterly samples. The additional data was submitted in August, 1982. In February, 1983, confirmation samples were taken by LQD/DEQ and spilt with RME.

II. Discussion

In its prior review, the Department found that the water quality in the production zone had been restored to baseline for all parameters except, uranium, vanadium, thorium-230 and pH (memos to file April 22, and April 27, 1982). The two production wells (P-10 and P-11) and the four monitoring wells (M-16, M-17, M-18 and M-19) were sampled 2-6 times during baseline and individual baseline averages and ranges were established for each of these wells. The four injection wells (I-12, I-13, I-14 and I-15) were not sampled at all during baseline and hence a pattern average and range were established for these wells.

Two subsequent quarterly samples showed pH to be stabilized at an average value of 7.9 compared to an average value of 8.49 for a pattern baseline average. The classification of use has not changed from baseline and the current pH values although slightly below the lower baseline range (i.e. 8.16-8.94) are acceptable restoration values.

Vanadium concentrations have dropped since October, 1981 to within baseline range in the injection wells. The concentration levels for vanadium in the production wells have decreased but are still above baseline. Vanadium concentrations appeared to have stabilized near or below baseline depending upon the well. Baseline concentrations are above 0.1 mg/l - the standard for Class II and Class III quality of use.

Concentration of Thorium-230 have appeared above the baseline concentration of 1.9 pCi/l. Generally, the concentration levels have been less than 5 pCi/l but values have been reported as high as 30 pCi/l. These high values do not appear with any consistency and some discrepancy appears to exist between the two laboratories on reported values for Thorium-230.

Uranium concentrations are above baseline in both the production and injection wells. Concentrations in all six wells (P-10, P-11, I-12, I-13, I-14 and I-15) increase steadily during the first six month period following active restoration. In the second six month period, Uranium concentrations increase slightly and appear to be stabilized. The concentration levels are below the standard for Class I, II and III - 5.0 mg/l.

III. Results of Confirmation Sampling

The results of the samples taken 2-7-83 confirm that the groundwater quality has been restored to baseline with the exception of uranium and pH. Production well, P-11, injection well I-15, and monitoring wells M-16 and M-19 were sampled at Pattern I The samples were analyzed for the full suite of water quality parameters (Appendix 2, Guideline No. 8) by Energy Laboratories. Samples were sent to Camp, Dresser & McKee, Inc. for analysis of Uranium, Radium-226 and Vanadium. Copies of the results are attached.

Values for pH were below the baseline range for wells P-11 and I-15 and above the baseline range for monitoring well M-19. The laboratory pH for wells P-11 and I.15 was 7.6. Baseline pH values ranged from 8.51 to 8.61 and from 8.16 to 8.94 for wells P-11 and I-15, respectively. The pH values for the production and injection wells have stabilized between 7.6 and 7.9 for the second six month period by stabilization. A pH value of 7.6 is acceptable in terms of groundwater restoration since few trace metals would be mobilized at a neutral pH. The pH value of 9.6 in the monitoring well M-19 is above the baseline range of 8.8 but should not be a major concern in terms of the water quality. The other water quality parameters are at baseline or within an acceptable range for baseline, including uranium.

Uranium values in the confirmation samples are within the baseline range or have decreased significantly since April, 1982. Concentrations are still above the baseline range in the production and injection wells as is shown in the table below.

Well	Baseline Range (mg/l)	Concentration, April 1, 1982	Confirmation Sample (m
P-11	.025 - .093	1.77	1.6
I-15	.012 - .287	3.36	2.1

Concentrations in the two monitoring wells are within the baseline range indicating that Uranium has not been mobilized in the vicinity of these wells due to the in-situ leach process.

IV. Conclusions

Restoration of groundwater quality to baseline has been successfully demonstrated at Pattern II, Reno Creek in situ leach test site for all parameters with the exception of uranium and pH. Concentration levels of uranium are above baseline at the production and injection wells at Pattern II although the concentration levels are below the standard for quality of use for Class I, II and III. Uranium appears to be decreasing or at least stabilizing at present concentration levels and with time should stabilize at levels closer to baseline. The variability of uranium concentrations in the pattern has decreased with time to indicate that the formation is reaching stabilization although above baseline at the present time. Uranium levels could possibly have been lower following restoration if maximum recovery of uranium had been achieved - such as would occur at a commercial scale.

Values for pH are below the baseline range but are well within an acceptable range of values such that mobilization of trace metals would not present a problem. Further restoration efforts, i.e. additional groundwater sweeps or alternate technologies do not appear to be warranted for the small improvement that may be possible. Additional restoration efforts could possibly mobilize more uranium or vanadium or other constituents which are presently stable.

A twelve month stabilization monitoring period is strongly recommended to evaluate groundwater quality stability. As stated by RME in their conclusions, it wasn't until the later portion of the monitoring year (i.e. April, 1981 to April, 1982) that evidence supporting stabilization evolved. Six months of stabilization monitoring is not considered sufficient to evaluate groundwater quality stability.

PS:dlw
Attachments

ENERGY LABORATORIES

ENERGY LABORATORIES, INC.

1105 WEST FIRST STREET · GILLETTE, WY 82716 · PHONE (307) 686-7175

RECEIVED MAR 1983 LAND QUALITY DIVISION

LABORATORY REPORT

Lab. No. G-83-0847

To Wyoming DEQ Date 3-1-83 CB

Address 401 West 19th Street, Cheyenne, WY 82002

ok - within/below baseline range
✓ - significantly above baseline

SPECIAL WATER ANALYSIS

Well P-11

1

Sampled 2-8-83 @ 10:15
Sample Submitted 2-8-83

CONSTITUENT	MILLIGRAMS PER LITER	Baseline range
Potassium	10	7.3 – 7.9
Sodium	327	287 – 360
Calcium	115	130 – 147
Magnesium	28	23 – 25
Sulfate	950	853 – 925
Chloride	11	10.9 – 18.8
Carbonate	0	2.4 – 7.7
Bicarbonate	120	97 – 116
Total Dissolved Solids @ 180°C	1,440	1440
Total Alkalinity as $CaCO_3$	98	80 - 95
Sum of Major Anions	22.0 meq/l	
Sum of Major Cations	22.5 meq/l	
Cation-Anion Balance, % difference	1.12	
Specific Conductance @ 25°C	1,820 umhos/cm	2067
pH	7.6	8.51 – 8.61
Nitrate & Nitrite as N	<0.05	<.05
Ammonia as N	<0.1	<.2
Fluoride	<0.10	.10 – .12
Total Acidity as $CaCO_3$	0	

TRACE METALS (Dissolved):

	mg/l	Baseline Range		mg/l	Baseline Range
Aluminum	<0.1	<0.2	Lead	<0.01	.01-.04
Arsenic	0.006	.001	Manganese	0.05	.04
Barium	<0.1	.11-.26	Mercury	<0.001	<0.0001
Boron	<0.1	<0.1	Molybdenum	0.009	.01 - .03
Cadmium	<0.001	<0.01	Nickel	<0.03	.01 - .02
Chromium	<0.02	0.07	Selenium	0.006	.009 - [illegible]
Copper	<0.01	0.02	Zinc	<0.01	.04 - .06
Iron	0.05	.05-.07			

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LABORATORY REPORT

Lab. No. G-83-0848

To Wyoming DEQ Date 3-1-83 CB

Address 401 West 19th Street Cheyenne, WY 82002

ok
✓ slightly elevated above baseline, no problem
↑ significantly above baseline

SPECIAL WATER ANALYSIS

3

Sampled 2-8-83 @ 12:45
Sample Submitted 2-8-83

Well I-15

CONSTITUENT	MILLIGRAMS PER LITER	Baseline range
✓ Potassium	10	5.8 - 9.5
ok Sodium	312	287 - 360
ok Calcium	119	108 - 153
ok Magnesium	33	19 - 33
ok Sulfate	956	818 - 1002
ok Chloride	11	7.0 - 18.8
ok Carbonate	0	0 - 14
ok Bicarbonate	113	89 - 176
ok Total Dissolved Solids @ 180°C	1,520	1340 - 1580
ok Total Alkalinity as $CaCO_3$	93	73 - 146
Sum of Major Anions	22.0	meq/l
Sum of Major Cations	22.5	meq/l
Cation-Anion Balance, % difference	1.12	
ok Specific Conductance @ 25°C	1,880	umhos/cm
→ pH	7.6	8.16 - 8.54
ok Nitrate & Nitrite as N	<0.05	.05
ok Ammonia as N	0.1	.2
ok Fluoride	<0.10	.09 - .15
Total Acidity as $CaCO_3$	0	

TRACE METALS (Dissolved):

	mg/l	Baseline		mg/l	Baseline
ok Aluminum	<0.1	.2	Lead ok	<0.01	.03 - .11
ok Arsenic	<0.005	.001 - .016	Manganese ok	0.06	.01 - .1
ok Barium	<0.1	.08 - .40	Mercury ok	<0.001	<.0001
ok Boron	<0.1	<.1	Molybdenum ok	0.007	.01 - .
ok Cadmium	<0.001	.01 - .02	Nickel ok	<0.03	.01 - 1
ok Chromium	<0.02	.02 - .11	Selenium ok	0.006	.009 -
ok Copper	<0.01	.01 - .02	Zinc ok	<0.01	.01 - ..
ok Iron	0.03	.03 - .61			

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LABORATORY REPORT

Lab. No. G-83-085

To Wyoming DEQ Date 3-1-83 CB

Address 401 West 19th Street Cheyenne, WY 82002

SPECIAL WATER ANALYSIS

Well M-16

#5
Sampled 2-9-83 @ 12:15
Sample Submitted 2-9-83

CONSTITUENT		MILLIGRAMS PER LITER	Baseline
Potassium	8.1	8	6.2 - 9.5
Sodium	309	333	301 - 325
Calcium	135	131	114 - 153
Magnesium	25.8	21	23 - 33
Sulfate	937	1,010	895 - 1012
Chloride	9.8	12	9 - 12
Carbonate	6.2	12	0 - 11
Bicarbonate	133	59	102 - 178
Total Dissolved Solids @ 180°C	1524	1,500	1180 - 1580
Total Alkalinity as $CaCO_3$	110	69	84 - 146
Sum of Major Anions		22.7	meq/l
Sum of Major Cations		23.0	meq/l
Cation-Anion Balance, % difference		0.66	
Specific Conductance @ 25°C	2114	1,990	2051 - 2234 umhos/cm
pH	8.43	8.9	8.16 - 8.65
Nitrate & Nitrite as N		<0.05	<0.05
Ammonia as N		<0.1	<0.2
Fluoride		<0.10	.10 - .11
Total Acidity as $CaCO_3$		0	

TRACE METALS (Dissolved):

	mg/l	baseline range		mg/l	baseline range
Aluminum	<0.1	<0.2	Lead	<0.01	.03 - .09
Arsenic	<0.005	.015 - .016	Manganese	0.03	.01 - .10
Barium	<0.1	.13 - .26	Mercury	<0.001	<.0001
Boron	<0.1	<0.1	Molybdenum	<0.005	.01 - .04
Cadmium	<0.001	.01 - .02	Nickel	<0.03	.05 - .10
Chromium	<0.02	.10 - .11	Selenium	<0.005	.15 - .01
Copper	<0.01	<0.01	Zinc	<0.01	.02 - .0
Iron	<0.03	.17 - .61			

ENERGY LABORATORIES

ENERGY LABORATORIES, INC.

1105 WEST FIRST STREET • GILLETTE, WY 82716 • PHONE (307) 686-7175

LABORATORY REPORT

Lab. No. G-83-0855

To: Wyoming DEQ   Date: 3-1-83 CB

Address: 401 West 19th Street   Cheyenne, WY 82002

SPECIAL WATER ANALYSIS

#6

Sampled 2-9-83 @ 1:45 PM

Sample Submitted 2-9-83

Well m-19

CONSTITUENT		MILLIGRAMS PER LITER	
Potassium	8.1	10	6.7 - 9.9
Sodium	312	330	297 - 327
Calcium	124	111	123 - 145
Magnesium	23.8	20	20 - 26
Sulfate	975	984	937 - 995
Chloride	10.0	11	8 - 13
Carbonate	5.9	30	5.0 - 7.5
Bicarbonate	101	24	83 - 111
Total Dissolved Solids @ 180°C	1557	1,480	1420 - 1560
Total Alkalinity as $CaCO_3$	83	70	73 - 89
Sum of Major Anions		22.2	meq/l
Sum of Major Cations		21.8	meq/l
Cation-Anion Balance, % difference		0.91	
Specific Conductance @ 25°C	2062	1,900	[illegible] - 2209 umhos/cm
pH	8.4	9.6	8.26 - 8.78
Nitrate & Nitrite as N		<0.05	<.05
Ammonia as N		0.1	<0.2
Fluoride		<0.10	.09 - .15
Total Acidity as $CaCO_3$		0	

RECEIVED 26 MAR 1983 LAND QUALITY DIVISION

TRACE METALS (Dissolved):

	mg/l		mg/l
Aluminum	<0.1 <0.2	Lead	<0.01 .06 - .09
Arsenic	<0.005 .014 - .014	Manganese	<0.02 .06 - .07
Barium	<0.1 .10 - .22	Mercury	<0.001 <.0001
Boron	<0.1 <0.1	Molybdenum	<0.005 .05
Cadmium	<0.001 .01	Nickel	<0.03 <0.05
Chromium	<0.02 .02 - .05	Selenium	<0.005 .01 - .012
Copper	<0.01 .01 - .01	Zinc	<0.01 .02 - .03
Iron	<0.03 .05 - .07		

CDM

environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0469

February 25, 1983

Ms. Paula M. Schmittdiel
State of Wyoming
Dept. of Environmental Quality
Land Quality Division
401 West 19th Street
Cheyenne, WY 82002

RECEIVED LAND QUALITY DIVISION

RE: 8698-15690-4-1
Date Samples Rec'd 2-14-83

REPORT OF ANALYSIS

Lab Designation	8698-15690-4-1	8698-15690-4-2	8698-15690-4-3	8698-15690-4-4
Sponsor Designation	Loc. 1 2-8-83	Loc. 3 2-8-83	Loc. 5 2-8-83	Loc. 6 2-9-83
	Well P-11	Well I-15	Well M-16	Well M-19
Determination				
Uranium (as U) dissolved, mg/L	↑ 1.6 .025-.093	↑ 2.1 .012-.287	ok 0.011 .015-.287	✓ 0.074 .023-.109
Radium-226, dissolved, pCi/L, ± counting error*	↑ 200 ± 10 265-285	ok 150 ± 10 106-768 (108)	ok 87 ± 4 120-768	ok 96 ± 4 106-119
Vanadium, mg/L	0.22 .05-.34 (.16)	ok 0.10 .0-1.9	ok <0.005 .05-.09	ok 0.015 .05-.109

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.

These samples are scheduled to be disposed of 45 days after the date of this report.

BY [signature]
Bud Summers
Radiochemistry
Supervisor

BS/srf

November 4, 1982

RENO CREEK

EVALUATION OF URANIUM STABILIZATION DATA FOR PATTERN 2

I. Factors Influencing Groundwater Stability

- o composition and strength of lixiviant
- o ambient baseline water quality (pH, redox potential, TDS, spatial variability)
- o geochemical composition of host formation
- o natural hydrologic regime (groundwater flow rate, permeability, recharge characteristics)
- o summary: influences are site specific

II. Pattern 2 Operational History and Purpose

- o small pattern with high ratio of injection/production wells (2 to 1)
- o production zone aquifer is average of 120 feet thick;
- o completion interval as much 37 feet
- o not mined to completion,

- lixiviant refortification/injection terminated after 75 days
- primary purpose of test was to evaluate amenability to Na_2HCO_3 leach solution with host formation and determine restoration effectiveness - not to maximize U_3O_8 recovery
- restoration with new technique (weak acid resin to remove divalent cations) returned all parameters to baseline except U_3O_8 levels ($\cong$ 1.0 mg/l)
- during final groundwater sweep, U_3O_8 levels initially rose, stabilized, began to decline slightly then rose again so sweep terminated with average of 1.2 mg/l

III. Groundwater Stability Monitoring

- essentially no change in water quality over a year monitoring period except U_3O_8
- U_3O_8 levels increased gradually over first 4 months
- fifth and sixth months began to indicate stability as upward trend stopped
- second 6 months indicates equilibrium within pattern occurring and stability confirmed
- average pattern U values at 6 months = 2.9 mg/l vs. 3.1 mg/l at one year (= 7% difference)

IV. Stabilization Data Analysis

- o statistical tests performed to detect presence or absence of significant trends
- o tests run included linear and curve regression analyses of average Unat values
- o results show U levels not linear, but curvilinear based on r values and significance levels
- o regression curve which best fits the data points can be divided into 2 near-linear segments and evaluated to determine slopes of segments
- o first line segment has significantly different slope than second segment indicating leveling of uranium values
- o slope for the last 4 data points, which describes the uranium trend over the last 7 months of stabilization, is statistically the same as a line with zero slope
- o uranium levels are stable and it is statistically unlikely they will increase any appreciable amount
- o coefficient of variability values were also calculated for each set of monthly/quarterly samples and analyzed
- o graph of these points was analyzed using linear and

common logorithmic regression analysis to determine if amount of variability has diminished

- again, graph of coefficient of variability values were best described by an asymptotic-logrithmic curve
- levels started high and are now approaching a constant level
- variability among uranium levels for each sampling period has diminished from 65% to 25% and is approaching stability
- this suggests that "large-scale" equilibration processes within the formation have occurred; no significant future fluctuations are expected
- results of tests on average Unat values and coefficients of variability for each sampling period strongly suggest:
  1) average uranium levels will not increase; and
  2) no large fluctuations will occur in individual wells in the future

V. Conclusions

- uranium levels have stabilized over the last 7 month period of monitoring, as indicated by pattern average concentrations
- data evaluation indicates stabilization was occurring before the end of the initial 6 month stabilization period
- elevated uranium levels within the pattern interior will eventually equilibrate with ambient aquifer concentrations through mixing, dilution, precipitation, etc.
- as the dispersion and chemical equilibrium processes occur, uranium levels will decrease to baseline concentrations
- graphs of uranium levels for wells P-10 and P-11 (showing a decrease in concentration) may be indicative of these conditions
- return to baseline will probably be a gradual process due to slow groundwater flow (3-4 ft./yr.)
- R & D restoration results verify that groundwater within the aquifer was returned to baseline conditions for all parameters except uranium

- o it is probable that post restoration uranium levels would be even lower in a production scale operation:
  - the goal would be to recover maximum amount of uranium, e.g. mine to depletion
  - the ratio of production wells to injection wells would be greater i.e. near 1:1 (production wells appear to "clean-up" faster)
  - restoration technology will continually improve
  - alternate restoration methods (RO, ED) may lower uranium levels.
- o for this reason, stabilization data from Pattern 2 should be considered reasonable proof that acceptable restoration work has been performed
- o this work is adequate to support a commercial-scale license; it also suggests a monitoring period of six months is adequate to test groundwater stability at this site

FIGURES, TABLES AND CALCULATIONS

ROCKY MOUNTAIN ENERGY COMPANY
CALCULATIONS

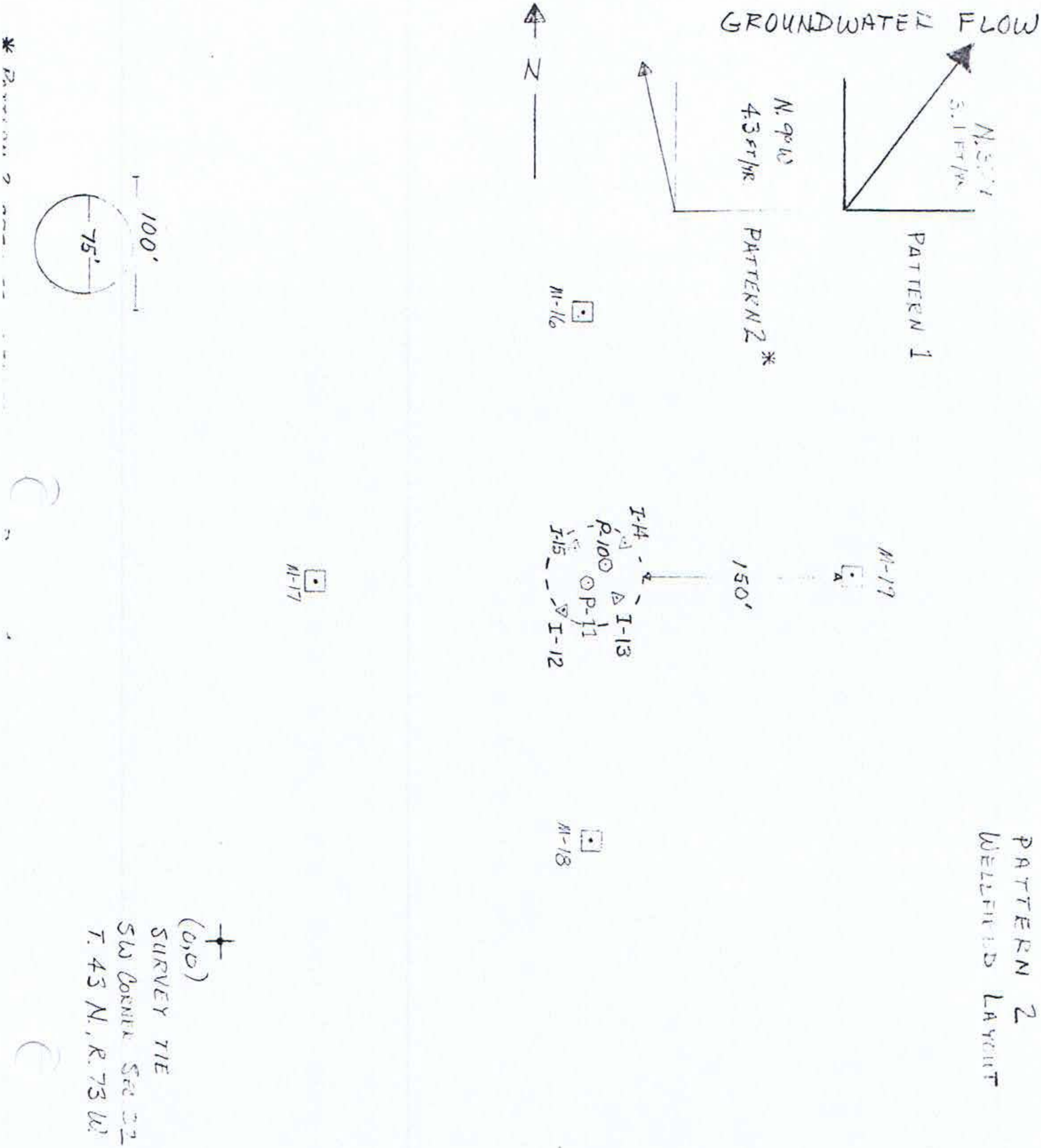
SHEET ___ OF ___

PROJECT: RENO CREEK — PROJ. NO. ___

DESCRIPTION: PATTERN 2 WELL CONFIGURATION SURVEYED LOCATIONS — DATE: 11/2/82

BY: MRN

CK'D BY: ___



ROCKY MOUNTAIN ENERGY COMPANY
CALCULATIONS

SHEET ___ OF ___

PROJECT: RENO CREEK

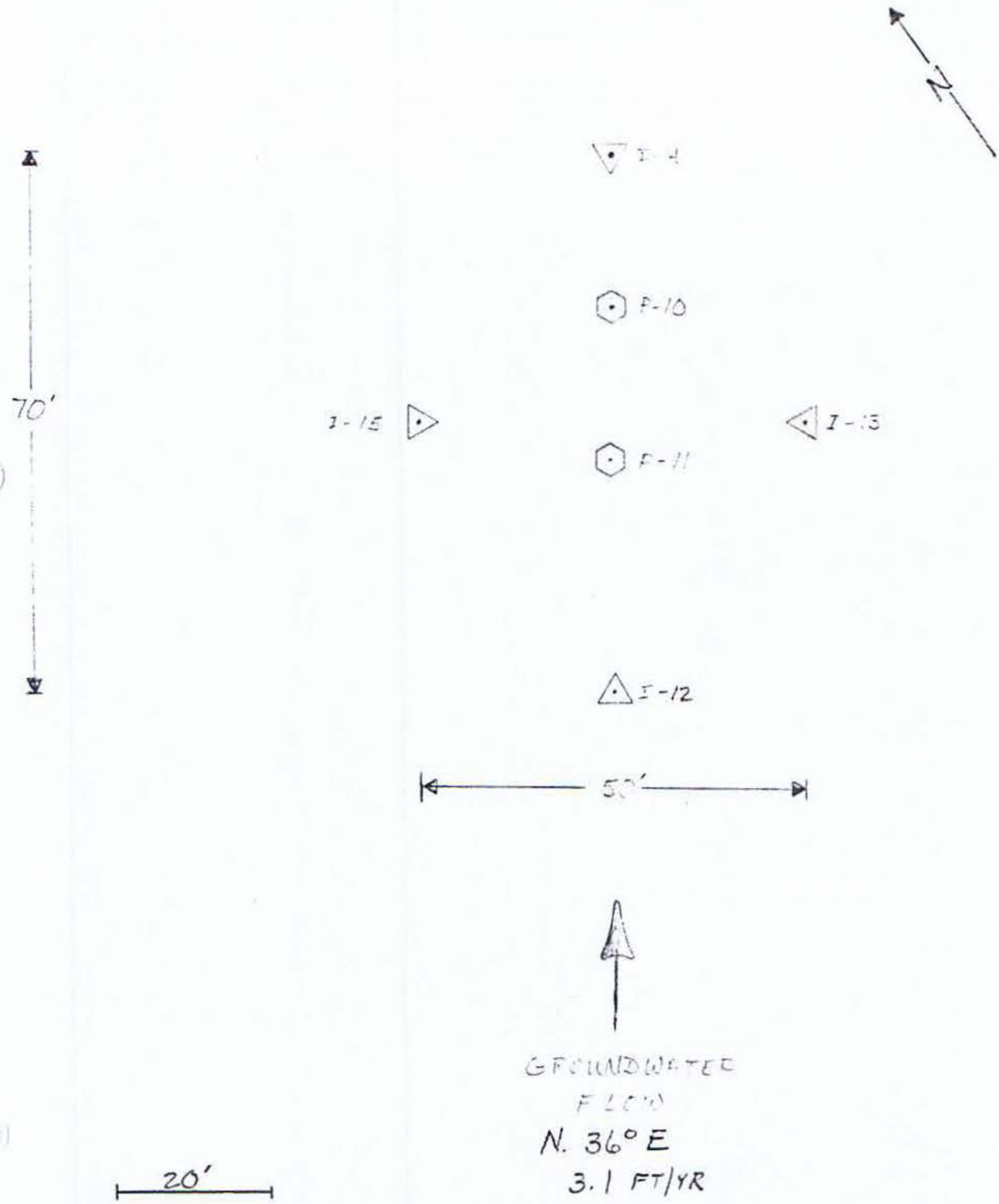
PROJ. NO.:

DESCRIPTION: PATTERN 2 WELL CONFIGURATION

DATE: 11/2/[illegible]

BY: MRN

CK'D BY:



RENO CREEK PATTERN 2 STABILIZATION DATA
URANIUM[1] CONCENTRATIONS (MG/l)

Date	P-10	P-11	I-12	I-13	I-14	I-15	Pattern Average
4/16/81	0.81	1.00	2.34	0.60	1.00	0.39	1.04
5/19/81	2.04	1.89	2.87	1.10	1.46	0.94	1.72
6/16/81	3.20	2.32	3.01	1.41	2.57	1.83	2.39
7/16/81	2.76	2.52	3.65	1.59	2.08	1.65	2.38
8/17/81	3.67	2.81	4.65	2.15	2.74	2.52	3.09
9/9/81	3.07	2.28	2.99	2.44	3.25	2.57	2.76
10/12/81	3.48	2.44	3.43	2.32	3.28	2.49	2.91
1/24/82	3.60	2.18	4.27	2.44[2]	3.67[2]	2.90[2]	3.18
4/1/82	2.95	1.77	3.44	3.12	4.05	3.36	3.12

1 Uranium levels are shown as Unat. Values were converted from U_3O_8 values previously submitted for comparison with WQD standards.

2 Interpolated values; no field data available.

RENO CREEK PATTERN 2 STABILIZATION DATA

COEFFICIENTS OF VARIABILITY

Date	Coefficient of Variability
4/16/81	65.1
5/19/81	41.2
6/16/81	28.6
7/16/81	32.6
8/17/81	29.6
9/9/81	14.2
10/12/81	18.7
1/24/81	23.9
4/1/82	24.3

RENO CREEK PATTERN 2 STABILIZATION DATA

Statistical Equations Used to Evaluate Uranium Values

Regression Analyses

Linear form: $y = a + bx$

where

$$b = \frac{\Sigma(x-\bar{x})(y-\bar{y})}{\Sigma(x-\bar{x})^2}$$

$$a = \bar{y} - b\bar{x}$$

Curvilinear forms:

$$y = a + b \log x$$

$$\log y = a + bx$$

$$\log y = a + b \log x$$

where equations for b and a are modified appropriately

t - tests

Significance of a correlation coefficient

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

with n-2 df

Comparison of 2 regression coefficients from small samples (variances assumed equal)

$$t = \frac{b_1-b_2}{s\sqrt{\frac{1}{\Sigma_1(x-x_1)^2} + \frac{1}{\Sigma_2(x-\bar{x}_2)^2}}}$$

with $n_1 + n_2 - 4$ df

where

$$s^2 = (n_1-2)s_1^2 + (n_2-2)s_2^2$$

Comparison of 2 regression coefficients from small samples (variances not assumed equal)

$$d = \frac{b_1-b_2}{s\sqrt{\frac{s_1^2}{\Sigma_1(x-\bar{x}_1)^2} + \frac{s_2^2}{\Sigma_2(x-\bar{x}_2)^2}}}$$

with f df given by

$$f = \frac{1}{\frac{u^2}{n_1-2} + \frac{(1-u)^2}{n_2-2}}$$

where

$$u = \frac{s_1{}^2/\Sigma_1(x-\bar{x}_1)^2}{s_1{}^2/\Sigma_1(x-\bar{x}_1)^2 x\, s_2{}^2(x-\bar{x}_2)^2}$$

Comparison of regression coefficient, from a small sample with a known standard

$$t = \frac{b - \beta}{s/\sqrt{2(x-\bar{x})^2}}$$

with n-2 df

F test

$$f = \frac{s_1{}^2}{s_2{}^2} \quad \text{at } f_1, f_2$$

where $f_1 = m_1-1$
$f_2 = m_2-1$

Variances

Sample variance

$$s^2 = \frac{1}{m-1} \Sigma(x-\bar{x})^2$$

Variance of the deviations of x from a regression line

$$s^2 = \frac{1}{n-2} \left\{\Sigma(x-\bar{x})^2 - \frac{[\Sigma(x-\bar{x})(x-\bar{x})]^2}{\Sigma(x-\bar{x})^2}\right\}$$

Average (Mean)

$$\bar{x} = \frac{1}{n} \Sigma x$$

Coefficient of Variability

$$CV = \frac{100s}{\bar{x}}$$

RENO CREEK PATTERN 2 STABILIZATION DATA

RESULTS OF STATISTICAL ANALYSES

Average Uranium Values

Linear equation for all points

$y = 1.7909705 + 0.0050795X$

$r = 0.8060384$**

Curvilinear equations for all points

$y = 0.8550197 + 0.8865408 \log X$

$r = 0.9390105$***

$\log y = 0.2306734 + 0.0010383X$

$r = 0.7483016$*

$\log y = 0.0006364 + 0.2019606 \log X$

$r = 0.9715121$***

Linear equation for first 5 points

$y = 1.1423514 + 0.0156813X$

$r = 0.9718156$**

Linear equation for last 4 points

$y = 2.5460201 + 0.0018584X$

$r = 0.8991846$

* $0.01 < P < 0.05$
** $0.001 < P < 0.01$
*** $P < 0.001$

F-test comparing variances of data for the 2 line segments

$$F = 4.257$$

t - test comparing regression coefficients (slopes) of 2 line segments

$$t = 6.491^{**}$$

t - test comparing regression coefficent of second line segment with 0

$$t = 2.9395761$$

<u>Coefficients of Variability</u>

Linear equation for all points

$$y = 42.601176 - 0.0825829\ X$$

$$r = -0.6316965$$

Curvilinear equations for all points

$$y = 64.851775 - 18.18156 \log X$$

$$r = -0.9282833^{***}$$

$$\log y = 1.5914225 - 0.0009932\ X$$

$$r = -0.5959089$$

$$\log y = 1.8346213 - 0.2055885\ X$$

$$r = -0.8233517^{**}$$

ROCKY MOUNTAIN ENERGY

Ref: UR 82-188

A Subsidiary of
Union Pacific Corporation

September 9, 1982

Mr. Ken Kalman
U.S. Nuclear Regulatory Commission
Uranium Recovery Licensing Branch
7915 Eastern Avenue
Silver Spring, MD 20910

Dear Mr. Kalman:

Re: Source Material License SUA-1338
Docket No. 40-869
Corrected Report: Reno Creek Pattern 2
Demonstrated Restoration

As discussed with you on September 1, 1982, enclosed is a corrected report for radionuclide concentrations in Pattern 2 injection and production wells from the final stabilization samples taken April 1, 1982. Table IV-A of the July 16, 1982 "Reno Creek Pattern 2 Restoration Report Addendum" reported a thorium value of 240 pCi/l for well I-14. The corrected report, dated August 4, 1982, gives a thorium 230 concentration of 18±6 pCi/l for a rerun of the 4/1/82 sample. According to the laboratory which performed the analyses, the first sample was inadvertently contaminated during analysis.

Please call if you have any questions.

Sincerely,

Michael R. Neumann

M.R. Neumann
Licensing Specialist

Enclosure

cc: R.E. Iwanicki
Paula Schmittdiel (LQD)
Pat Spieles
Dick Lennox (WQD)
Glen Mooney (LQD)
Richard Chancellor (LQD)

CDM

environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0469

August 4, 1982

Pat Spieles
Rocky Mountain Energy Co.
P.O. Box 3719
Casper, WY 82602

RE: 700-14266-11 CORRECTED REPORT
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation / Sponsor Designation	700-14266-11-1 P-10 4-1-82	700-14266-11-2 P-11 4-1-82	700-14266-11-3 I-12 4-1-82	700-14266-11-4 I-13 4-1-82	700-14266-11-5 I-14 4-1-82
Determination					
Uranium (as U) total, mg/L	3.5	2.3	4.4	3.4	4.9
Radium-226, total, pCi/L ± counting error	320 ± 10	250 ± 10	170 ± 10	260 ± 10	150 ± 10
Thorium-230, total, pCi/L ± counting error	6.1 ± 1.5	31 ± 3	30 ± 3	3.4 ± 1.2	18 ± 6

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.

These samples are scheduled to be disposed of 45 days after the date of this report.

July 16, 1982

Mr. Walt Ackerman, Administrator
Land Quality Division
401 W. 19th Street
Cheyenne, WY 82002

Dear Mr. Ackerman:

Re: Final Groundwater Stabilization Data for Test Pattern 2 at Reno Creek R & D ISL Facility - License SUA-1338, R & D Permit No. TFN 1 4/192

This letter transmits the above referenced information as requested by your attached letter of May, 1982. These data indicate that there have been no consistent trends or significant changes in the uranium values or other parameters within the pattern since the completion of the six-month stabilization period (October 1981). Three wells showed a decrease in the uranium content in April 1982, while three wells showed an increase in uranium content for the same time. The pattern averages, therefore, of the uranium values in October 1981 and April 1982 were not significantly different. As previously observed, the uranium values in Test Pattern 2 are below the standard of 5 mg/l U natural as per Wyoming Department of Environmental Quality water quality regulations.

The data has been compiled in a format suitable for inclusion as an addendum to the Reno Creek Demonstrated Restoration Report, dated November 1981.

As you may know, Rocky Mountain Energy (RME) is conducting studies to evaluate the feasibility of a production scale facility at Reno Creek. Should the project prove to be viable, it is RME's intention to use results of the carbonate test restoration program in support of license/permit applications to fulfill demonstrated restoration requirements.

10 Longs Peak Drive
Box 2000
Broomfield, Colorado 80020
303 469-8844

Since this information is essentially the same as that previously submitted in the Reno Creek Demonstrated Restoration Report, we are confident that reasonable proof of restoration capability for a commercial-scale ISL facility has been demonstrated. Written concurrence regarding the adequacy of demonstrated restoration, as verified by the attached data and previously submitted material is requested.

If you have questions concerning these data, please call me at 469-8844, extension 2221.

Sincerely,

Michael R. Neumann

Michael R. Neumann
Licensing Environmental
Specialist

MRN/gbm

Enclosures

cc: P. Schmittdiel
D. Lennox
G. Mooney
R. Chancellor
U.S. Nuclear Regulatory Commission

Reno Creek Pattern 2 Restoration Report

ROCKY MOUNTAIN ENERGY

RENO CREEK

PATTERN 2

RESTORATION REPORT

ADDENDUM

JULY 16, 1982

Table III-A
(cont.)

Reno Creek
Pattern 2 Production Wells
Restoration Data

Parameter[1]	Baseline Range[2]	Well P-10 4/1/82 NML	Well P-10 4/1/82 CDM	Well P-11 4/1/82 NML	Well P-11 4/1/82 CDM
Field					
pH	8.2 - 8.9	7.6	8.1	7.7	8.0
Conductivity	1890 - 2234	2000	2500	1990	2400
Major Consituents					
Bicarbonate (HCO_3)	89 - 178	187	160	159	130
Carbonate (CO_3)	0 - 14	0	0	0	0
Alkalinity (as CaCo eq)	73 - 146	153	130	130	110
Calcium	108 - 153	118	110	92	105
Chloride	7.0 - 18.8	18	11	16	12
Magnesium	19 - 33	17	22	16	22
Potassium	5.8 - 9.5	7.5	8.1	6.8	7.3
Sodium	287 - 360	295	350	282	330
Sulfate	818 - 1002	783	960	644	910
TDS	1340 - 1580	1330	1510	1160	1410
Anion/Cation Balance	-	101	99	105	101
Minor Constituents					
Ammonia as N	<0.2		<0.2		<0.2
Nitrate as N	<0.05		<0.05		< 0.05
Nitrite as N	<0.05		<0.05		< 0.05
Aluminum	<0.2		< 0.5		< 0.5
Arsenic	0.001 - 0.016		0.006		0.007
Barium	0.08 - 0.40		<0.2		<0.2
Boron	<0.1		<0.1		<0.1
Cadmium	0.01 - 0.02		0.012		0.009
Chromium	0.02 - 0.11		<0.005		<0.005
Copper	0.01 - 0.02		<0.005		<0.005
Fluoride	0.09 - 0.15		0.1		<0.1
Iron	0.03 - 0.61	0.08	0.13	0.03	0.08
Lead	0.03 - 0.11		<0.005		<0.005
Manganese	0.01 - 0.14		0.068		0.071
Mercury	<0.0001		0.0001		0.0001
Molybdenum	0.01 - 0.11		0.008		0.011
Nickel	0.01 - 1.10		0.02		<0.02
Selenium	0.009 - 0.017		<0.005		<0.005
Vanadium	0.05 - 0.34	0.31	0.39	0.39	0.43
Zinc	0.01 - 0.09		<0.005		<0.005

Table III-A
(cont.)

Parameter	Baseline Range	Well P-10 4/1/82 NML	Well P-10 4/1/82 CDM	Well P-11 4/1/82 NML	Well P-11 4/1/82 CDM
Radiochemistry					
Uranium[3]	0.012 - 0.287	3.51	3.5	2.11	2.3
Radium-226	106 - 768		320		250
Thorium-230	0 - 1.9		6.1		31

[1]All values expressed as mg/l except pH (standard units), conductivity (umhos/cm), radium and thorium (pCi/l).

[2]Baseline range is for all pattern production zone wells following outlier removal.

[3]NML values are U_3O_8; CDM values are U nat.

Table IV-A
(cont.)

Reno Creek
Pattern 2 Injection Wells
Restoration Water Quality

	Well I-12 4/1/82 NML	Well I-12 4/1/82 CDM	Well I-13 4/1/82 NML	Well I-13 4/1/82 CDM	Well I-14 4/1/82 NML	Well I-14 4/1/82 CDM	Well I-15 4/1/82 NML	Well I-15 4/1/82 CDM
Field								
pH	7.8	8.1	7.7	8.1	7.9	8.2	7.8	8.1
Conductivity	1990	2400	2000	2500	2000	2500	1990	2400
Major Constituents								
Bicarbonate (HCO_3)	187	150	198	160	183	150	144	120
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Alkalinity	153	120	162	130	150	120	118	96
Calcium	97	100	92	95	75	90	112	120
Chloride	18	9	16	12	21	16	17	9
Magnesium	21	27	25	26	21	25	30	30
Potassium	8.7	8.3	9.8	8.9	9.5	9.7	10.2	8.9
Sodium	301	310	361	360	350	360	321	300
Sulfate	819	920	935	960	835	950	849	940
TDS	1358	1450	1236	1490	1401	1460	1409	1410
Ionic Balance	98	96	99	99	100	99	104	100
Minor Constituents								
Boron		< 0.1		< 0.1		< 0.1		< 0.
Chromium		< 0.005		< 0.005		< 0.005		< 0.00
Copper		< 0.005		< 0.005		< 0.005		< 0.00
Fluoride		< 0.1		< 0.1		< 0.1		< 0.
Iron	0.05	0.12	0.12	0.27	0.06	0.13	0.06	0.1
Lead		< 0.005		< 0.005		< 0.005		< 0.00
Manganese		0.083		0.099		0.08		0.08
Molybdenum		0.005		0.007		0.006		0.00
Nickel		0.02		< 0.02		0.03		0.0
Vanadium	0.22	0.26	0.25	0.29	0.16	0.10	0.16	0.1
Zinc		< 0.005		0.013		< 0.005		0.00
Radiochemistry								
Uranium[1]	4.1	4.4	3.72	3.4	4.82	4.9	4.0	3
Radium-226		170		260		150		180
Thorium-230		30		3.4		240		4

Note: All values reported as mg/l except pH (standard units), conductivity umhos/cm), radium, thorium (pCi/l).

[1]NML values are U_3O_8; CDM values are U nat.

Table V
(updated)

Reno Creek
Pattern 2 Stabilization Data
Interior Wells
4/16/81 - 4/1/82

Date	Parameter[1]	P-10	P-11	I-12	I-13	I-14	I-15	Pattern Average
4/16/81	Uranium	0.97	1.20	2.79	0.81	1.19	0.47	1.24
	Bicarb.	121	126	133	119	119	123	124
	TDS[2]	1529	1480	1450	1510	1475	1525	1494
5/19/81	Uranium	2.43	2.25	3.42	1.31	1.74	1.12	2.05
	Bicarb.	153	148	154	154	147	126	147
	TDS	1440	1460	1420	1460	1440	1480	1450
6/16/81	Uranium	3.81	2.76	3.58	1.68	3.06	2.18	2.85
	Bicarb.	129	133	125	121	138	131	130
	TDS	1600	1520	1420	1580	1560	1660	1557
7/16/81	Uranium	3.29	3.00	4.34	1.89	2.48	1.97	2.83
	Bicarb.	146	133	141	140	133	133	138
	TDS	1540	1500	1480	1520	1560	1520	1520
8/17/81	Uranium	4.37	3.35	5.54	2.56	3.26	3.00	3.68
	Bicarb.	148	133	148	121	103	112	128
	TDS	1540	1540	1500	1520	1540	1540	1530
9/9/81	Uranium	3.66	2.71	3.56	2.90	3.87	3.06	3.29
	Bicarb.	154	145	167	152	153	132	151
	TDS	1660	1540	1640	1680	1580	1600	1617
10/12/81	Uranium	4.14	2.91	4.08	2.76	3.91	2.96	3.46
	Bicarb.	164	145	157	163	157	131	153
	TDS[2]	1489	1347	1369	1377	1351	1355	1381
1/24/82	Uranium	4.29	2.60	5.08				4.0
	Bicarb.	132	188	188				169
	TDS	1600	1400	1350				1450
4/1/82	Uranium	3.51	2.11	4.10	3.72	4.82	4.00	3.71
	Bicarb.	187	159	187	198	183	144	176
	TDS[2]	1420	1285	1404	1363	1430	1409	1385

[1]All values given as mg/l.

[2]Values are average of Nine Mile Lake and CDM analyses.

Note: Uranium values are U_3O_8; U nat values can be determined by multiplying U_3O_8 values by 0.85.

Table VI

Reno Creek
Pattern 2 Stabilization Data
Quarterly Check (Jan. 1981)

Parameter	Baseline[1] Range	Well P-10	Well P-11	Well I-12
pH	8.2 - 8.9	8.3	8.06	8.10
Conductivity	1890 - 2234	2100	2000	2000
Bicarbonate (HCO_3)	89 - 178	132	188	187
Carbonate (CO_3)	0 - 14	0	0	0
Alkalinity	73 - 146	108	154	153
Calcium	108 - 153	90	125	97
Chloride	7.0 - 18.8	16	14	18
Magnesium	19 - 33	23	18	21
Potassium	5.8 - 9.5	9.9	8.7	8.7
Sodium	287 - 360	342	384	262
Sulfate	818 - 1002	891	838	823
TDS	1340 - 1580	1600	1400	1350
Aluminum	<0.2	0.31	0.09	0.08
Cadmium	0.01 -<0.02	0.001	0.01	0.01
Chromium	0.01 - 0.11	0.01	0.03	0.03
Fluoride	0.09 - 0.15	0.10	0.1	0.1
Iron	0.03 - 0.61	0.10	0.04	0.05
Lead	0.03 - 0.11	0.04	0.01	<0.01
Molybdenum	0.01 - 0.11	--	0.13	0.06
Manganese	0.01 - 0.14	0.08	0.53	0.74
Nickel	0.01 - 1.10	0.02	0.03	0.01
Vanadium	0.05 - 0.34	0.38	0.44	0.30
Zinc	0.01 - 0.09	0.01	0.01	0.01
Uranium as U_3O_8	0.012 - 0.287	4.29	2.60	5.08

Note: All results are in mg/l (ppm) except pH (standard units) and conductivity (umhos/cm)

[1]Baseline range is for all production zone wells following outlier removal.

Pat Spieles
May 18, 1982

RE: 8669-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	8669-14266-11-6 I-15 4-1-82	8669-14266-11-7 M-16 4-1-82	8669-14266-11-8 M-17 4-1-82	8669-14266-11-9 M-18 4-1-82	8669-14266-11-10 M-19 4-1-82
Determination (mg/L)					
pH	8.1	10.9	8.1	10.9	8.0
Conductivity, µmhos/cm	2400	2400	2200	2200	2300
Bicarbonate (as HCO_3)	120	56	87	0	23
Carbonate (as CO_3)	0	38	0	21	0
Alkalinity (as $CaCO_3$)	96	110	72	55	19
Calcium, total	120	120	110	110	120
Chloride	9	10	9	10	9
Magnesium, total	30	34	23	8	15
Potassium, total	8.9	8.9	6.5	9.5	8.6
Sodium, total	300	280	270	260	280
Sulfate (as SO_4)	940	860	880	790	910
TDS (at 180°C)	1410	1280	1280	1130	1310
Anion/Cation, %	100	104	99	102	100

These samples are scheduled to be disposed of 30 days after the date of this report.

ADDENDUM A

Pat Spieles
May 18, 1982

RE: 8669-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	8669-14266-11-6 I-15 4-1-82	8669-14266-11-7 M-16 4-1-82	8669-14266-11-8 M-17 4-1-82	8669-14266-11-9 M-18 4-1-82	8669-14266-11-10 M-19 4-1-82
Determination (mg/L)					
Ammonia (as N)	<0.2	0.2	<0.2	<0.2	<0.2
Nitrate (as N)	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrite (as N)	<0.05	<0.05	<0.05	<0.05	<0.05
Aluminum, total	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic, total	<0.005	<0.005	<0.005	<0.005	<0.005
Barium, total	0.2	0.2	<0.2	<0.2	0.2
Boron	0.1	<0.1	0.1	<0.1	0.1
Cadmium, total	0.008	0.009	0.011	0.008	0.008
Chromium, total	<0.005	<0.005	<0.005	<0.005	<0.005
Copper, total	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoride	<0.1	<0.1	0.1	<0.1	<0.1
Iron, total	0.10	0.25	0.12	0.10	0.10
Lead, total	<0.005	0.012	<0.005	<0.005	<0.005
Manganese, total	0.084	0.040	0.079	0.033	0.044
Mercury, total	0.0001	0.0001	0.0001	0.0001	0.0001
Molybdenum, total	0.008	<0.005	<0.005	<0.005	<0.005
Nickel, total	0.02	0.02	0.03	<0.02	<0.02

These samples are scheduled to be disposed of 30 days after the date of this report.

Pat Spieles
May 18, 1982

RE: 8669-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation	8669-14266-11-6	8669-14266-11-7	8669-14266-11-8	8669-14266-11-9	8669-14266-11-10
Sponsor Designation	I-15 4-1-82	M-16 4-1-82	M-17 4-1-82	M-18 4-1-82	M-19 4-1-82
Determination (mg/L)					
Selenium, total	<0.005	<0.005	<0.005	<0.005	<0.005
Vanadium, total	0.12	<0.005	0.011	0.077	0.010
Zinc, total	0.008	0.18	0.011	<0.005	<0.005

These samples are scheduled to be disposed of 30 days after the date of this report.

Pat Spieles
April 30, 1982

RE: 700-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	700-14266-11-6 I-15 4-1-82	700-14266-11-7 M-16 4-1-82	700-14266-11-8 M-17 4-1-82	700-14266-11-9 M-18 4-1-82	700-14266-11-10 M-19 4-1-82
Determination					
Uranium (as U) total, mg/L	3.0	0.019	0.090	0.022	0.067
Radium-226, total, pCi/L ± counting error	180 ± 10	45 ± 3	900 ± 20	68 ± 4	86 ± 4
Thorium-230, total, pCi/L ± counting error	4.3 ± 1.2	-0.2 ± 0.9	-0.3 ± 0.9	0.2 ± 1.0	-0.2 ± 0.8

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.

These samples are scheduled to be disposed of 45 days after the date of this report.

CDM

environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0469

April 30, 1982

Pat Spieles
Rocky Mountain Energy Co.
P.O. Box 3719
Casper, WY 82602

RE: 700-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

ADDENDUM B

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	700-14266-11-1 P-10 4-1-82	700-14266-11-2 P-11 4-1-82	700-14266-11-3 I-12 4-1-82	700-14266-11-4 I-13 4-1-82	700-14266-11-5 I-14 4-1-82
Determination					
Uranium (as U) total, mg/L	3.5	2.3	4.4	3.4	4.9
Radium-226, total, pCi/L ± counting error	320 ± 10	250 ± 10	170 ± 10	260 ± 10	150 ± 10
Thorium-230, total, pCi/L ± counting error	6.1 ± 1.5	31 ± 3	30 ± 3	3.4 ± 1.2	240 ± 10

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.

These samples are scheduled to be disposed of 45 days after the date of this report.

CDM

environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0469

May 18, 1982
Page 1 of 9

Pat Spieles
Rocky Mountain Energy Co.
P.O. Box 3719
Casper, WY 82602

RE: 8669-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation / Sponsor Designation	8669-14266-11-1 P-10 4-1-82	8669-14266-11-2 P-11 4-1-82	8669-14266-11-3 I-12 4-1-82	8669-14266-11-4 I-13 4-1-82	8669-14266-11-5 I-14 4-1-82
Determination (mg/L)					
pH	8.1	8.0	8.1	8.1	8.2
Conductivity, µmhos/cm	2500	2400	2400	2500	2500
Bicarbonate (as HCO_3)	160	130	150	160	150
Carbonate (as CO_3)	0	0	0	0	0
Alkalinity (as $CaCO_3$)	130	110	120	130	120
Calcium, total	110	105	100	95	90
Chloride	11	12	9	12	16
Magnesium, total	22	22	27	26	25
Potassium, total	8.1	7.3	8.3	8.9	9.7
Sodium, total	350	330	310	360	360
Sulfate (as SO_4)	960	910	920	960	950
TDS (at 180°C)	1510	1410	1450	1490	1460
Anion/Cation, %	99	101	96	99	99

These samples are scheduled to be disposed of 30 days after the date of this report.

Pat Spieles
May 18, 1982

RE: 8669-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	8669-14266-11-1 P-10 4-1-82	8669-14266-11-2 P-11 4-1-82	8669-14266-11-3 I-12 4-1-82	8669-14266-11-4 I-13 4-1-82	8669-14266-11-5 I-14 4-1-82
Determination (mg/L)					
Ammonia (as N)	<0.2	<0.2	<0.2	<0.2	<0.2
Nitrate (as N)	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrite (as N)	<0.05	<0.05	<0.05	<0.05	<0.05
Aluminum, total	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic, total	0.006	0.007	<0.005	0.005	0.006
Barium, total	<0.2	<0.2	<0.2	<0.2	0.2
Boron	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium, total	0.012	0.009	0.009	0.013	0.010
Chromium, total	<0.005	<0.005	<0.005	<0.005	<0.005
Copper, total	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoride	0.1	<0.1	<0.1	<0.1	<0.1
Iron, total	0.13	0.08	0.12	0.27	0.13
Lead, total	<0.005	<0.005	<0.005	<0.005	<0.005
Manganese, total	0.068	0.071	0.083	0.099	0.081
Mercury, total	0.0001	0.0001	0.0001	0.0001	0.0001
Molybdenum, total	0.008	0.011	0.005	0.007	0.006
Nickel, total	0.02	<0.02	0.02	<0.02	0.03

These samples are scheduled to be disposed of 30 days after the date of this report.

Pat Spieles
May 18, 1982
Page 3 of 9

RE: 8669-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation	8669-14266-11-1	8669-14266-11-2	8669-14266-11-3	8669-14266-11-4	8669-14266-11-5
Sponsor Designation	P-10 4-1-82	P-11 4-1-82	I-12 4-1-82	I-13 4-1-82	I-14 4-1-82
Determination (mg/L)					
Selenium, total	<0.005	<0.005	<0.005	<0.005	<0.005
Vanadium, total	0.39	0.43	0.26	0.29	0.10
Zinc, total	<0.005	<0.005	<0.005	0.013	<0.005

These samples are scheduled to be disposed of 30 days after the date of this report.

Pat Spieles
May 18, 1982

RE: 8669-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation	8669-14266-11-11
Sponsor Designation	LSM-21 4-1-82
Determination (mg/L)	
pH	10.4
Conductivity, μmhos/cm	460
Bicarbonate (as HCO_3)	0
Carbonate (as CO_3)	61
Alkalinity (as $CaCO_3$)	110
Calcium, total	4
Chloride	23
Magnesium, total	4
Potassium, total	8.9
Sodium, total	73
Sulfate (as SO_4)	56
TDS (at 180°C)	220
Anion/Cation, %	1.02

These samples are scheduled to be disposed of 30 days after the date of this report.

Pat Spieles
May 18, 1982
Page 8 of 9

RE: 8669-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation	8669-14266-11-11
Sponsor Designation	LSM-21 4-1-82
Determination (mg/L)	
Ammonia (as N)	0.4
Nitrate (as N)	<0.05
Nitrite (as N)	<0.05
Aluminum, total	<0.5
Arsenic, total	<0.005
Barium, total	<0.2
Boron	0.1
Cadmium, total	<0.005
Chromium, total	<0.005
Copper, total	<0.005
Fluoride	0.7
Iron, total	0.54
Lead, total	<0.005
Manganese, total	0.047
Mercury, total	0.0001
Molybdenum, total	<0.005
Nickel, total	<0.02

These samples are scheduled to be disposed of 30 days after the date of this report.

Pat Spieles
May 18, 1982
Page 9 of 9

RE: 8669-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation	8669-14266-11-11
Sponsor Designation	LSM-21
	4-1-82

Determination (mg/L)

Selenium, total	<0.005
Vanadium, total	0.013
Zinc, total	0.008

These samples are scheduled to be disposed of 30 days after the date of this report.

BY Chris Shugarts
Chris Shugarts
Water Laboratory
Supervisor

CS/srf

RE: 700-14266-11
P.O. AP2-1483, Rel. 611
Date Samples Rec'd 4-20-82

REPORT OF ANALYSIS

Lab Designation	700-14266-11-11
Sponsor Designation	LSM-21 4-1-82

Determination

Uranium (as U) total, mg/L	0.006
Radium-226, total, pCi/L ± counting error	6.0 ± 1.2
Thorium-230, total, pCi/L ± counting error	0.5 ± 1.0

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.

These samples are scheduled to be disposed of 45 days after the date of this report.

BY [signature]
Bud Summers
Radiochemistry
Supervisor

BS/srf

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAY 2 ̆ 1982

MAY 20 1982

WMUR:FWR
Docket No. 40-8697

Rocky Mountain Energy Company
ATTN: Mr. Michael Neumann
Field Environmental Coordinator
10 Longs Peak Drive
Box 2000
Broomfield, Colorado 80020

Gentlemen:

The NRC staff has reviewed the groundwater restoration and six month postrestoration stability data for Test Pattern II at your Reno Creek R&D ISL facility. Based on that review, the staff concludes that at this time no further restoration of the pattern is necessary. Final determination of the adequacy of restoration of Test Pattern II will be made upon receipt of the groundwater quality data from the additional two quarterly stability sampling rounds.

J J Linehan for
Ross A. Scarano, Chief
Uranium Recovery Licensing Branch
Division of Waste Management

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Department of Environmental Quality

LAND QUALITY DIVISION

DISTRICT IV OFFICE

30 EAST GRINNELL STREET   TELEPHONE 307-672-6488   SHERIDAN, WYOMING 82801

May 5, 1982

Mr. Michael Neuman
Field Environmental Coordinator
Rocky Mountain Energy
P.O. Box 3719
Casper, Wyoming 82602

RE: Reno Creek ISL Project, Permit No. 479

Dear Mr. Neuman:

Enclosed is a summary of review comments on the Demonstrated Restoration Report, Pattern II, November, 1981, made by both the Land and Water Quality Divisions.

This review of the Demonstrated Restoration Report for Pattern II at Reno Creek In-Situ Leaching project will consist of a three part discussion on: (1) baseline water quality, (2) restored water quality in the production and injection wells and monitoring wells, and (3) recommended action by the Department.

1. BASELINE WATER QUALITY

The overall water quality in the production zone is quite good - Class II (Chapter VIII, WQD Rules and Regulations). In many cases, the majority of the minor constituents were in the range of Class I water. Sulfate was consistently in the range of Class III Water (800-1100 mg/l). TDS was in the range of Class II water. The concentration levels of the other major constituents was in the range of Class II water or better. Vanadium exceeded Class II and Class III standards for baseline by 30 to 50 percent.

Baseline data was collected for the production wells P-10 and P-11 and for the six monitoring wells - M-16, 17, 18, and 19, USM-20 and LSM-21. Because of the small area of the well field, it was felt that water quality would not differ significantly between the injection and the production wells. To establish restoration goals, baseline volumes for the production and monitoring wells were averaged together. Five to six samples were taken during the baseline period for the major constituents, while two to four samples were taken for minor constituents. One monitoring well each was placed in the upper sand unit and lower sand unit at the well field. These wells were monitored 2 to 4 times during baseline. Because of the lack of water in the upper sand unit, this well was only sampled twice. During restoration, the well did not produce enough water to obtain a water sample.

2. RESTORED WATER QUALITY IN THE PRODUCTION AND INJECTION WELLS

The water quality in the production zone has been restored to baseline or better for all constituents except uranium, vanadium, and pH. The pH levels were slightly below baseline (7.8 - 8.1 compared to 8.2 - 8.9) but were within the range for Class I and Class II standards. The major constituents analyzed: bicarbonate, carbonate, alkalinity, calcium, chloride, magnesium, potassium, sodium, sulfate and total dissolved solids have returned to baseline range (see Tables III, IIIA, IV and IVA). Potassium was consistently higher for NML Laboratory than the values reported by the CDM Laboratory. Chloride and magnesium showed slightly elevated levels in the 4/16/81 sample. These concentrations were not significant and were within the baseline range for the 10/12/81 samples. All minor constituents were returned to baseline with the exception of vanadium. Vanadium exceeded the upper baseline range (0.34 mg/l) by almost fifty percent in the 4/16/81 samples. The concentration levels dropped slightly for the 10/12/81 samples but were still above baseline. The chromium values obtained by the NML were higher than those values obtained by the CDM Laboratory although the October analysis was within the baseline range.

The radio-chemistry analytical results indicated uranium has not returned to baseline range; although, as of October, 1981, the reported concentrations were within the standards for Class II water WQD Rules and Regulations. The general trend for the analytical results indicates that the concentration of uranium is increasing (see Table V and Figure 7). The results obtained by the CDM Laboratory were higher than those obtained by NML Laboratory for uranium, but in both cases the results exceeded baseline. Thorium-230 shows a pattern similar to uranium.

3. RECOMMENDED DEPARTMENTAL ACTION

The groundwater quality of Pattern II has been restored with the exception of uranium and vanadium which still show concentrations above baseline levels.

It is recommended that the Department request two additional samples and analyses for uranium before considering whether or not restoration has been achieved.

Rocky Mountain Energy has collected two quarterly samples since October, 1981, which will be submitted soon. Review of these analyses results should be adequate to make a decision on the adequacy of restoration.

If you have any questions regarding these comments, please contact this office.

Sincerely,

Glenn Mooney

Glenn Mooney
Geologist

GM:kn

Enclosure
cc: Paula Schmittdiel and Dick Lennox

ROCKY MOUNTAIN ENERGY

Ref: UR -390

ESD Files
RC
Permits / SML

A Subsidiary of
Union Pacific Corporation

December 7, 1981

Attn: Mr. Ross A. Scarano, Chief
Uranium Recovery Licensing Branch
Division of Waste Management
U.S. Nuclear Regulatory Commission
Willste Building
7915 Eastern Avenue
Silver Spring, MD 20910

Dear Mr. Scarano:

Re: License SUA-1338, Docket No. 40-8697
Reno Creek R & D Project

Pursuant to Condition No. 33 (Amendment No. 3) of the above referenced license enclosed herewith are three copies of RMEC's "Reno Creek Demonstrated Restoration Report". Addressed in the report are leaching, restoration, and stabilization phases of the carbonate leach test (Pattern 2) at our Reno Creek site. As agreed upon by RMEC and NRC, sampling of production well P-10 and one injection well will continue until April, 1982 on a quarterly frequency with results to be submitted to NRC at the conclusion of the monitoring period.

In accordance with conversations between myself and Mr. Ross of your staff, RMEC anticipates your review and evaluation of the material presented. Concurrent with this submittal, copies of the report are also being distributed to appropriate personnel with the Wyoming Department of Environmental Quality.

Should you have any questions, please don't hesitate to call.

Sincerely,

Michael R. Neumann

M.R. Neumann
Licensing Specialist

Enclosure

cc: Mr. John Linehan
Mr. Fred Ross
Mr. Walter Ackerman (DEQ, LQD) w/enc.
Ms. Kathy Muller (DEQ, LQD) w/enc.
Mr. Tony Mancini (DEQ, WQD) w/enc.
Mr. Richard Chancellor (DEQ, LQD) w/enc.
Mr. Tom Mueller (DEQ, WQD) w/enc.

R.E. Iwanicki (RMEC)
J.A. Yellich (RMEC)
J.A. Yopps (RMEC)

10 Longs Peak Drive
Box 2000
Broomfield, Colorado 80020

RENO CREEK PROJECT

DEMONSTRATED RESTORATION REPORT

Research and Development

Uranium Solution Mining Operation

Campbell County, Wyoming

R & D Permit No. TFN 1 4/192
Source Material License SUA - 1338

November, 1981

Rocky Mountain Energy Company

RENO CREEK

DEMONSTRATED RESTORATION REPORT

OPERATIONAL SUMMARY

Mining Phase

Leaching of Pattern 2 at Reno Creek started on October 7, 1980 when addition of lixiviant began. Pattern 2 is a modified 5-spot pattern consisting of 4 injection wells, 2 production wells and 6 monitor wells. Drawing No. C-001 shows the location and well configuration of the pattern.

Production rates were initially set at 25 gpm with 20 gpm injection and later adjusted to 23 gpm production with the same (20 gpm) injection flow rate.

Leaching operations continued from October 7 to December 22, 1980 during which time approximately 10 aquifer pore volumes were circulated through the production zone and 1200 lbs. of uranium recovered. The lixiviant used was a sodium bicarbonate solution and hydrogen peroxide used as the primary oxidant.

Restoration Phase

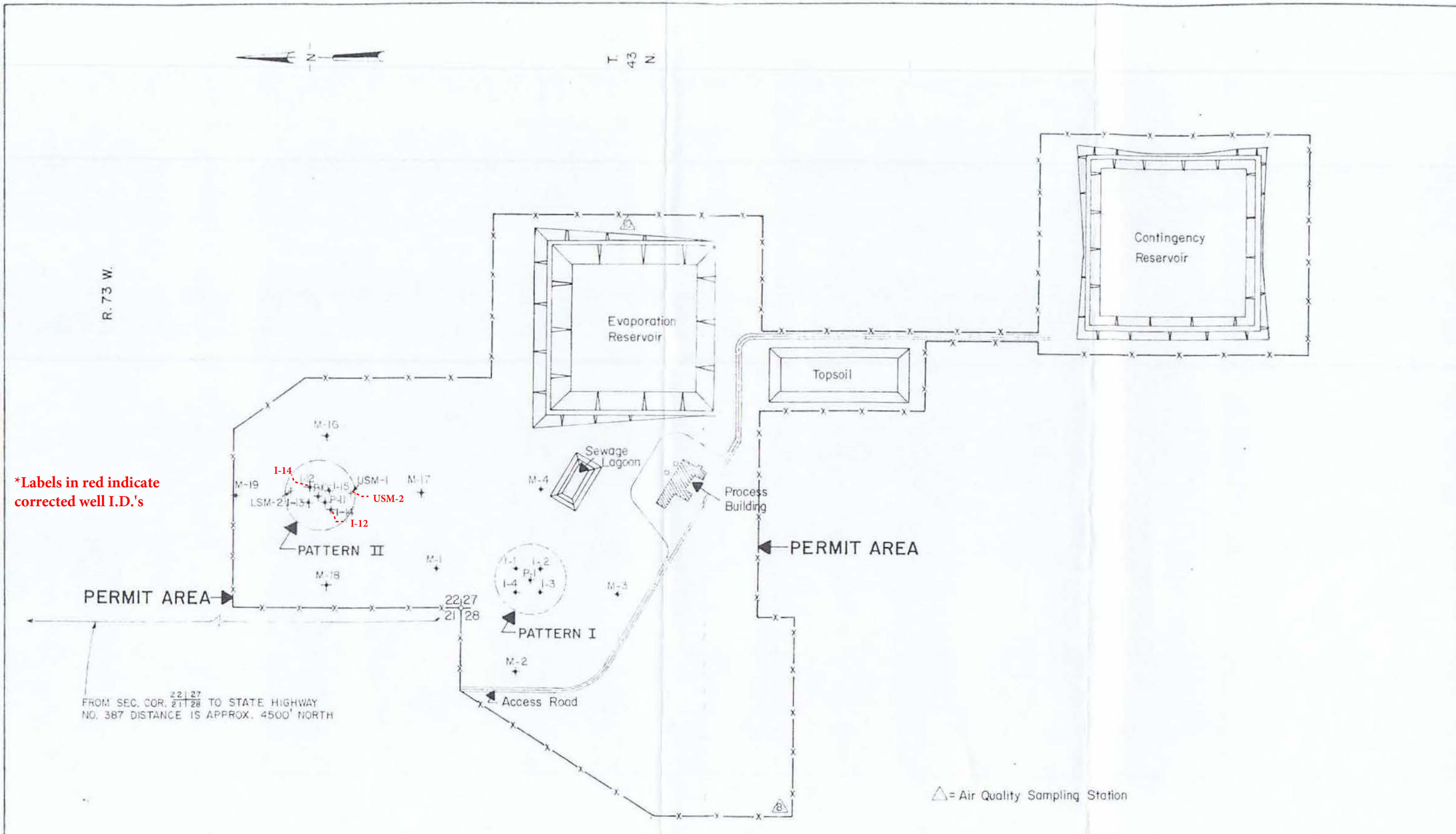
Restoration of the test pattern began December 22, 1980 when chemical refortification of lixiviant was discontinued. Circulation of production fluid through the wellfield and the processing plant to lower uranium concentration began.

During the initial phase of restoration, it was suggested that pre-treatment of the production fluid by an ion exchange process prior to R/O would greatly speed restoration. Accordingly, IX columns were prepared to strip divalent cations from the production fluid by means of a weak acid resin. Evaluation of the effectiveness of this treatment method indicated that the ion exchange process was performing well enough to eliminate the need for R/O treatment. Figure 1 shows the actual restoration circuit used and the reverse osmosis circuit originally proposed (indicated by dashed line flow streams).

Groundwater restoration using the ion exchange resin began on February 17, 1981. This phase of the restoration program continued until March 13, 1981 during which time approximately 2 pore volumes were circulated through the leached pattern.

Analysis of production zone water quality following this restoration phase indicated that groundwater affected during leaching had been restored to background ranges for the parameters of concern, with the exception of uranium and vanadium. Uranium levels were effectively reduced from about 15 mg/l to less than 2 mg/l while vanadium concentrations dropped to approximately 1 mg/l. Both elements remained in the 1 to 2 mg/l range during the final 10 days of IX treatment without dropping noticeably.

RC-C-001



REVISIONS						REFERENCE DRAWINGS	
NO.	DESCRIPTION	BY	CHKD	APPD	ISSUED	DWG. NO.	TITLE
1	MONITOR WELL ADDITION (USM & LSM)	S.J.	M.N.		7-17-80		
2	ADD TIE FROM SEC. TO HWY.	S.J.	M.N.		5-8-81		

ISSUED	DATE	SCALE: 1" = 200'	
CONSULT.		DRAWN SLS	DATE 4/21/80
BIDS		CHECKED	
CONST.		APPROVED	

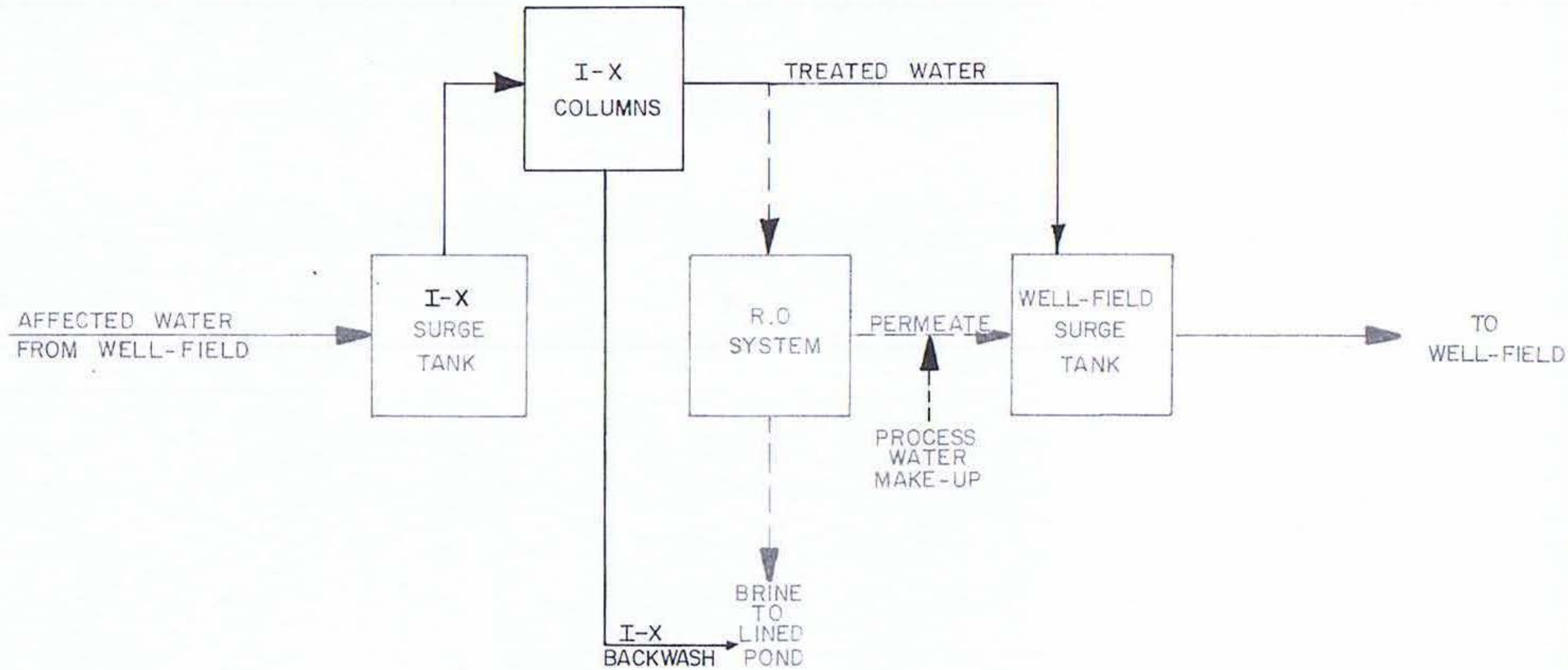
ROCKY MOUNTAIN ENERGY COMPANY
CASPER, WYOMING

PROJECT

TITLE RENO CREEK URANIUM
PILOT PLANT SITE PLAN

PROJECT DWG NO. RC-C-001
2

RC-P-05-005



CARBONATE RESTORATION CIRCUIT (REVISED)

PATTERN II - RENO CREEK

RC-P-05-005

Because of the relatively low concentrations, further removal by means of IX or R/O was impracticable. Therefore, an attempt to lower uranium and vanadium concentrations by means of a groundwater sweep of the production zone was initiated.

The groundwater sweep began on March 13, 1981 and continued until April 16, 1981. During this restoration phase, a total of approximately 4.5 aquifer pore volumes were recovered from the pattern. On April 16, the pattern was shut down in order to evaluate restoraiton stability.

RESTORATION DISCUSSION

Data Interpretation

Analysis of water quality data following completion of the restoration program indicates that restoration of groundwater affected during mining was successful.

Table I describes pre-mining groundwater quality (baseline) for key parameters and compares it to water quality within the production zone at the close of each operational phase. Table II presents data summarizing the number of aquifer pore volumes circulated or recovered during leaching and the respective phases of the restoration program. Tables III, III-A, IV and IV-A present assay results, as determined by two laboratories, of the April 16 sampling of production and injection wells at the conlcusion of the restoration program and the October 12 sampling following six months of demonstrated stabilization.

Figures 2 through 6 graphically depict water quality restoration as described by key parameter (uranium, bicarbonate, calcium, chloride, and conductivity) concentrations during the various phases of restoration. Figures 7 and 8 illustrate the fluctuations observed in uranium and bicarbonate levels in four of the pattern interior wells during the stabilization phase. In contrast, Figure 9 depicts the very minor changes observed in Total Dissolved Solids (TDS) during the stabilization phase which provides a good indicator of overall water quality stability. The line identified as "Pattern Ave." represents the average value for all production and injection well assays.

As shown in Table III-A, all parameters have been returned to baseline ranges with the exception of pH, uranium, and vanadium. Of these parameters, all are either below Wyoming DEQ Class I Groundwater Standards (Domestic Use) or do not have Class I maximum concentration limits.[1]

POST RESTORATION STABILITY

Data Presentation

Water quality in the restored pattern was monitored for compositional stability by monthly sampling of the production, injection and monitor wells for a six month period which began April 16, 1981. Initial samples collected at the time of shut down and final samples collected at the end of the six month stabilization period were analyzed for the parameters listed in Tables

---

[1] Wyoming Department of Environmental Quality, Water Quality Rules and Regulations, Chapter VIII, Quality Standards for Wyoming Groundwaters, April, 1980.

TABLE I

RENO CREEK PATTERN 2
PRODUCTION ZONE WATER QUALITY

Parameter[1]	Baseline 2 Range	Phase I (Leaching)	Phase II (Post Leach)	Phase III (Post IX)	Phase IV (Post Sweep)
pH	8.2-8.9	7.2	7.4	7.7	7.7
Cond.	1890-2234	3500	3400	2000	1995
HCO_3	89-178	1800	1670	160	125
Ca	108-153	330	207	69	87
Cl	7.0-18.8	240	113	19	15
Na	287-360	900	770	305	322
Fe	0.03-0.61	8.0	0.6	0.16	0.39
U_3O_8	0.012-0.287	65	16	1.64	1.37
V	0.05-0.34	6	3	1.05	0.45
Ra-226	106-768	-	311	238	222

[1]All values expressed as mg/l except pH (standard units) conductivity (μmhos/cm) and Ra 226 (pCi/l).

[2]Baseline range is for all Pattern II wells following removal of outlying data points.

TABLE II

RENO CREEK PATTERN 2

WATER BALANCE SUMMARY

OPERATIONAL PHASE	GALLONS INJECTED	GALLONS RECOVERED	BLEED VOLUME (Gallons)	PORE VOLUMES CIRCULATED
Leaching 10/7/80 - 12/21/80	2,217,600	2,590,560	372,960	10.0
RECIRCULATION 12/22/80 - 2/22/81	1,398,324	1,714,601	316,277	6.6
RESTORATION - ION EXCHANGE 2/23/81 - 3/13/81	430,817	550,619	119,802	2.1
RESTORATION - GROUNDWATER SWEEP 3/13/81 - 4/16/81	-	1,171,032	1,171,032	4.5
TOTALS	4,046,741	5,026,812	1,980,071	23.2
RESTORATION TOTALS	430,817	1,721,651	1,290,834	6.6

NOTE: 1 Pore Volume = 259,000 gallons
Total groundwater consumption during restoration = 5.0 Pore Volumes

TABLE III

RENO CREEK
Pattern 2
Restoration Data

PARAMETER[1]	Baseline Range	WELL P-10 04/16/81 NML	WELL P-10 04/16/81 CDM	WELL P-11 04/16/81 NML	WELL P-11 04/16/81 CDM
Field					
pH	8.16-8.94	7.6	-	7.8	-
Conductivity	1890-2234	2000	-	1990	-
Major Constituents					
Bicarbonate (HCO_3)	89-178	121	129	126	122
Carbonate (CO_3)	0-14	0	0	0	0
Alkalinity (as $CaCO_3$eq)	73-146	99	107	103	101
Calcium	108-153	100	85	84	79
Chloride	7.0-18.8	18	13	16	11
Magnesium	19-33	31	21	14	21
Potassium	5.8-9.5	7.7	6.5	10.0	6.4
Sodium	287-360	321	290	346	330
Sulfate	818-1002	892	820	885	804
TDS	1340-1580	1560	1497	1520	1440
Anion/Cation Balance	-	104%	104%	102%	94%
Minor Constituents					
Ammonia as N	<0.2	-	<0.2	-	<0.2
Nitrate as N	<0.05	-	<0.05	-	<0.05
Nitrite as N	<0.05	-	<0.05	-	<0.05
Aluminum	<0.2	0.1	<0.5	<0.1	<0.5
Arsenic	0.001-0.016	-	0.009	-	0.009
Barium	0.08-0.40	-	<0.2	-	<0.2
Boron	<0.1	0.1	<0.1	<0.1	<0.1
Cadmium	0.01-0.02	0.01	<0.01	0.01	<0.01
Chromium	0.02-0.11	0.15	<0.02	0.15	<0.02
Copper	0.01-0.02	0.01	<0.05	0.02	<0.05
Fluoride	0.09-0.15	0.2	0.1	0.16	0.10
Iron	0.03-0.61	0.30	0.21	0.48	<0.05
Lead	0.03-0.11	0.08	<0.005	0.07	<0.005
Manganese	0.01-0.14	0.06	<0.05	0.09	<0.05
Mercury	<0.0001	-	<0.0001	-	<0.0001
Molybdenum	0.01-0.11	0.03	<0.005	0.08	0.012
Nickel	0.01-1.10	0.06	<0.05	0.07	<0.05
Selenium	0.009-0.017	-	0.010	-	0.010
Vanadium	0.05-0.34	0.42	0.36	0.53	0.47
Zinc	0.01-0.09	0.01	0.01	0.01	0.02
Radiochemistry					
Uranium as U_3O_8	0.012-0.287	0.97	1.6	1.20	1.7
Radium - 226	106-768	241	220	253	175
Thorium - 230	0 - 1.9	3.3	1.4	<0.6	1.3

[1] All values expressed as mg/l except pH (std. units), conductivity (umhos/cm) radium and thorium (pCi/l).

[2] Baseline range is for all pattern wells following outlier removal.

TABLE III-A

RENO CREEK
Pattern 2
Restoration Data

PARAMETER	Baseline Range	WELL P-10 10/12/81 NML	CDM	WELL P-11 10/12/81 NML	CDM
Field					
pH	8.16-8.94	7.8	-	7.9	-
Conductivity	1890-2234	2100	-	2000	-
Major Constituents					
Bicarbonate (HCO_3)	89-178	164	136	145	111
Carbonate (CO_3)	0-14	0	0	0	0
Alkalinity (as CaCO eq)	73-146	134	113	119	92
Calcium	108-153	101	91	104	85
Chloride	7.0-18.8	20	13	18	11
Magnesium	19-33	22	23	21	22
Potassium	5.8-9.5	10.2	6.8	9.6	6.5
Sodium	287-360	355	340	347	350
Sulfate	818-1002	990	921	782	898
TDS	1340-1580	1578	1400	1353	1340
Anion/Cation Balance	-	106%	98%	*	103%
Minor Constituents					
Ammonia as N	<0.2	-	<0.2	-	<0.2
Nitrate as N	<0.05	-	<0.05	-	<0.05
Nitrite as N	<0.05	-	<0.05	-	<0.05
Aluminum	<0.2	-	<0.5	-	<0.05
Arsenic	0.001-0.016	-	<0.005	-	<0.005
Barium	0.08-0.40	-	<0.2	-	<0.2
Boron	<0.1	-	<0.1	-	<0.1
Cadmium	0.01-0.02	<0.01	<0.005	0.01	<0.005
Chromium	0.02-0.11	0.45	0.013	0.15	0.012
Copper	0.01-0.02	0.01	<0.005	0.01	<0.005
Fluoride	0.09-0.15	-	0.1	-	0.1
Iron	0.03-0.61	0.04	0.12	0.06	0.03
Lead	0.03-0.11	0.03	<0.005	0.01	<0.005
Manganese	0.01-0.14	0.08	0.059	0.06	0.055
Mercury	<0.0001	-	<0.0001	-	<0.0001
Molybdenum	0.01-0.11	0.10	0.019	0.04	0.023
Nickel	0.01-1.10	0.02	0.03	0.02	0.03
Selenium	0.009-0.017	-	<0.005	-	<0.005
Vanadium	0.05-0.34	0.40	0.44	0.53	0.50
Zinc	0.01-0.09	0.14	0.123	0.02	0.011
Radiochemistry					
Uranium as U_3O_8	0.012-0.287	4.14	*	2.91	*
Radium-226	106-768	243	*	199	*
Thorium-230	0-1.9	5.9	*	3.6	*

1 All values expressed as mg/l except pH (std. units), conductivity (umhos/cn) radium and thorium (pCi/l).

2 Baseline range is for all pattern wells following outlier removal.

* Results pending.

RENO CREEK
PATTERN 2 INJECTION WELLS
RESTORATION WATER QUALITY

PARAMETER	WELL I-12 04/16/81 NML	CDM	WELL I-13 04/16/81 NML	CDM	WELL I-14 04/16/81 NML	CDM	WELL I-15 04/16/81 NML	CDM
Field								
pH	7.8	--	7.8	--	7.9	--	7.7	--
Conductivity	1990	--	2093	--	2000	--	2000	--
Major Constituents								
Bicarbonate (HCO_3)	133	136	119	136	119	126	123	129
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Alkalinity	109	112	98	112	98	104	101	107
Calcium	87	72	82	69	84	77	101	95
Chloride	15	10	15	10	18	13	28	14
Magnesium	29	26	24	24	36	28	49	31
Potassium	12	7.4	10.0	7.0	12	8.0	13	8.8
Sodium	332	290	363	340	341	320	328	300
Sulfate	917	936	917	940	948	900	934	934
TDS	1500	1400	1560	1460	1500	1450	1560	1490
Anion/Cation Bal.	96%	119%	97%	108%	100%	104%	94%	107%
Minor Constituents								
Arsenic	0.010	0.010	0.009	0.009	0.007	0.007	0.005	0.005
Cadmium	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Copper	0.02	0.05	0.01	0.05	0.01	0.05	0.01	0.05
Fluoride	0.14	0.1	0.10	0.1	0.16	0.2	0.10	0.1
Iron	0.02	0.05	0.06	0.12	0.04	0.05	0.05	0.05
Lead	0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005
Manganese	0.09	0.05	0.04	0.05	0.05	0.05	0.01	0.05
Molybdenum	0.01	0.007	0.01	0.009	0.01	0.007	0.01	0.005
Nickel	0.03	0.05	0.04	0.05	0.04	0.05	0.06	0.05
Selenium	0.026	0.026	0.007	0.007	0.017	0.017	0.009	0.009
Vanadium	0.48	0.440	0.74	0.700	0.39	0.280	0.36	0.250
Zinc	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Radiochemistry								
Uranium (as U_3O_8)	2.79	4.5	0.81	1.2	1.19	1.9	0.47	0.82
Radium-226	119	101±9	142	107±9	130	98±9	106	133±10
Thorium-230	5.4	1.6±0.6	1.6	0.2±0.3	1.9	0.1±0.3	0.4	0.7±0.4

NOTE
The following parameters were non-detectable: Ammonia, Nitrate, Nitrite Aluminum, Barium, Boron, Chromium, Mercury.

All values reported as mg/l except pH (std. units), conductivity (µmhos/cm), radium and thorium (pCi/l).

TABLE IV-A

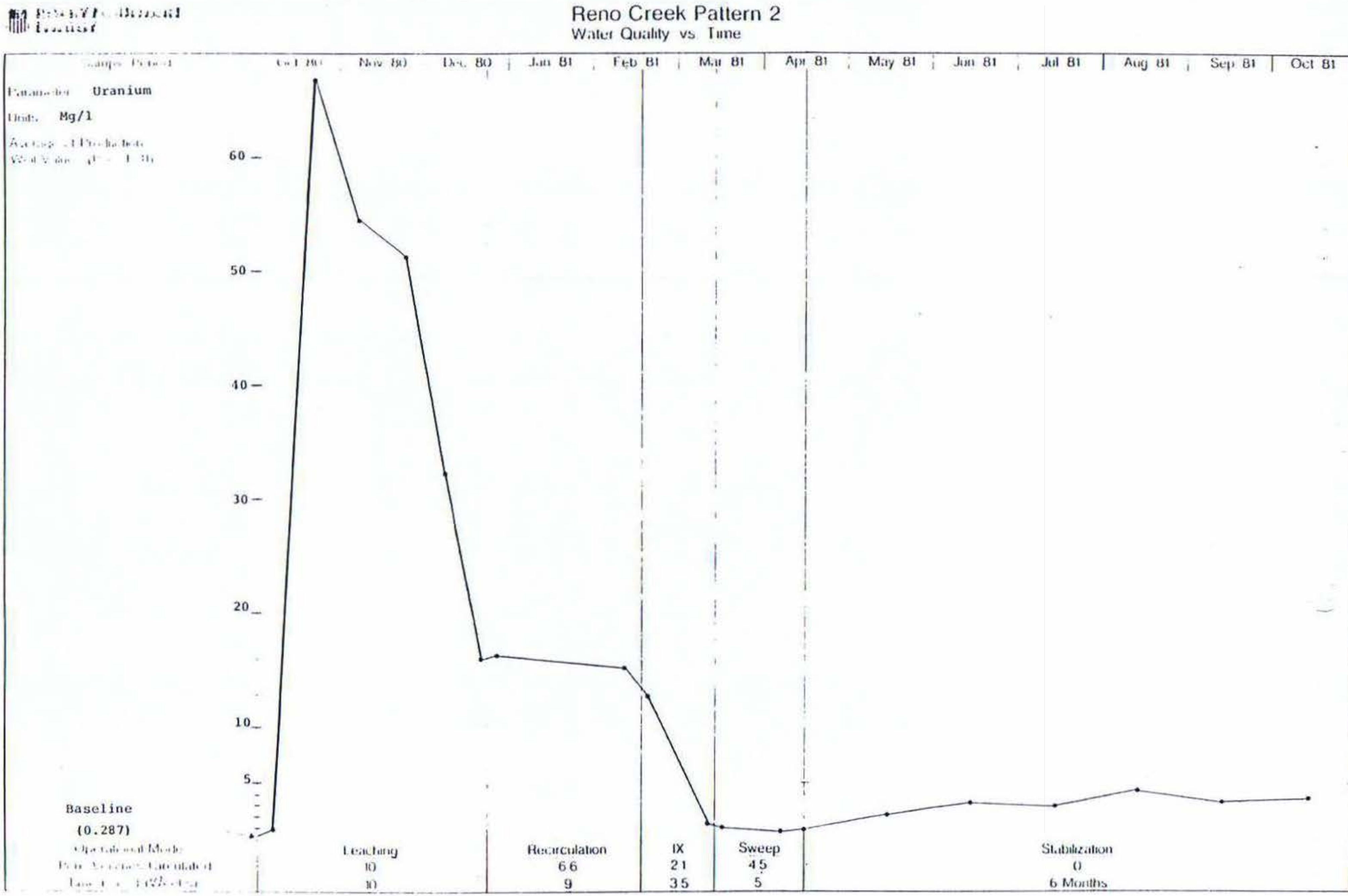
RENO CREEK
PATTERN 2 INJECTION WELLS
RESTORATION WATER QUALITY

	WELL I-12 10/12/81 NML	CDM	WELL I-13 10/12/81 NML	CDM	WELL I-14 10/12/81 NML	CDM	WELL I-15 10/12/81 NML	CDM
Field								
pH	8.1	-	7.9	-	8.1	-	8.0	-
Conductivity	2000	-	2100	-	2000	-	2000	-
Major Constituents								
Bicarbonate (HCO_3)	157	128	163	146	157	133	131	111
Carbonate (CO_3)	0	0	0	0	0	0	0	0
Alkalinity	129	106	134	121	129	110	107	92
Calcium	97	91	86	85	99	83	98	110
Chloride	18	10	15	11	18	9	18	10
Magnesium	26	27	25	26	25	27	29	31
Potassium	10.8	7.4	10.6	7.3	10.8	7.5	12.5	7.8
Sodium	309	340	347	350	322	350	300	300
Sulfate	850	899	820	911	820	878	839	908
TDS	1387	1350	1384	1370	1372	1330	1361	1350
Ionic Balance	100%	103%	93%	101%	95%	105%	97%	101%
Minor Constituents								
Boron	-	0.1	-	0.2	-	0.1	-	0.1
Chromium	0.14	0.012	0.03	0.012	0.01	0.012	0.01	0.015
Copper	0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005
Fluoride	-	0.1	-	0.1	-	0.01	-	0.1
Iron	0.03	0.09	0.05	0.06	0.01	0.04	0.01	0.11
Lead	0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005
Manganese	0.07	0.056	0.08	0.070	0.06	0.056	0.07	0.059
Molybdenum	0.02	0.015	0.03	0.017	0.02	0.014	0.03	0.009
Nickel	0.02	0.02	0.01	0.03	0.02	0.03	0.03	0.02
Vanadium	0.39	0.34	0.48	0.44	0.39	0.40	0.27	0.18
Zinc	0.02	0.008	0.06	0.055	0.04	0.023	0.12	0.097
Radiochemistry								
Uranium as (U_3O_8)	4.08	*	2.76	*	3.91	*	2.96	*
Radium-226	135	*	163	*	171	*	180	*
Thorium-230	5.1	*	3.2	*	2.6	*	1.7	*

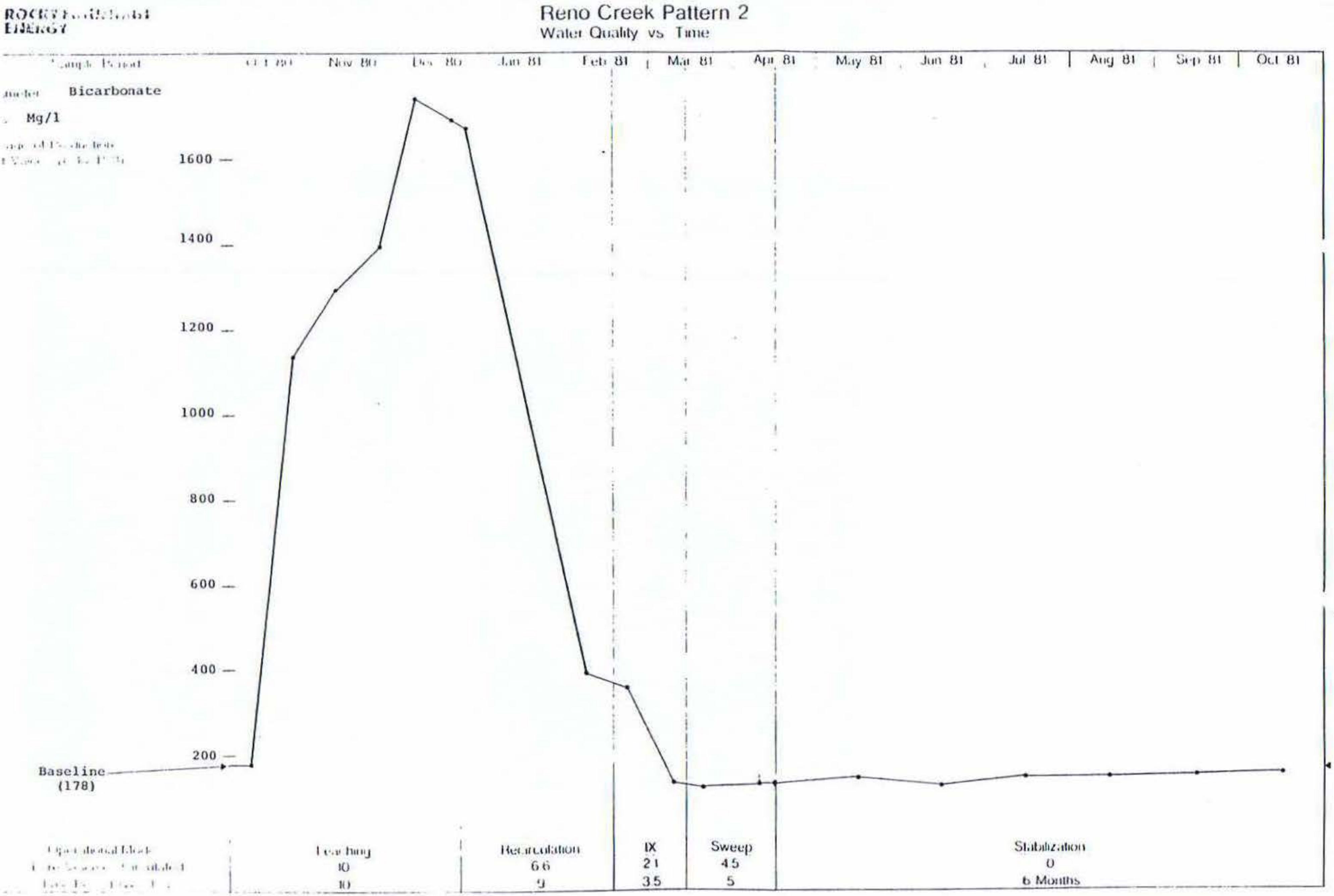
Note

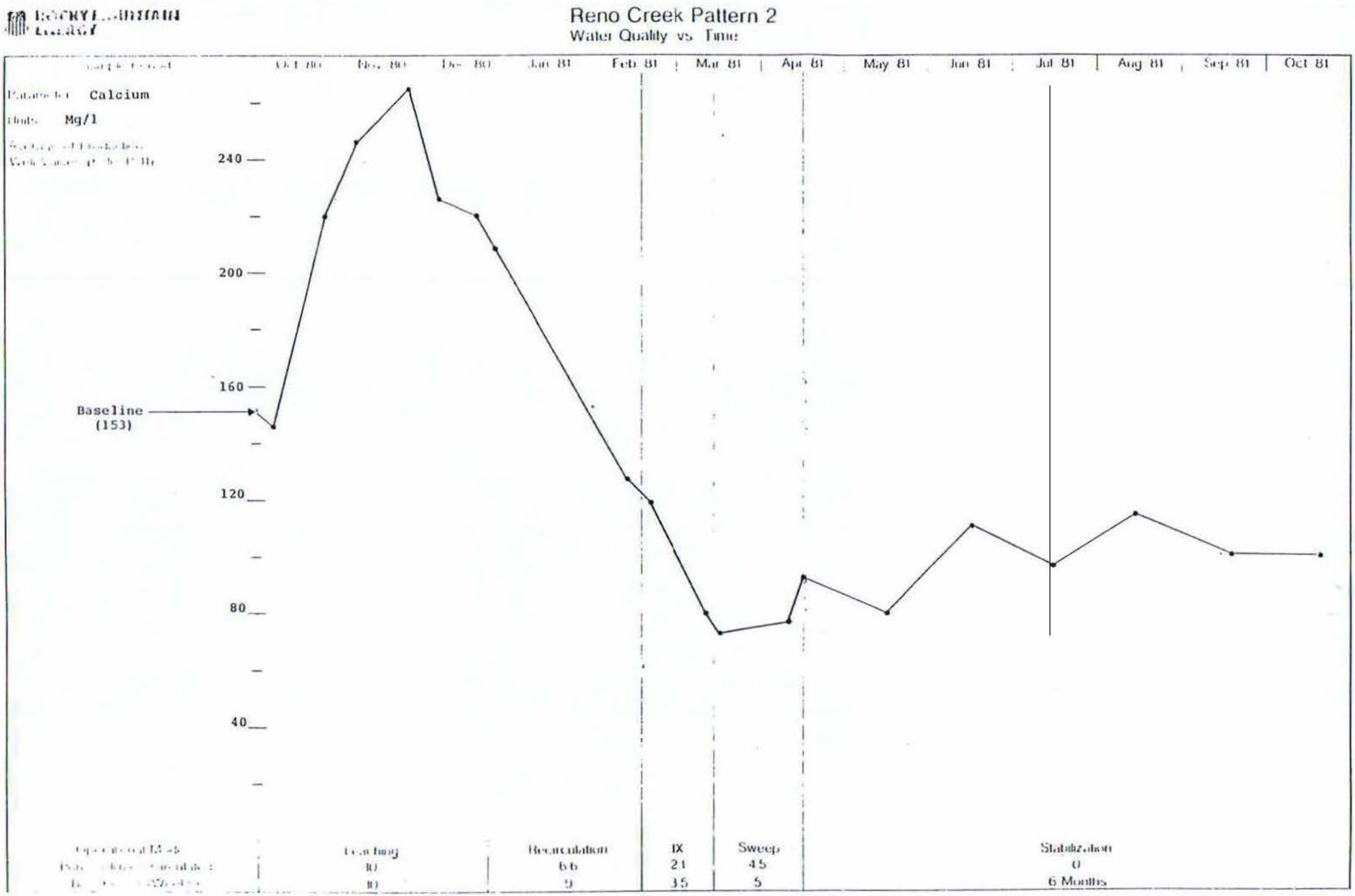
The following parameters were non-detectable: Ammonia, Nitrate, Nitrite Aluminum, Arsenic, Barium, Cadmium, Mercury, Selenium.

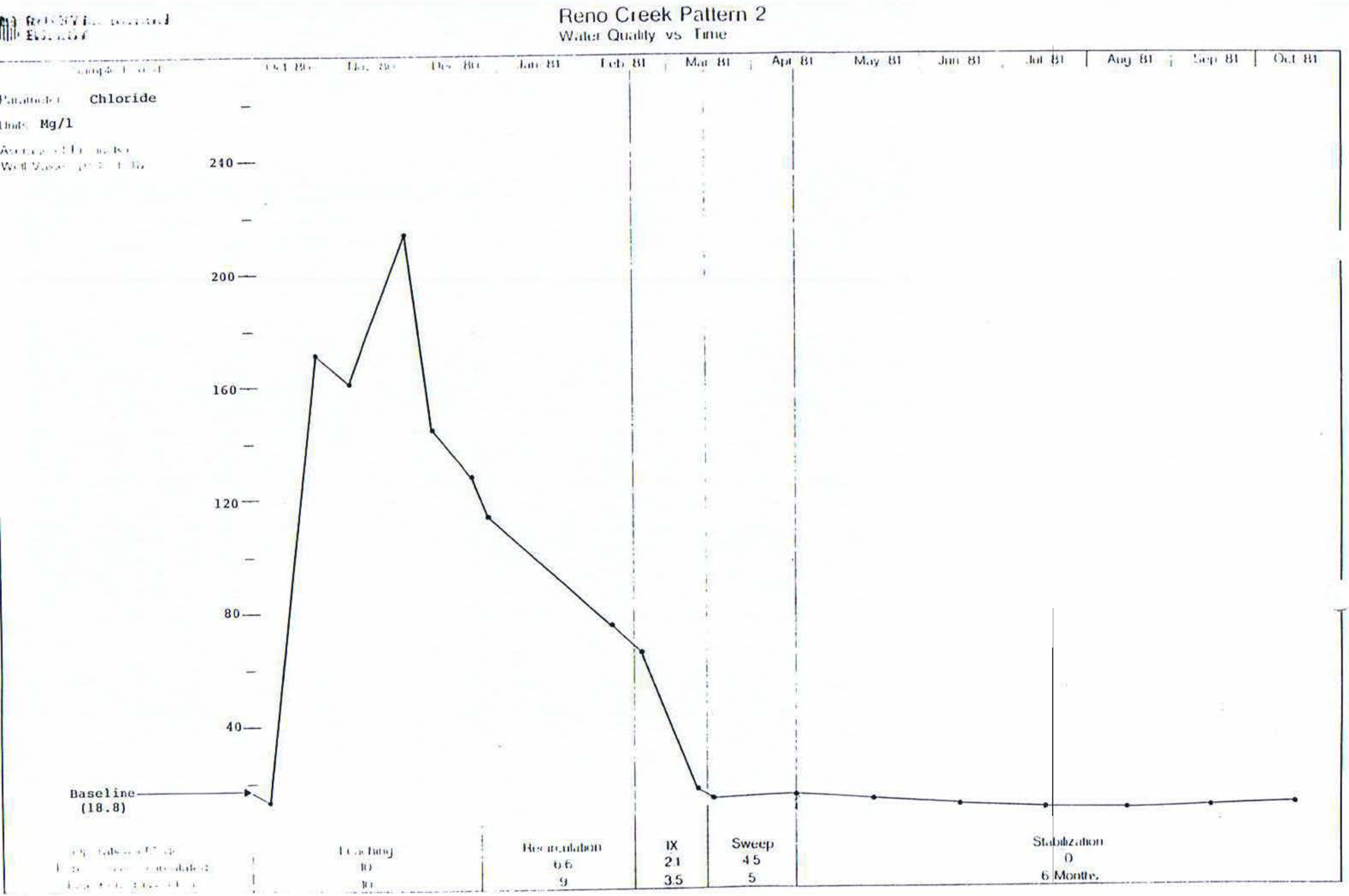
All values reported as mg/l except pH (std units), conductivity (umhos/cm), radium and thorium (pCi/l).

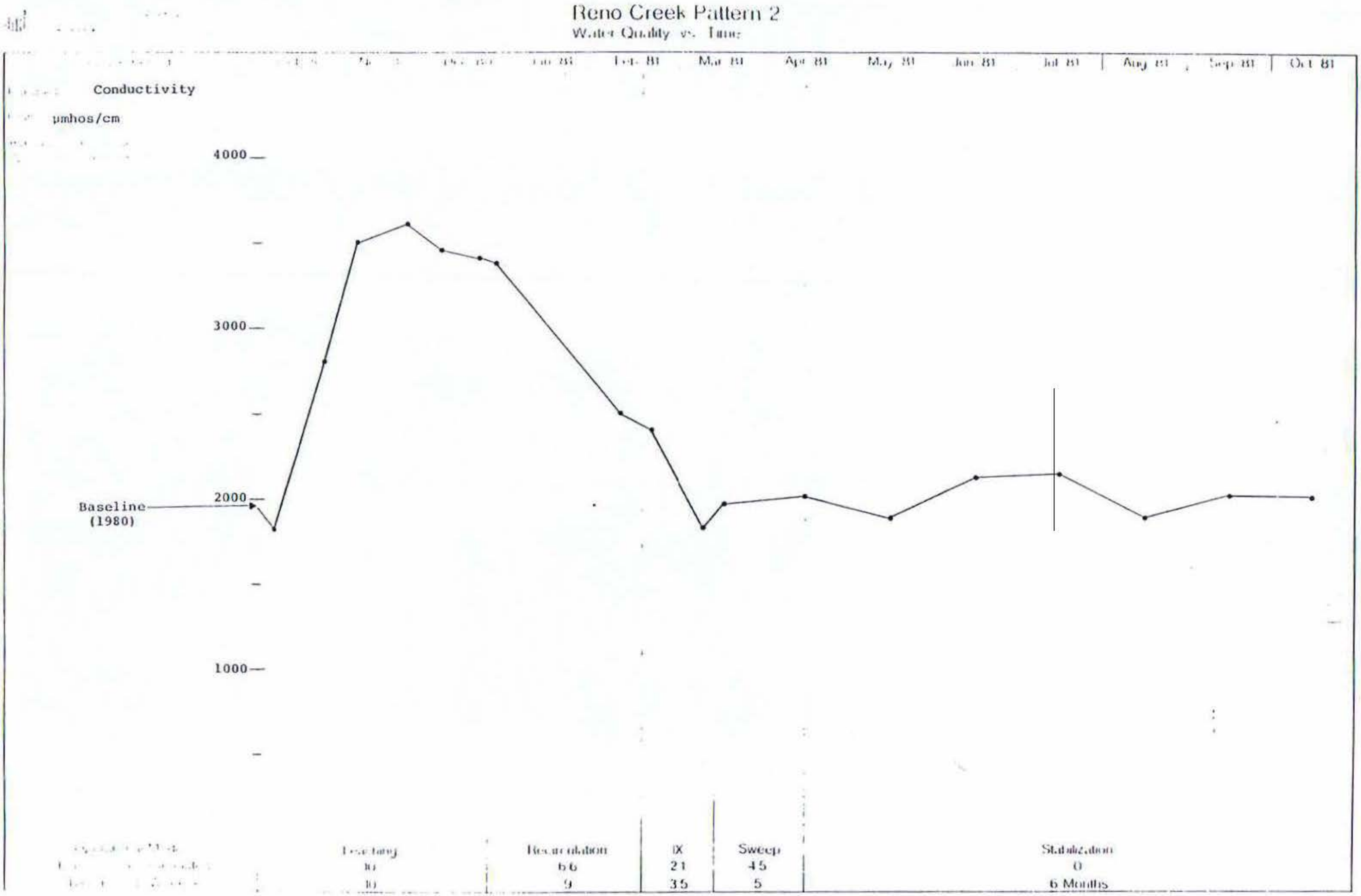


Reno Creek Pattern 2
Water Quality vs. Time
Nov 80
Dec 80
Jan 81
Feb 81
Mar 81
Apr 81
May 81
Jun 81
Jul 81
Aug 81
Sep 81
Oct 81
Uranium
Mg/1
60
50
40
30
20
10
5
Baseline
(0.287)
Leaching
10
10
Recirculation
6.6
9
IX
2.1
3.5
Sweep
4.5
5
Stabilization
0
6 Months


Reno Creek Pattern 2
Water Quality vs Time
Bicarbonate
Mg/1
Oct 80
Nov 80
Dec 80
Jan 81
Feb 81
Mar 81
Apr 81
May 81
Jun 81
Jul 81
Aug 81
Sep 81
Oct 81
1600
1400
1200
1000
800
600
400
200
Baseline
(178)
Leaching
10
10
Recirculation
6.6
9
IX
2.1
3.5
Sweep
4.5
5
Stabilization
0
6 Months


Reno Creek Pattern 2
Water Quality vs. Time
Parameter Calcium
Units Mg/1
Oct 80
Nov 80
Dec 80
Jan 81
Feb 81
Mar 81
Apr 81
May 81
Jun 81
Jul 81
Aug 81
Sep 81
Oct 81
240
200
160
120
80
40
Baseline
(153)
Leaching
10
10
Recirculation
6.6
9
IX
2.1
3.5
Sweep
4.5
5
Stabilization
0
6 Months


Reno Creek Pattern 2
Water Quality vs Time
Parameter Chloride
Units Mg/1
Baseline (18.8)
240
200
160
120
80
40
Feb 81
Mar 81
Apr 81
May 81
Jun 81
Jul 81
Aug 81
Sep 81
Oct 81
Recirculation
6.6
9
IX
2.1
3.5
Sweep
4.5
5
Stabilization
0
6 Months



Reno Creek Pattern 2
Water Quality vs. Time
Jan 81
Feb 81
Mar 81
Apr 81
May 81
Jun 81
Jul 81
Aug 81
Sep 81
Oct 81
Conductivity
µmhos/cm
4000
3000
2000
1000
Baseline
(1980)
Recirculation
66
9
IX
21
35
Sweep
45
5
Stabilization
0
6 Months

RENO CREEK PATTERN 2
RESTORATION STABILIZATION

Parameter: URANIUM

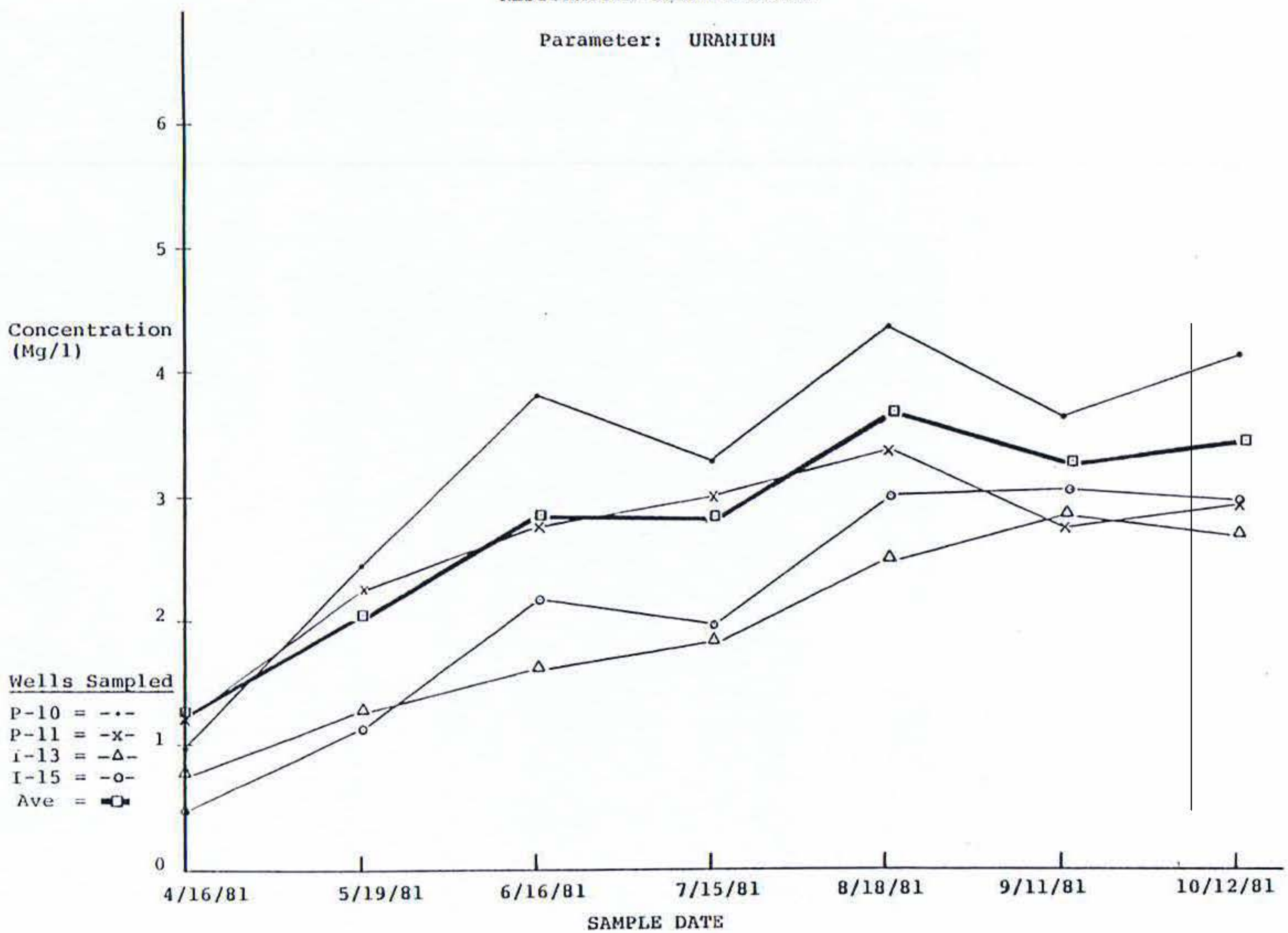


Figure 7

FIGURE 7

RENO CREEK PATTERN 2
RESTORATION STABILIZATION
Parameter: BICARBONATE

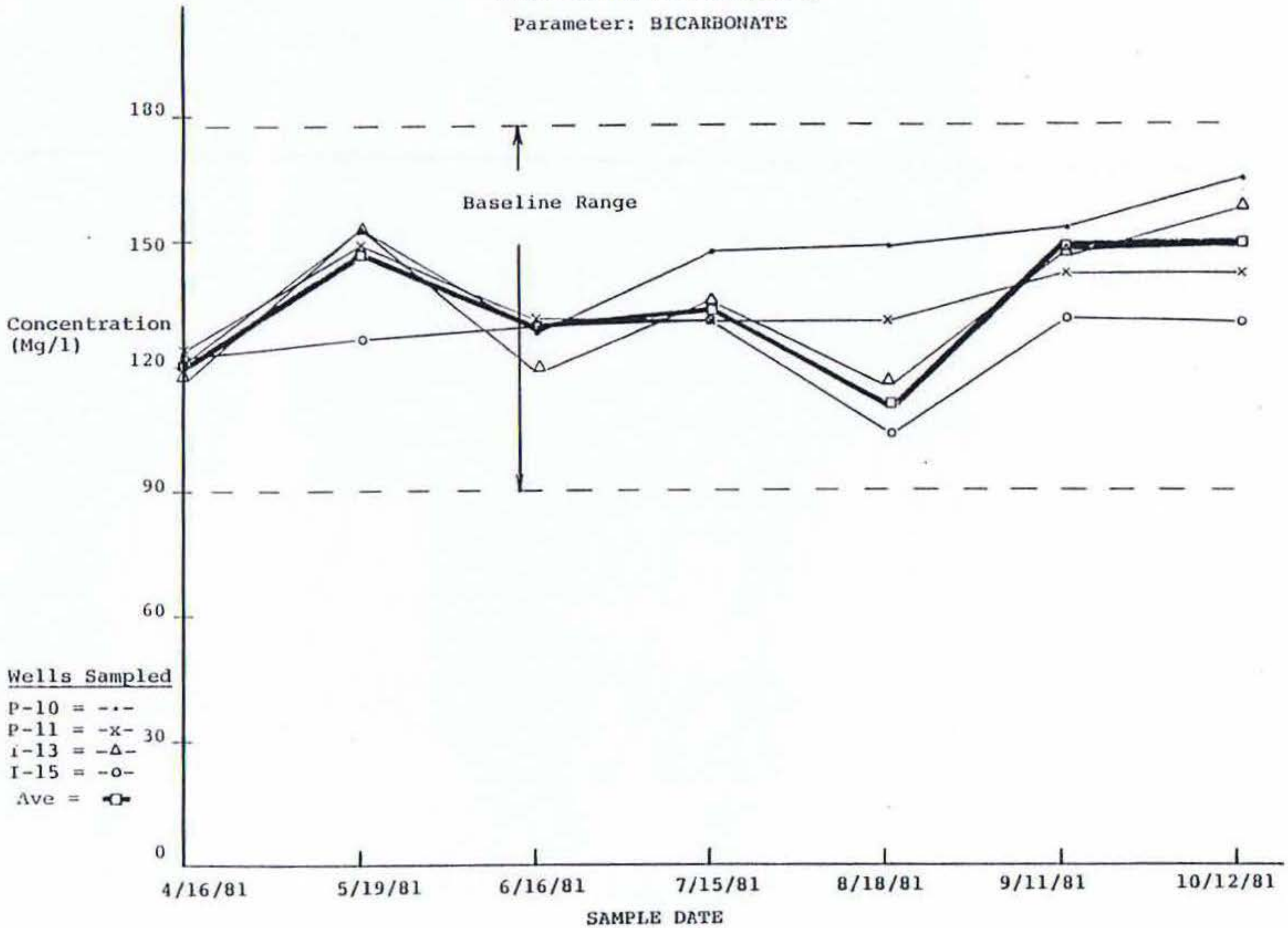


Figure 8

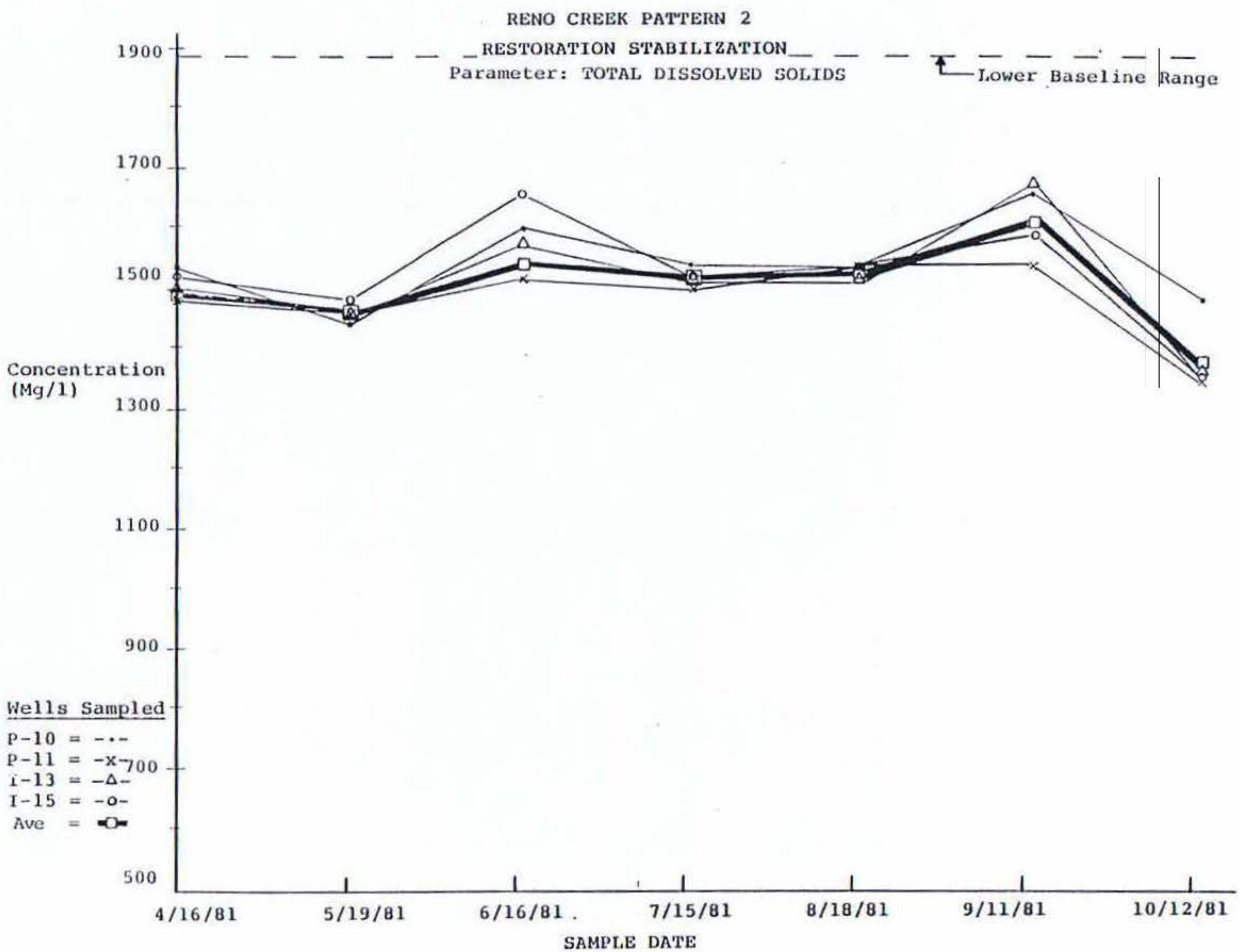

RENO CREEK PATTERN 2
RESTORATION STABILIZATION
Parameter: TOTAL DISSOLVED SOLIDS
Lower Baseline Range
1900
1700
1500
1300
1100
900
700
500
Concentration (Mg/1)
Wells Sampled
P-10 = -·-
P-11 = -x-
I-13 = -Δ-
I-15 = -o-
Ave =
4/16/81
5/19/81
6/16/81
7/15/81
8/18/81
9/11/81
10/12/81
SAMPLE DATE

Figure 9

III through IV-A. Samples collected during the interim four month period were analyzed for pH, conductivity, TDS, bicarbonate, chloride, uranium and vanadium. Table V and Figures 7,8, and 9 respectively give interior well data and depict water quality stability for three key parameters. As previously noted, the pattern average for these parameters is also shown.

Appendices A and B present water quality for the pattern monitor wells, as determined by two laboratories, at the conclusion of the six month demonstrated restoration period. Appendix C summarizes pre-mining water quality for the entire pattern as well as describing results of individual well analyses. The data clearly indicates that water quality in the vicinity of the monitor wells is well within baseline range.

Conclusion

The primary objectives of the Pattern 2 test were to:

1) evaluate the performance of a carbonate lixiviant in the Reno Creek orebody with respect to uranium concentrations in pregnant solution (e.g. head grades) and

2) demonstrate a restoration method which would be environmentally and operationally acceptable for a production mine facility at Reno Creek.

These objectives have been fully met.

Analysis of the groundwater quality data and graphs confirm that stabilization of water quality within the restored pattern has been demonstrated. All groundwater constituents except uranium have stabilized at levels below or approximating pre-mining water quality. Uranium levels within the pattern interior are well below the Wyoming drinking water standard of 5 mg/l. Initial and final well samplings indicate there was no mobilization or build up of toxic elements such as arsenic, mercury or selenium as a result of mining activities. Total Dissolved Solids (TDS) levels are well below baseline range indicating overall improvement in water quality.

All post restoration data supports the conclusion that affected groundwater can be returned to a condition such that its quality of use is equal to or better than and consistent with premining use suitability.

TABLE V

RENO CREEK
PATTERN 2 STABILIZATION DATA
INTERIOR WELLS
4/16/81 - 10/12/81

Date	Parameter	P-10	P-11	I-12	I-13	I-14	I-15	Pattern Average
4/16	Uranium	0.97	1.20	2.79	0.81	1.19	0.47	1.24
	Bicarb.	121	126	133	119	119	123	124
	TDS[2]	1529	1480	1450	1510	1475	1525	1494
5/19	Uranium	2.43	2.25	3.42	1.31	1.74	1.12	2.05
	Bicarb.	153	148	154	154	147	126	147
	TDS	1440	1460	1420	1460	1440	1480	1450
6/16	Uranium	3.81	2.76	3.58	1.68	3.06	2.18	2.85
	Bicarb.	129	133	125	121	138	131	130
	TDS	1600	1520	1420	1580	1560	1660	1557
7/16	Uranium	3.29	3.00	4.34	1.89	2.48	1.97	2.83
	Bicarb.	146	133	141	140	133	133	138
	TDS	1540	1500	1480	1520	1560	1520	1520
8/17	Uranium	4.37	3.35	5.54	2.56	3.26	3.00	3.68
	Bicarb.	148	133	148	121	103	112	128
	TDS	1540	1540	1500	1520	1540	1540	1530
9/9	Uranium	3.66	2.71	3.56	2.90	3.87	3.06	3.29
	Bicarb.	154	145	167	152	153	132	151
	TDS	1660	1540	1640	1680	1580	1600	1617
10/12	Uranium	4.14	2.91	4.08	2.76	3.91	2.96	3.46
	Bicarb.	164	145	157	163	157	131	153
	TDS[2]	1489	1347	1369	1377	1351	1355	1381

[1] All values given as mg/l.

[2] TDS values for first and last sampling are average of Nine Mile Lake and CDM analyses.

CDM

environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0469

November 13, 1981

Pat Spieles
Rocky Mountain Energy Co.
P.O. Box 3719
Casper, WY 82602

RE: 700-13441-4
Rel No. 2271
Date Samples Rec'd 11-2-81

APPENDIX A

REPORT OF ANALYSIS

Lab Designation / Sponsor Designation	700-13441-4-1 RC-M-16 10-18-81		700-13441-4-2 RC-M-17 10-18-81		700-13441-4-3 RC-M-18 10-18-81		700-13441-4-4 RC-M-19 10-18-81		
Determination (mg/L)		NML		NML		NML		NML	Baseline Range[1]
Bicarbonate (as HCO_3)	60	74	80	103	49	72	29	51	89-178
Carbonate (as CO_3)	0	trace	0	0	4	trace	4	trace	0-14
Alkalinity	50	61	66	84	48	59	31	42	73-146
Calcium, total	110	119	101	102	109	100	110	119	114-1[illegible]
Chloride	7	10	8	14	8	14	7	10	8-14
Magnesium, total	22	21	23	21	19	19	22	20	19-33
Potassium, total	6.5	8.7	5.7	8.1	7.2	9.7	7.2	9.2	5.8-9.5
Sodium, total	310	266	280	262	280	271	300	286	290-332
Sulfate (as SO_4)	923	848	841	776	831	743	906	805	818-1002
TDS (at 180°C)	1300	1309*	1230	1233*	1170	1192*	1240	1274*	1360-1580
Anion/Cation, percent	103	-	101	-	105	-	104	-	-
Ammonia (as N)	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2
Nitrate (as N)	0.05	-	<0.05	-	<0.05	-	0.05	-	<0.05
Nitrite (as N)	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05

These samples are scheduled to be disposed of 30 days after the date of this report.

[1] Observed range for baseline sampling of production zone monitor wells.

* N[illegible] (NML) TDS values calculated.

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CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
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Pat Spieles
November 13, 1981

RE: 700-13441-4
Rel No. 2271
Date Samples Rec'd 11-2-81

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	700-13441-4-1 RC-M-16 10-18-81		700-13441-4-2 RC-M-17 10-18-81		700-13441-4-3 RC-M-18 10-18-81		700-13441-4-4 RC-M-19 10-18-81		
Determination (mg/L)		NML		NML		NML		NML	Baseline[1] Range
Aluminum, total	0.7		0.6		0.6		0.5		<0.2
Arsenic, total	<0.005		0.005		<0.005		<0.005		0.014-0.016
Barium, total	<0.1		<0.1		<0.1		<0.1		0.10-0.33
Boron	0.1		0.1		0.1		0.1		<0.1
Cadmium, total	0.010		0.007		0.005		0.009		<0.01-0.02
Chromium, total	0.030		0.030		0.031		0.035		0.02-0.11
Copper, total	<0.005		<0.005		<0.005		<0.005		<0.01-0.05
Fluoride	0.1		0.2		0.1		0.1		0.09-0.15
Iron, total	0.04		0.04		0.04		0.05		0.05-[illegible]1
Lead, total	<0.005		<0.005		<0.005		<0.005		0.03-0.11
Manganese, total	0.014		0.035		0.010		0.022		0.01-0.10
Mercury, total	0.0001		0.0001		0.0001		<0.0001		<0.0001
Molybdenum, total	0.009		0.007		0.009		0.007		0.01-0.11
Nickel, total	0.20		0.20		0.21		0.24		0.02-0.10
Selenium, total	0.030		0.020		0.047		0.030		0.01-0.017
Vanadium, total	0.19		0.21		0.12		0.10		0.05-0.20
Uranium, total	*	0.009	*	0.071	*	0.054		0.071	0.001-0.148

These samples are scheduled to be disposed of 30 days after the date of this report.

[1] Observed range for baseline sampling of production zone monitor wells

*Results pending

CDM

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CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0469

RE: 700-13441-4
Rel No. 2271
Date Samples Rec'd 11-2-81

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	700-13441-4-1 RC-M-16 10-18-81		700-13441-4-2 RC-M-17 10-18-81		700-13441-4-3 RC-M-18 10-18-81		700-13441-4-4 RC-M-19 10-18-81		
Determination (mg/L)		NML		NML		NML		NML	Baseline Range
Zinc, total	0.020	–	0.014	–	0.061	–	0.043	–	0.01-0.09
pH	8.5	8.7	8.0	7.9	8.4	8.7	8.6	8.9	8.2-8.9
Conductivity, µmhos/cm	2200	2000	2000	1925	2000	1880	2100	1990	1890-2234

These samples are scheduled to be disposed of 30 days after the date of this report.

BY [signature]
David LeMaster
Water Laboratory
Supervisor

DL/srf

A-3

CDM

environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0469

October 30, 1981
Page 1 of 4

Pat Spieles
Rocky Mountain Energy Co.
P.O. Box 3719
Casper, WY 82602

RE: 700-13368-7
Release No. 2270
Date Sample Rec'd 10-19-81

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	700-13368-7-1 RC-P10 10-13-81	700-13368-7-2 RC-P11 10-13-81	700-13368-7-3 RC-I12 10-12-81	700-13368-7-4 RC-I13 10-13-81	700-13368-7-5 RC-I14 10-12-81
Determination (mg/L)					
Bicarbonate (as HCO_3)	136	111	128	146	133
Carbonate (as CO_3)	0	0	0	0	0
Alkalinity (as $CaCO_3$)	113	92	106	121	110
Calcium, total	91	85	91	85	83
Chloride	13	11	10	11	9
Magnesium, total	23	22	27	26	27
Potassium, total	6.8	6.3	7.4	7.3	7.5
Sodium, total	340	350	340	350	350
Sulfate (as SO_4)	921	898	899	911	878
TDS (at 180°C)	1400	1340	1350	1370	1330
Cation/Anion, percent	98	103	103	101	105
Ammonia (as N)	<0.2	<0.2	<0.2	<0.2	<0.2
Nitrate (as N)	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrite (as N)	<0.05	<0.05	<0.05	<0.05	<0.05
Aluminum, total	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic, total	<0.005	<0.005	<0.005	<0.005	<0.005

These samples are scheduled to be disposed of 30 days after the date of this report.

Appendix B

CDM

environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0469

RE: 700-13368-7
Release No. 2270
Date Sample Rec'd 10-19-81

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	700-13368-7-1 RC-P10 10-13-81	700-13368-7-2 RC-P11 10-13-81	700-13368-7-3 RC-I12 10-12-81	700-13368-7-4 RC-I13 10-13-81	700-13368-7-5 RC-I14 10-12-81
Determination (mg/L)					
Barium, total	<0.2	<0.2	<0.2	<0.2	<0.2
Boron	0.1	0.1	0.1	0.2	0.1
Cadmium, total	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium, total	0.013	0.012	0.012	0.012	0.012
Copper, total	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoride	0.1	0.1	0.1	0.1	0.1
Iron	0.12	0.03	0.09	0.06	0.04
Lead	<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	0.059	0.055	0.056	0.070	0.056
Mercury	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	0.019	0.023	0.015	0.017	0.014
Nickel	0.03	0.03	0.02	0.03	0.03
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005
Vanadium	0.44	0.50	0.34	0.44	0.40
Zinc	0.123	0.011	0.008	0.055	0.023

These samples are scheduled to be disposed of 30 days after the date of this report.

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environmental engineers, scientists,
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CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0469

RE: 700-13368-7
Release No. 2270
Date Sample Rec'd 10-19-81

REPORT OF ANALYSIS

Lab Designation	700-13368-7-6	700-13368-7-7
Sponsor Designation	RC-I15	RC-LSM21
	10-13-81	10-13-81
Determination (mg/L)		
Bicarbonate (as HCO_3)	111	0
Carbonate (as CO_3)	0	54
Alkalinity (as $CaCO_3$)	92	106
Calcium, total	110	4.5
Chloride	10	24
Magnesium, total	31	0.31
Potassium, total	7.8	8.4
Sodium, total	300	75
Sulfate (as SO_4)	908	23
TDS (at 180°C)	1350	198
Cation/Anion, percent	101	93
Ammonia (as N)	<0.2	0.3
Nitrate (as N)	<0.05	<0.05
Nitrite (as N)	<0.05	<0.05
Aluminum, total	<0.5	0.8
Arsenic, total	<0.005	<0.005

These samples are scheduled to be disposed of 30 days after the date of this report.

CDM

environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0469

Pat Spieles
October 30, 1981

RE: 700-13368-7
Release No. 2270
Date Sample Rec'd 10-19-81

REPORT OF ANALYSIS

Lab Designation	700-13368-7-6	700-13368-7-7
Sponsor Designation	RC-I15 10-13-81	RC-LSM21 10-13-81
Determination (mg/L)		
Barium, total	<0.2	<0.2
Boron	0.1	0.2
Cadmium, total	<0.005	<0.005
Chromium, total	0.015	0.012
Copper, total	<0.005	<0.005
Fluoride	0.1	0.6
Iron	0.11	0.48
Lead	<0.005	<0.008
Manganese	0.059	0.017
Mercury	<0.0001	<0.0001
Molybdenum	0.009	0.005
Nickel	<0.02	<0.02
Selenium	<0.005	<0.005
Vanadium	0.18	0.050
Zinc	0.097	0.085

These samples are scheduled to be disposed of 30 days after the date of this report.

BY David LeMaster
David LeMaster
Water Laboratory Supervisor

DL/srf

APPENDIX C

RENO CREEK
Pattern 2

Final Baseline
Pattern Average [1]

Field		n[2]	Mean	Std. Dev.	UCL*	Range
pH		32	8.49	0.16	9.71	8.16-8.94
Conductivity	µmhos/cm	32	2013	63	2353	1890-2234
Major Constituents						
Bicarbonate (HCO_3)	mg/l	30	117	12.6	157	89-178
Carbonate (CO_3)	mg/l	30	6.4	4.0	15.8	0-14
Alkalinity (as $CaCO_3$eq)	mg/l	30	96	10.5		73-146
Calcium	mg/l	30	129	8.4		108-153
Chloride	mg/l	30	11.3	2.0	16.8	7.0-18.8
Magnesium	mg/l	30	24.8	1.4		19-33
Potassium	mg/l	30	7.9	0.4		5.8-9.5
Sodium	mg/l	30	311	4.9		287-360
Sulfate	mg/l	30	910	38.9		818-1002
TDS	mg/l	30	1447	64		1340-1580
Minor Constituents						
Ammonia as N	mg/l	12	<0.2			-----
Nitrate as N	mg/l	12	<0.05			-----
Nitrite as N	mg/l	12	<0.05			-----
Aluminum	mg/l	12	<0.2			-----
Arsenic	mg/l	12	0.011			0.001-0.016
Barium	mg/l	12	0.19			0.08-0.40
Boron	mg/l	12	<0.1			-----
Cadmium	mg/l	12	0.02			0.01-0.02
Chromium	mg/l	12	0.08			0.02-0.11
Copper	mg/l	12	0.01			0.01-0.02
Fluoride	mg/l	12	0.11			0.09-0.15
Iron	mg/l	32	0.11			0.03-0.61
Lead	mg/l	12	0.08			0.03-0.11
Manganese	mg/l	12	0.07			0.01-0.14
Mercury	mg/l	12	<0.0001			-----
Molybdenum	mg/l	12	0.04			0.01-0.11
Nickel	mg/l	12	0.04			0.01-1.10
Selenium	mg/l	12	0.012			0.009-0.017
Vanadium	mg/l	32	0.08	0.04	0.18	0.05-0.34
Zinc	mg/l	12	0.04			0.01-0.09
Radiochemistry						
Uranium as U_3O_8	mg/l	30	0.067	0.014	0.104	0.012-0.287
Radium - 226	pci/l	12	278	148	632	106-768
Thorium - 230	pci/l	12	0.59	0.66	2.09	0.0 - 1.9

*UCL's given for excursion detection parameters only; UCL=1.1(2Std.Dev.+10%Mean)

November 24, 1980

[1] Average calculated from all monitor and production well data.

[2] Equals number of samples.

RENO CREEK
Pattern 2

Final Baseline
Well P-10

Field		n	Mean	Std. Dev.	Range
pH		5	8.26	0.05	8.20-8.33
Conductivity	µmhos/cm	5	1964	59	1923-2033
Major Constituents					
Bicarbonate (HCO_3)	mg/l	5	128	14.7	113-144
Carbonate (CO_3)	mg/l	5	0	0	0-0
Alkalinity (as $CaCO_3$eq)	mg/l	5	105	11.9	93-118
Calcium	mg/l	5	117	7.7	108-129
Chloride	mg/l	5	12.6	1.2	11.1-13.9
Magnesium	mg/l	5	26.8	1.3	25-28
Potassium	mg/l	5	7.2	0.2	7.0-7.4
Sodium	mg/l	5	319	21	300-350
Sulfate	mg/l	5	895	24	873-928
TDS	mg/l	5	1360	14	1340-1380
Minor Constituents					
Ammonia as N	mg/l	2	<0.2		-----
Nitrate as N	mg/l	2	<0.05		-----
Nitrite as N	mg/l	2	<0.05		-----
Aluminum	mg/l	5	<0.2		-----
Arsenic	mg/l	5	0.004		0.001-0.006
Barium	mg/l	5	0.20		0.08-0.40
Boron	mg/l	2	<0.1		-----
Cadmium	mg/l	5	<0.01		-----
Chromium	mg/l	5	0.08		0.05-0.10
Copper	mg/l	5	0.02		0.01-0.02
Fluoride	mg/l	4	0.12		0.11-0.13
Iron	mg/l	5	0.06		0.05-0.08
Lead	mg/l	5	0.03		0.03-0.03
Manganese	mg/l	5	0.08		0.06-0.10
Mercury	mg/l	2	<0.0001		-----
Molybdenum	mg/l	5	0.05		0.03-0.11
Nickel	mg/l	7	0.02		0.01-0.03
Selenium	mg/l	2	0.10		0.009-0.010
Vanadium	mg/l	5	<0.05	0	----
Zinc	mg/l	5	0.03		0.03-0.04
Radiochemistry					
Uranium as U_3O_8	mg/l	5	0.063	0.027	0.024-0.091
Radium - 226	pci/l	6	274	8.8	262-283
Thorium - 230	pci/l	6	0.21	0.18	0.0-0.46

November 24, 1980

36/E9

RENO CREEK
Pattern 2

Final Baseline
Well P-11

Field		n	Mean	Std. Dev.	Range
pH		5	8.54	0.04	8.51-8.61
Conductivity	µmhos/cm	5	1998	41	1970-2067
Major Constituents					
Bicarbonate (HCO_3)	mg/l	5	109	8.0	97-116
Carbonate (CO_3)	mg/l	5	4.5	2.0	2.4-7.7
Alkalinity (as $CaCO_3$ eq)	mg/l	5	90	6.4	80-95
Calcium	mg/l	6	137	6.4	130-147
Chloride	mg/l	6	14.2	2.7	10.9-18.8
Magnesium	mg/l	6	24.1		23-25
Potassium	mg/l	6	7.6	0.2	7.3-7.9
Sodium	mg/l	6	312	27	287-360
Sulfate	mg/l	6	893	31	853-925
TDS	mg/l	2	1440		1440-1440
Minor Constituents					
Ammonia as N	mg/l	2	<0.2		-----
Nitrate as N	mg/l	2	<0.05		-----
Nitrite as N	mg/l	2	<0.05		-----
Aluminum	mg/l	2	<0.2		-----
Arsenic	mg/l	2	0.001		0.001-0.001
Barium	mg/l	2	0.17		0.11-0.26
Boron	mg/l	2	<0.1		-----
Cadmium	mg/l	2	<0.01		-----
Chromium	mg/l	2	0.07		0.07-0.07
Copper	mg/l	2	0.02		0.02-0.02
Fluoride	mg/l	2	0.11		0.10-0.12
Iron	mg/l	2	0.06		0.05-0.07
Lead	mg/l	2	0.03		0.01-0.04
Manganese	mg/l	2	0.04		0.04-0.04
Mercury	mg/l	2	<0.0001		-----
Molybdenum	mg/l	2	0.02		0.01-0.03
Nickel	mg/l	2	0.02		0.01-0.02
Selenium	mg/l	2	0.010		0.009-0.010
Vanadium	mg/l	6	0.16	0.11	0.05-0.34
Zinc	mg/l	2	0.05		0.04-0.06
Radiochemistry					
Uranium as U_{38}	mg/l	2	0.065		0.025-0.093
Radium - 226	pci/l	2	275		265-285
Thorium - 230	pci/l	2	0.2		0.1-0.3

November 24, 1980

36/E8

RENO CREEK
Pattern 2

Final Baseline
Well M-16

Field		n	Mean	Std. Dev.	UCL*	Range
pH		5	8.43	0.18	9.66	8.16-8.65
Conductivity	µmhos/cm	5	2114	70	2480	2051-2234
Major Constituents						
Bicarbonate (HCO_3)	mg/l	5	133	30	212	102-178
Carbonate (CO_3)	mg/l	5	8.2	4.6		0-11
Alkalinity (as $CaCO_3$ eq)	mg/l	5	110	24		84-146
Calcium	mg/l	6	135	12.8		114-153
Chloride	mg/l	6	9.8	1.5	14.1	9-12
Magnesium	mg/l	6	25.8	3.7		23-33
Potassium	mg/l	6	8.1	1.2		6.2-9.5
Sodium	mg/l	6	309	9.2		301-325
Sulfate	mg/l	6	937	53		895-1002
TDS	mg/l	5	1524	43		1480-1580
Minor Constituents						
Ammonia as N	mg/l	2	<0.2			-----
Nitrate as N	mg/l	2	<0.05			-----
Nitrite as N	mg/l	2	<0.05			-----
Aluminum	mg/l	2	<0.2			-----
Arsenic	mg/l	2	0.016			0.015-0.016
Barium	mg/l	3	0.21			0.13-0.26
Boron	mg/l	2	<0.1			-----
Cadmium	mg/l	3	0.02			0.01-0.02
Chromium	mg/l	3	0.11			0.10-0.11
Copper	mg/l	2	<0.01			-----
Fluoride	mg/l	4	0.11			0.10-0.11
Iron	mg/l	5	0.29			0.17-0.61
Lead	mg/l	3	0.05			0.03-0.09
Manganese	mg/l	3	0.06			0.01-0.10
Mercury	mg/l	2	<0.0001			-----
Molybdenum	mg/l	3	0.02			0.01-0.04
Nickel	mg/l	3	0.08			0.05-0.10
Selenium	mg/l	2	0.016			0.15-0.017
Vanadium	mg/l	6	0.06	0.02	0.10	0.05-0.09
Zinc	mg/l	3	0.02			0.02-0.02
Radiochemistry						
Uranium as U_3O_8	mg/l	5	0.086	0.114	0.345	0.013-0.287
Radium - 226	pci/l	3	444	324		120-768
Thorium - 230	pci/l	2	0.3	0		0.3-0.3

*UCL's given for excursion detection parameters only. UCL=1.1(2Std.Dev.+10%Mean)

November 24, 1980

36/E7

RENO CREEK
Pattern 2

Final Baseline
Well M-17

Field		n	Mean	Std. Dev.	UCL	Range
pH		5	8.57	0.21	9.88	8.32-8.79
Conductivity	µmhos/cm	5	1991	65	2334	1923-2062
Major Constituents						
Bicarbonate (HCO_3)	mg/l	5	123	9.7	156	116-139
Carbonate (CO_3)	mg/l	5	10.8	1.8		10-14
Alkalinity (as $CaCO_3$ eq)	mg/l	5	101	8.0		95-114
Calcium	mg/l	6	129	4.4		125-137
Chloride	mg/l	5	9	1.9	14.0	7-12
Magnesium	mg/l	6	25.2	4.0		22-33
Potassium	mg/l	6	8.2	1.2		5.8-9.2
Sodium	mg/l	6	305	8.9		291-315
Sulfate	mg/l	6	890	65		818-992
TDS	mg/l	6	1460	52		1380-1540
Minor Constituents						
Ammonia as N	mg/l	2	<0.2			-----
Nitrate as N	mg/l	2	<0.05			-----
Nitrite as N	mg/l	2	<0.05			-----
Aluminum	mg/l	3	<0.2			-----
Arsenic	mg/l	2	0.015			0.014-0.015
Barium	mg/l	3	0.25			0.16-0.33
Boron	mg/l	2	<0.1			-----
Cadmium	mg/l	3	0.02			0.01-0.02
Chromium	mg/l	3	0.07			0.03-0.10
Copper	mg/l	2	0.01			0.01-0.01
Fluoride	mg/l	3	0.10			0.10-0.10
Iron	mg/l	5	0.12			0.05-0.20
Lead	mg/l	3	0.06			0.04-0.07
Manganese	mg/l	3	0.10			0.07-0.14
Mercury	mg/l	2	<0.0001			-----
Molybdenum	mg/l	3	0.03			0.01-0.06
Nickel	mg/l	3	0.04			0.02-0.06
Selenium	mg/l	2	0.011			0.10-0.012
Vanadium	mg/l	5	0.08	0.06	0.22	0.05-0.20
Zinc	mg/l	3	0.02			0.01-0.03
Radiochemistry						
Uranium as U_3O_8	mg/l	5	0.080	0.55	0.209	0.025-0.148
Radium - 226	pci/l	3	447	314		133-760
Thorium - 230	pci/l	2	1.9	0		1.9-1.9

*UCL's given for excursion detection parameters only. UCL=1.1(2Std.dev.+10%Mean)

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36/E6

RENO CREEK
Pattern 2

Final Baseline
Well M-18

Field		n	Mean	Std. Dev.	UCL	Range
pH		6	8.75	0.12	9.89	8.59-8.94
Conductivity	umhos/cm	5	1949	34.5	2220	1890-1977
Major Constituents						
Bicarbonate (HCO_3)	mg/l	6	109	8.5	138	100-121
Carbonate (CO_3)	mg/l	6	9.7	0.7		8.2-10.0
Alkalinity (as $CaCO_3$ eq)	mg/l	6	89	6.9		83-99
Calcium	mg/l	6	120	2.5		117-123
Chloride	mg/l	5	12.0	1.4	16.3	11-14
Magnesium	mg/l	6	23.2	3.7		19-30
Potassium	mg/l	6	8.1	0.5		7.3-8.7
Sodium	mg/l	6	307	14.8		290-332
Sulfate	mg/l	6	869	23.5		843-898
TDS	mg/l	5	1392	26.8		1360-1420
Minor Constituents						
Ammonia as N	mg/l	2	<0.2			-----
Nitrate as N	mg/l	2	<0.05			-----
Nitrite as N	mg/l	2	<0.05			-----
Aluminum	mg/l	2	<0.02			-----
Arsenic	mg/l	2	0.015			0.014-0.015
Barium	mg/l	2	0.12			0.10-0.14
Boron	mg/l	2	<0.1			-----
Cadmium	mg/l	2	<0.01			-----
Chromium	mg/l	2	0.08			0.05-0.10
Copper	mg/l	2	0.01			0.01-0.01
Fluoride	mg/l	4	0.10			0.10-0.11
Iron	mg/l	5	0.07			0.05-0.12
Lead	mg/l	2	0.11			0.11-0.11
Manganese	mg/l	2	0.04			0.03-0.04
Mercury	mg/l	2	<0.0001			-----
Molybdenum	mg/l	2	0.08			0.05-0.11
Nickel	mg/l	2	<0.05			-----
Selenium	mg/l	2	0.013			0.010-0.015
Vanadium	mg/l	6	0.06	0.029	0.131	0.05-0.12
Zinc	mg/l	2	0.03			0.02-0.04
Radiochemistry						
Uranium as U_3O_8	mg/l	6	0.048	0.025	0.109	0.012-0.070
Radium - 226	pci/l	3	117	4.7		112-121
Thorium - 230	pci/l	3	0.6	0.6		0.0-1.1

*UCL's given for excursion detection parameters only. UCL=1.1(2Std.Dev.+10%mean)

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36/E5

RENO CREEK
Pattern 2

Final Baseline
Well M-19

Field		n	Mean	Std. Dev.	UCL*	Range
pH		6	8.44	0.19	9.71	8.26-8.78
Conductivity	µmhos/cm	6	2063	79.3	2444	1987-2209
Major Constituents						
Bicarbonate (HCO_3)	mg/l	6	101	8.4	130	89-111
Carbonate (CO_3)	mg/l	6	5.4	1.0		5.0-7.5
Alkalinity (as $CaCO_3$eq)	mg/l	6	83	7.0		73-89
Calcium	mg/l	6	134	7.2		123-145
Chloride	mg/l	6	10.0	1.7	14.7	8-13
Magnesium	mg/l	5	23.8	2.3		20-26
Potassium	mg/l	6	8.1	0.9		6.7-9.4
Sodium	mg/l	6	312	11.3		297-327
Sulfate	mg/l	6	975	21.0		937-995
TDS	mg/l	6	1507	51.6		1420-1560
Minor Constituents						
Ammonia as N	mg/l	2	<0.2			-----
Nitrate as N	mg/l	2	<0.05			-----
Nitrite as N	mg/l	2	<0.05			-----
Aluminum	mg/l	2	<0.2			-----
Arsenic	mg/l	2	0.014			0.014-0.014
Barium	mg/l	2	0.16			0.10-0.22
Boron	mg/l	2	<0.1			-----
Cadmium	mg/l	2	0.01			-----
Chromium	mg/l	2	0.04			0.02-0.05
Copper	mg/l	2	0.01			0.01-0.01
Fluoride	mg/l	4	0.11			0.09-0.15
Iron	mg/l	4	0.06			0.05-0.07
Lead	mg/l	2	0.09			0.08-0.09
Manganese	mg/l	2	0.07			0.06-0.07
Mercury	mg/l	2	<0.0001			-----
Molybdenum	mg/l	2	0.05			-----
Nickel	mg/l	2	<0.05			-----
Selenium	mg/l	2	0.011			0.010-0.012
Vanadium	mg/l	6	0.06	0.018	0.11	0.05-0.09
Zinc	mg/l	2	0.06			0.02-0.09
Radiochemistry						
Uranium as U_3O_8	mg/l	6	0.058	0.032	0.135	0.023-0.109
Radium - 226	pci/l	3	112	6.7		106-119
Thorium - 230	pci/l	3	0.3	0.1		0.2-0.4

*UCL's given for excursion detection parameters only. UCL=1.1(2Std.Dev.+10%mean)

November 24, 1980

RENO CREEK
Pattern 2

Final Baseline
WELL USM-20**

Field		n	Mean	Std. Dev.	UCL*	Range
pH		2	11.70	0.21	13.33	11.55-11.85
Conductivity	µmhos/cm	2	2862	2013	4743	1438-4286
Major Constituents						
Bicarbonate (HCO_3)	mg/l	2	0	0	0	0
Carbonate (CO_3)	mg/l	2	339	15.6	407	328-350
Alkalinity (as $CaCO_3$ eq)	mg/l	2	565	25.4		547-583
Calcium	mg/l	2	97	26		78-115
Chloride	mg/l	2	163	77	348	108-217
Magnesium	mg/l	2	1.6	0.8		1.0-2.2
Potassium	mg/l	2	42.9	15.8		31.7-54.1
Sodium	mg/l	2	330	69		281-378
Sulfate	mg/l	2	390	86		329-450
TDS	mg/l	2	1225	375		960-1490
Minor Constituents						
Ammonia as N	mg/l	2	0.2			-----
Nitrate as N	mg/l	2	0.05			-----
Nitrite as N	mg/l	2	0.05			-----
Aluminum	mg/l	2	1.6			1.5-1.7
Arsenic	mg/l	2	0.014			0.012-0.016
Barium	mg/l	2	0.53			0.45-0.60
Boron	mg/l	2	0.1			-----
Cadmium	mg/l	2	0.01			-----
Chromium	mg/l	2	0.19			0.18-0.20
Copper	mg/l	2	0.03			0.03-0.03
Fluoride	mg/l	2	0.4			0.4-0.4
Iron	mg/l	2	0.38			0.36-0.40
Lead	mg/l	2	0.06			0.05-0.07
Manganese	mg/l	2	0.05			0.04-0.06
Mercury	mg/l	2	0.0001			-----
Molybdenum	mg/l	2	0.3			0.2-0.4
Nickel	mg/l	2	0.04			0.03-0.05
Selenium	mg/l	2	0.014			0.013-0.015
Vanadium	mg/l	3	0.12	0.08	0.31	0.06-0.21
Zinc	mg/l	2	0.02			0.03-0.05
Radiochemistry						
Uranium as U_3O_8	mg/l	3	0.045	0.030	0.114	0.021-0.078
Radium - 226	pci/l	2	15	7.1	32.1	10-20
Thorium - 230	pci/l	2	3	1.4	6.4	2-4

*UCL's given for excursion detection parameters only; UCL=1.1(2Std.Dev.+10%Mean)
**Well makes little or no water; contamination of samples from drilling fluid is apparent.

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RENO CREEK

Final Baseline

Well - LSM - 21**

Field		n	Mean	Std. Dev.	UCL*	Range
pH		4	11.79	0.24	13.50	11.45-12.00
Conductivity	µmhos/cm	4	2369	868	4517	1437-3250
Major Constituents						
Bicarbonate (HCO_3)	mg/l	3	0	0	0	0
Carbonate (CO_3)	mg/l	3	300	24	383	273-318
Alkalinity (as $CaCO_3$ eq)	mg/l	3	500			455-530
Calcium	mg/l	7	61			16-177
Chloride	mg/l	9	137	88	344	32-287
Magnesium	mg/l	3	3.7			1.2-7.6
Potassium	mg/l	7	24.8			16.8-34.0
Sodium	mg/l	4	266			226-326
Sulfate	mg/l	8	296			53-578
TDS	mg/l	6	1137			360-1720
Minor Constituents						
Ammonia as N	mg/l	2	0.40			0.39-0.41
Nitrate as N	mg/l	2	<0.05			-----
Nitrite as N	mg/l	2	<0.05			-----
Aluminum	mg/l	5	0.6			0.1-1.4
Arsenic	mg/l	2	0.014			0.006-0.022
Barium	mg/l	5	0.13			0.05-0.39
Boron	mg/l	2	<0.1			-----
Cadmium	mg/l	2	<0.01			-----
Chromium	mg/l	5	0.05			-----
Copper	mg/l	5	0.02			0.01-0.03
Fluoride	mg/l	2	0.5			0.4-0.6
Iron	mg/l	4	0.21			0.16-0.33
Lead	mg/l	5	0.11			0.05-0.30
Manganese	mg/l	6	0.03			0.01-0.08
Mercury	mg/l	2	<0.0001			-----
Molybdenum	mg/l	5	0.07			0.05-0.14
Nickel	mg/l	5	0.08			0.05-0.22
Selenium	mg/l	3	0.004			0.002-0.005
Vanadium	mg/l	5	0.07	0.04	0.15	0.05-0.13
Zinc	mg/l	4	0.03			0.01-0.06
Radiochemistry						
Uranium as U_3O_8	mg/l	5	0.017	0.032	0.090	0.001-0.075
Radium - 226	pci/l	4	9.8	1.9	15.0	7.0-11.1
Thorium - 230	pci/l	3	1.3	2.3	6.5	0.0-4.0

*UCL's given for excursion detection parameters only; UCL=1.1(2Std.Dev.+10%Mean)

**Well makes little or no water; contamination of samples from drilling fluid is apparent.

November 24, 1980

36/El

ADDENDUM 1-B
NRC PRE-SUBMISSION APPLICATION AUDIT MATRIX

NRC Comment		Comment Response	Comment Location
Technical Report			
TR Section 1.0	Discussion of ISR process needs to be site-specific, as opposed to generic.	The language in TR Section 1.7 has been revised to reflect site-specific ISR processes.	TR Section 1.7 begins on p. 1-6.
	Language on 11,000 gallons per minute (gpm) flow rate is vague. AUC needs to specifically state which flow rate is being requested in the license.	Section 1.8 specifies a maximum flow rate of 11,000 gpm.	TR Section 1.8 begins on p. 1-9.
	The Gantt chart presented in the application only addresses the first mine unit. Please provide a general sequence for all mine unit develop, understanding that such sequences are subject to change	TR Figure 1-3 (Gantt chart) now reflects the entire proposed life cycle of the Proposed Project.	TR figure 1-3 is located at the end of Section 1.
	AUC does not discuss the surety, decommissioning plan, or groundwater restoration	A brief summary of financial assurance, decommissioning and groundwater restoration is included in TR Section 1. More detailed discussions regarding each of these subjects can be found in TR Section 6 and TR addendum 6-A (Restoration Action Plan).	Financial assurance in Sec. 1.13 on p. 1-13; decommissioning in Sec. 1.13 on p. 1-13 and groundwater restoration in Sec. 1.11 on p. 1-12.
TR Section 2.0	Figure 2.1.3. The deep disposal well is shown outside of the proposed license area in Section 34.	TR figure 2.1-3 now reflects correct locations for each of the proposed deep disposal wells. TR figure 3-1 depicts the proposed location of the relocated DDW. A written explanation can be found in TR Section 4.3.6.2.2.	TR Figure 2.1-3 is located at the end of Section 2.1 while figure 3-1 is at the end of Section 3. TR Section 4.3.6.2.2 begins on p. 4-18.
	Section 2.2.1, page 2.2-3. AUC does not describe the extent of oil production. During the site tour, staff observed an oil rig drilling within or near the license area (see NUREG-1569 Section 2.6.3 (5)).	A brief summary listing other natural resources being recovered in the Proposed Project area is found in TR Section 2.2.1 with more detailed discussion in ER Section 3.1.8.	TR Section 2.2.1 begins on p. 2.2-1; ER Section 3.1.8 begins on p. 3.1-7.
	The application says no residences are in the proposed license area. Please ensure that the status of residences within the proposed license area remains consistent during the application review period and during operations. NRC staff must be notified of changes in the status of residences during both the application review and operational periods.	The following language is now in the document: "There currently is one residence (the Taffner homestead) located within the Proposed Project boundary. AUC will acquire the Taffner property prior to construction and it will not thereafter be used as a residence. The domestic water well located at the Taffner residence will be plugged in accordance with all WDEQ Rules and Regulations and will not be used for consumption once construction begins."	This language is found in several places in the document including TR Sec. 2.2 (p. 2.2-2) and ER Sec. 3.1.5 (p. 3.1-4).
	Site location and layout map should contain plant outline, pond locations and outline, ore body locations, wellfield locations, and general monitoring well ring locations.	Several figures including TR figures 2.1-3, 3-1 and 3-3 located at the end of their respective sections display each of these features.	TR Figures 2.1-3, 3-1 and 3-3.
	Restricted areas and fence lines should be identified on a site plan.	TR figure 3-1 depicts these features.	TR Figure 3-1 is located at the end of Section 3.
	AUC should provide a map locating nuclear facilities within 50 miles of the site	ER Figure 3.1-6 depicts these facilities.	ER Figure 3.1-6 is located at the end of Section 3.1.
TR Section 2.5	The Year Round Summary data for the regional met data did not appear to reflect the 12 month data. For example, one particular data set showed all the monthly data to be positive values. However, the Year Round Summary was a negative value.	The data in question in both TR Section 2.5 and ER Section 3.6 has been updated.	The tables reflecting these revisions are located in the back of both sections.
	The staff suggests that AUC include the calibration records of meteorological equipment to demonstrate that the quality of the data is adequate for the staff's review.	TR Addendum 2.5-A (The Meteorological System Audit Report with the applicable calibration records) is now included in the application.	TR Addendum 2.5-A is located at the end of Section 2.5..
TR Section 2.6	Figures 2.6a-1 through 2.6a-6. Cross sections are provided on a very large scale (e.g.A-A' is approximately 20,000 feet long and defined with 8 boreholes/wells). Some of the points used to define the cross sections are more than 1 mile apart. Please provide individual cross sections along the major axis of each of the six separate ore bodies using closely spaced well/borehole data that is available. Densely defined cross sections at the local scale of each ore body will enable the staff to analyze the continuity and thickness of aquifers and aquitards to facilitate the review (NUREG-1569 Section 2.6.3 (2)). These higher resolution cross sections should include water levels of the production zone aquifer (PZA), if possible.	Cross sections on a larger project scale are provided as Figures 2.6A-12 to 2.6A-16. Smaller scale cross sections that run through the major ore bodies are shown in plan view on Figure 2.6A-17 location map, and provided as Figures 2.6A-18 to 2.6A-23. These also include the potentiometric elevation surface of the production zone aquifer.	TR Addendum figures 2.6A-11 through 2.6A-23 include structural cross sections including the ore body areas and begin on p. 2.6A-16.
	Addendum 2.6b. Please provide isopachs or other appropriate graphics of underlying or overlying sandstones/aquifers. These would be helpful to demonstrate the continuity of these sandstones/aquifers.	Based on the available site hydrogeologic data, the Overlying Aquifer is not continuous across the Project (see TR Section 2.6.2.2.1 and 2.7.2.3). The overlying aquifer appears continuous on a local scale within the PZM well clusters, but the specific units present in each of the well clusters do not correlate with each other over the greater distances across Proposed Project. Therefore, it would be misleading and inappropriate to construct an isopach of a series of discontinuous sand intervals that compose the Overlying Aquifer .Based on the available site data, the Underlying Unit does not meet the characteristics of an aquifer (seee TR Section 2.7.2.3). The underlying unit is also a discontinuous unit across the project, and therefore not appropriate for the construction of an isopach for this unit. Cross-sections provided in Figures 2.6A-12 to 2.6A-16 and 2.6A-18 to 2.6A-23 help to illustrate the lack of continuity of the Overlying Aquifer and Underlying Unit across the Project.	TR Section 2.6.2.2.1 begins on p. 2.6-8 and Section 2.7.2.3 begins on p. 2.7-27. The Addendum figures noted begin on p. 2.6A-16.

NRC Comment		Comment Response	Comment Location
	Coal bed methane (CBM) and deep well injection zones are not indicated on any cross sections (NUREG-1569 section 2.6.3 (3)). Please provide one cross section showing these zones.	Figure 2.6A-4 is a type log in the area that shows the stratigraphic relationship of the PZA, the local CBM production zone in the Big George Coal, and proposed deep well injection targets.	TR Figure 2.6A-4 is located in Addendum 2.6-A on p. 2.6A-9.
	A borehole log or cross section showing location of Ft Union aquifers relative to production zone would help the NRC staff evaluate water supply resources relative to production zone aquifers (NUREG-1569, Section 2.6.3 (3)).	Figure 2.6A-4 also shows the stratigraphic location of the Fort Union aquifer (water supply for Wright), in relation to the PZA, local CBM production, and the proposed deep well injection zone.	TR Figure 2.6A-4 is located in Addendum 2.6-A on p. 2.6A-9.
TR Section 2.7	Please provide surface water reservoirs (Table 2.7a-10) and CBM impoundments within license area on surface water features map (Figure 2.7-3A) (NUREG-1569 Section 2.7.3(1)).	The map (TR figure 2.7A-7) depicting these items has been inserted into the document.	Figure 2.7A-7 in TR Addendum 2.7A.
	Please provide a description of CBM impoundment monitoring wells, if any, which may be required by the State of Wyoming.	A discussion describing the CBM groundwater studies and monitoring well network in the area begins in TR Section 2.7.2.6.	TR Section 2.7.2.6 begins on p. 2.7-61
	Please provide maps showing potential flooding around drainages or in/near planned wellfields/production units. These maps should include those for the 25-, 50-, and 100-year return interval (NUREG-1569 Section 2.7.3(2)).	The description of the flood inundation study begins in TR Section 2.7.1.5 and includes the table/figure references for this comment.	TR Section 2.7.1.5 begins on p. 2.7-9; Each of these flood inundation tables are found in TR Addendum 2.7-A; figures 2.7A-4 and 2.7A-5 are also found in TR Addendum 2.7-A.
	Please provide a discussion of erosion protection for wellfields/production unit infrastructure that may be located in any areas subject to flooding from a 25-, 50- or 100-year event (NUREG-1569 Section 2.7.3(2)).	Brief discussions of erosion control regarding flooding is in TR Sections 2.7.1.5.2 and 2.7.1.7.	TR Section 2.7.1.5.2 begins on p. 2.7-10 and 2.7.1.7 on p. 2.7-12.
	Figure 2.7a-6 would be enhanced if the WYPDES sample locations were shown relative to drainages and surface water sampling locations.	TR figure 2.7A-7 displays WYPDES locations.	Figure 2.7A-7 is located in TR Addendum 2.7-A.
	In Section 2.7.1.8, some surface water samples show wide swings in iron, manganese, conductivity, TDS, sodium, sulfate, alkalinity, chloride and other constituents between quarters. Please include an analysis to determine if these variations are a consequence of the impact from CBM produced water on surface water quality or some other source.	TR Section 2.7.1.9 analyzes surface water quality in the Proposed Project area including the impacts of CBM produced water in Section 2.7.1.9.2.	TR Section 2.7.1.9 begins on p. 2.7-12.
	Please add ground surface elevations, top of casing elevations, and UTM coordinates of all wells to Table 2.7.2-1 (NUREG-1569 Section 2.7.3(3)).	TR Tables 2.7B-1 and 2.7B-2 include this information.	Both tables are located in TR Addendum 2.7-B.
	Please confirm whether or not the shallow monitoring (SM) unit meets the definition of an aquifer in 10 CFR Part 40, Appendix A.	Discussion of the SM Unit and its definition is in TR Section 2.7.2.2.2.	The SM Unit discussion in TR Section 2.7.2.2.2 begins on p. 2.7-28.
	If the SM unit is not an aquifer, the overlying aquifer would be the surficial aquifer. Please provide the depth to water in the overlying aquifer across the license area. Depth to water would be helpful to evaluate if leaks at the surface or in wellfield trunklines/piping would contaminate the overlying aquifer.	Updated discussions of the overlying aquifer are found throughout TR Section 2.7 especially Section 2.7.2.3 and ER Section 3.4. More discussions can be found in the Groundwater Numerical Model Report in TR Addendum 2.7-C. TR Addendum 2.7-B includes Figure 2.7B-8 (Overlying Aquifer Water Level Elevations) and Table 2.7B-4 which lists depth to water in AUC's seven overlying aquifer monitor wells.	The Overlying Aquifer discussion in Section 2.7.2.3 begins on p. 2.7-28; the various tables and figures are found in TR Addendum 2.7-B.
	Please provide an evaluation of overlying aquifer interaction with any surface drainage	A detailed discussion of the Proposed Project's surface drainage is found in TR Section 2.7.1. Based on geologic and hydrologic data at the Project, the Overlying Aquifer is considered isolated from surficial drainages. A brief summary regarding the overlying aquifer is found in Section 2.7.2.3.	TR Section 2.7.1 begins on p. 2.7-2; the brief summary begins on p. 2.7-28.
	Please confirm whether or not the underlying aquifer (UA) meets the definition of an aquifer in 10 CFR Part 40, Appendix A.	The Underlying Unit does not meet the characteristics of an aquifer. A discussion of the underlying aquifer including definition begins in TR Section 2.7.2.3 and ER Section 3.4.2.3.	The Underlying Unit discussion in TR Section 2.7.2.3 begins on p. 2.7-31; ER Section 3.4.2.3 begins on p. 3.4-27
	Please provide a map showing measured level data at individual wells for the overlying and underlying aquifer (see NUREG-1569 2.7.3 (3)).	Figures 2.7B-8 and 2.7B-9 present maps of measured water level elevations for the Overlying Aquifer and the Underlying Unit, respectively. Due to the discontinuous nature of both of these stratigraphic units across the project, a potentiometric elevation contour map was not constructed.	TR addendum figures 2.7B-8 and 2.7B-9 are located on pages 2.7B-86 and 87.
	PZM-1 and PZM-3 pumping tests indicate large drawdown response at pumping wells PZM 1 and PZM 3. Please address whether these drawdowns may lead to dewatering of production wells at proposed operating rates.	The large drawdown responses observed in the pumping wells at the PZM1 and PZM3 pump tests are the result of relatively inefficient wells, as the drawdowns observed in the wellbores do not accurately represent water level conditions in the aquifer away from the well completion.	PZM1 pump test discussion begins in TR Section 2.7.2.7.1 on p. 2.7-43. PZM3 pump test discussion begins on p. 2.7-46.

NRC Comment		Comment Response	Comment Location
	Page 2.7-45. The UA aquifer test at 1.9 gallons per minute (gpm) for 27 minutes, indicated 104 feet (ft) of drawdown. Data in Table 2.7.2-29 are not at a time scale where the response curve can be evaluated. Please provide more of a description of the underlying aquifer.	Due to the very low well yield observed in most of the tests conducted in the overlying aquifer, water table unit, and the underlying unit, the drawdown observed during pumping in most of the wells is defined by casing storage, with little aquifer input. For these wells, the drawdown was of no use in analysis, and the recovery data was used for aquifer properties. A description of the underlying unit, which does not meet the characteristics of an aquifer is provided in TR Section 2.7.2.3. A detailed discussion can also be found in TR Addendum 2.7-D (Pumping Test Report).	The underlying unit discussion is found in TR Section 2.7.2.3 beginning on p. 2.7-31; Section 2.7.2.7 begins on p. 2.7-42.
	Global comment – the time scale of the pumping tests is not at a resolution to assess early, middle and late time response for specific effects.	Figures depicting early to middle time hydrographs of the two tests conducted in the partially saturated areas (PZM1 and PZM3) illustrate the earlier time response observed in these pumping wells. Detailed discussions and accompanying figures/tables regarding these pumping tests can be found in TR Section 2.7.2.7, and TR addenda 2.7-B (Groundwater Tables/Figures), 2.7-C (Groundwater Flow Model Report) and 2.7-D (Pumping Test Report.	TR Section 2.7.2.7 begins on p. 2.7-42, all addenda can be found at the end of TR Section 2.7.
	Please provide Stiff and Piper diagrams of pre-operational ground water quality.	Stiff and Piper diagram analysis is discussed in TR Section 2.7.2.8.2 with diagrams in Addendum 2.7-B.	The Stiff /Piper discussion is in TR Section 2.7.2.8.2 and begins on p. 2.7-66. Various Stiff and Piper diagrams are located in TR Addendum 2.7-B beginning with Figure 2.7B-60.
	Please check the SM water quality data to evaluate if this water is of the same quality as CBM-produced water.	A discussion describing ground water quality including the differences between the SM Unit and CBM samples begins in TR Section 2.7.2.8.2.	TR Section 2.7.2.8.2 begins on p. 2.7-66 and continues through p. 2.7-71.
	Please provide an inventory and completion description of oil/gas wells located within 3 miles of the license area similar to the groundwater and CBM wells shown in Figures 2.7.2-50 and 2.7.2-51.	TR Figure 2.6A-5 and ER Figure 3.1-5 display these wells; ER Tables 3.1-5 and 3.1-6 include additional information.	Figure 2.6A-5 is located in TR Addendum 2.6-A; ER Figure 3.1-5, and Tables 3.1-5 and 3.1-6 are at the end of ER Section 3.1
	Please provide discussions of all private wells in the proposed license area in the TR similar to discussion in Environmental Report (ER) Section 3.4.2.7 (e.g., number of wells, use, yield and aquifer completion). Please describe how these wells in the PZA and OA will be addressed during operations in the TR (like ER 4.4.2.1.). Will these private wells be plugged, recompleted in other zones, etc?	More detailed discussions regarding private wells are now included in both TR Section 2.7.2.7 and ER Section 3.4.2.7. Groundwater impact assessments are located in TR Sections 7.2.8.1 and 7.2.8.2, and ER Sections 4.4.2.1 and 4.4.2.2.	TR Section 2.7.2.7 begins on p. 2.7-62, TR Section 7.2.8.1 begins on p. 7-27, ER Section 3.4.2.7 begins on p. 3.4-63, and ER Section 4.4.2.1 begins on p. 4-20.
TR Section 2.9	There was no discussion regarding fish, livestock, or crop sampling. If no such sampling was performed, please provide a justification. Staff also suggests providing a more complete description of the vegetation types.	The sampling of vegetation and fish is discussed in TR Section 2.9.10 with further habitat discussion in TR Section 2.8. Vegetation is discussed in TR Section 2.8.4.1 and ER Section 3.5.4.1. ER Addenda 3.5-A through 3.5-G include vegetation discussions. As noted in Section TR 2.9.1, no crop farming activities occur within the project area.	TR Section 2.8.4.1 begins on p. 2.8-3; TR Section 2.9.10 begins on p. 2.9-16; ER Section 3.5.4.1 begins on p. 3.5-3; the ER Addenda are located at the end of ER Section 3.5.
	The staff suggests that AUC produce one map with all the environmental sampling points on the map. If possible superimpose a sector diagram on the map. This will allow the reviewer to see if sampling locations are in the proper sector. Also, please provide a table to include each sampling location, sector, and distance from the central processing plant or other designated centroid.	TR Figure 2.9-1 includes sampling locations and CPP location.	This figure is located at the end of TR Section 2.9.
	Section 2.9. Regulatory Guide 4.14 recommends quarterly water quality sampling for total uranium, radium 226, thorium 230, lead 210, and polonium 210 in all private wells that could be used for drinking water or livestock within 2 kilometers (km) of the license boundary. Tables 2.9-16 through 2.9-20 only show that 1 quarter of sampling performed for a limited number of private wells in fall 2010. Please conduct this quarterly sampling for all private wells within 2 km.	Four quarters of sampling have been conducted for the stock/domestic wells and results are reflected in upated groundwater tables in TR Addendum 2.7-B. Groundwater quality discussion begins in TR Section 2.7.2.8.2.	The updated tables begin with TR Addendum Table 2.7B-38 through 2.7B-40. TR Section 2.7.2.8.2 begins on p. 2.7-66.
	Please provide a table describing the private well completions and map (update 2.7.2-50?) of all private wells within 2 km of the license area that would be part of this quarterly sampling.	TR Figure 2.7B-58 includes locatons of all domestic/stock wells within 2 km of the proposed license area. Table 2.7B-18 includes all known non-CBM well completions within 2 km while Table 2.7B-37 includes just the Stock/Domestic Wells.	Figure 2.7B-58 (p. 136), Table 2.7B-18 (begins on p. 36) and Table 2.7B-37 (p. 70) are all located in TR Addendum 2.7-B.
	Please note that Figure 2.9-25 is missing.	The missing figure in question is now included in the document as TR Figure 2.9-20.	Figure 2.9-20 is located at the end of TR Section 2.9.
TR Section 3.0	Please provide a commitment to maintain an inward gradient in all production areas until restoration stability monitoring begins. Please provide a discussion of the concentration of dissolved oxygen of the lixiviant. What is the concentration to be injected in the production area in the partially saturated aquifer?	The inward gradient commitment is discussed in TR Section 3.1.5. A lixiviant discussion regarding DO and the partially saturated aquifer can be found in TR Section 3.1.4.1.	TR Section 3.1.5 begins on p. 3-15. Section 3.1.4.1 begins on p. 3-13.
	Please state if hydrogen peroxide will or will not be used in the lixiviant.	The discussion of the precipitation system and hydrogen peroxide begins in TR Section 3.2.1.3 A lixiviant discussion regarding hydrogen peroxide can be found in TR Section 3.1.4.1.	Section 3.2.1.3 begins on p. 3-28. Section 3.1.4.1 begins on p. 3-13.

NRC Comment		Comment Response	Comment Location
	Please provide a discussion of the anticipated operating head in the partially saturated portions of the production areas. Is this head sufficient to maintain the dissolved oxygen concentration in the lixiviant in solution at the injection wells?	A lixiviant discussion regarding DO and the partially saturated aquifer can be found in TR Section 3.1.4.1.	Section 3.1.4.1 begins on p. 3-13.
	Will injectivity be lost if oxygen comes out of solution in the injection wells in partially saturated portions of the production area? Please address how injectivity loss will be addressed if it occurs.	A lixiviant discussion regarding DO and the partially saturated aquifer can be found in TR Section 3.1.4.1.	Section 3.1.4.1 begins on p. 3-13
	Please provide a comprehensive analysis of waste disposal capacity. The application provides the predicted maximum waste disposal rate for the deep disposal wells during operation (115 gallons per minute (gpm)), operation/restoration (183 gpm) and restoration (104 gpm). However, the application does not state what the expected actual rates would be for each disposal well, which often differ from the permitted rates. Based on this expected rate, will four disposal wells meet and exceed this maximum waste disposal rate of 183 gpm? Is excess capacity available if any of the disposal wells goes out of operation (e.g. surge ponds)?	Expanded discussions on wastewater disposal capacity and backup pond(s) are found in TR Sections 3.1.8 and 4.3.	TR Section 3.1.8 begins on p. 3-22 while Section 4.3 begins on p. 4-7.
	Please provide an analysis to assess the maximum extraction (production well) rate that can be achieved in partially saturated production areas without dewatering.	The observed pumping well drawdown observed in the partially saturated pump test areas (PZM1 and PZM3) are misleading and are the result of relatively inefficient well completions in the pumping wells. The apparent steepness of the drawdown cone out to additional observation wells from these pump tests does not reflect actual aquifer conditions away from the completion zone in these pumping wells. Significant aquifer dewatering at the proposed design rates for the Project in the partially saturated areas (20 GPM) is not a concern for this Project. This question is addressed in TR Addendum 2.7-C (Groundwater Flow Model Report).	TR addendum 2.7-C is located at the end of TR Section 2.7.
	Please provide evidence that an excursion can be captured in the partially saturated production areas without dewatering or "chasing an excursion" with numerous extraction wells. The application presents cones of dewatering that are deep and tight based on pumping test results, which produce smaller capture radii than that of a confined, saturated aquifer.	This question is addressed in TR Addendum 2.7-C (Groundwater Flow Model Report).	TR addendum 2.7-C is located at the end of TR Section 2.7.
	Section 3.1.5. Please provide evidence that an inward gradient can be achieved and maintained in the partially saturated production areas. Will the proposed bleed of 0.5-1.5% also be sufficient in the partially saturated zones?	Based on the results of modeling provided in TR Addendum 2.7-C (Groundwater Model Report), an inward gradient can be maintained in the partially saturated areas. A horizontal flare determination was conducted on Production Unit 6 in the partially saturated area of the Project, and a 2 year simulation was conducted at proposed design rates. Groundwater flow particles placed at the production unit perimeter remain within hydraulic control of this production unit at a 1% modeled bleed. Additional discussion is found in TR Section 3.1.5.	TR addendum 2.7-C is located at the end of TR Section 2.7. TR Section 3.1.5 begins on p. 3-15.
	Please provide actual drawdown analysis and maps of anticipated drawdown within and outside the license area to determine the extent of the drawdown based on maximum consumptive use in the TR. Page 3-14 only states that the pumping tests indicate negligible drawdown outside the wellfield area.	Detailed discussions, analysis, model projections and accompanying figures/tables of pumping tests can be found in TR Section 2.7.2, and TR addenda 2.7-B (Groundwater Tables and Figures), 2.7-C (Groundwater Flow Model Report) and 2.7-D (Regional Hydrologic Test Report).	TR Section 2.7.2 begins on p. 2.7-17; the addenda can be found at the end of TR Section 2.7
	Please provide a commitment to determine if any new private well completions are added within 2 km of the license area during the application review and license periods. Please also provide a commitment to evaluate the impact of ISR operation on any new well completions or if any new well will impact hydraulic control of ISR production areas.	TR Section 7.2.8.2 and ER Section 4.4.2.2 include these discussions.	TR Section 7.2.8.2 begins on p. 7-27 and ER Section 4.4.2.2 begins on p. 4-21.
	AUC should specify the flow rate being requested in the license application	A water balance discussion including flow rates can be found in TR Section 3.1.7.	Section 3.1.7 begins on p. 3-19.
	Discussions of roll fronts are too generic; these should be more site-specific.	TR Section 2.6.2.6 discusses roll fronts accompanied by Figure 2.6A-27 which is site specific.	TR Section 2.6.2.6 begins on p. 2.6-15 while Figure 2.6A-27 is located at the end of TR Addendum 2.6A.
	Discussion of well construction methods is confusing. It appears that either there is no Method 1, or Method 1 is incorrectly labeled.	Four well completion methods and accompanying Figure 3-2 are discussed in TR Section 3.1.3.	TR Section 3.1.3 begins on p. 3-4.
	Model results regarding offsite water quantity/quality impacts should be provided.	This discussion can be found in TR Addendum 2.7-C (Groundwater Flow Model). A groundwater impact discussion can also be found in ER Section 4.4.2	TR Addendum 2.7-C is located at the end of TR Section 2.7; ER Section 4.4.2 begins on p. 4-19.
	Model justifications should also be provided regarding flare, ability to recover excursions, and ability to detect excursions.	Horizontal flare demonstrate and demonstration of excursion recovery is discussed in TR Addendum 2.7-C (Groundwater Flow Model).	TR Addendum 2.7-C is located at the end of TR Section 2.7.
	It appears that some confusion exists regarding which stream will be treated by operational RO. Will it be the bleed or a portion of barren lixiviant?	Water balance is discussed in detail in TR Section 3.1.7.	Section 3.1.7 begins on p. 3-19.

NRC Comment		Comment Response	Comment Location
	Please provide more detail on tank secondary containment and the volume of tanks vs.volume of containment. Also, please discuss the fate of spilled liquids or method ofrecovery.	CPP liquid containment discussions are found in TR Section 3.2.3.2. More discussions regarding spills and containment can be found in ER Sections 6.4.1.3 and 6.10.2.	TR Section 3.2.3.2 begins on p. 3-39. ER Section 6.4.1.3 begins on p. 6-23 and Section 6.10.1 begins on p. 6-42.
	Please provide a diagram showing the manner in which pressure and flow meters are monitored by AUC staff. Do these meters connect to computers at the main plant?	TR Section 3.4 provides discussion of instrumentation and control while Figure 3-9 is a flow diagram.	Section 3.4 begins on p. 3-40 while Figure 3-9 can be found at the end of the section.
	Please provide descriptions of dryer monitoring equipment and a statement that hourly measurements of system performance will be made per Criterion 8.	A discussion of yellowcake drying systems including hourly checks begins in TR Section 3.4.3.	TR Section 3.4.3 begins on p. 3-41.
	Please provide waste volume estimates.	Byproduct volume discussions are found in TR Section 3.4.5 and in ER Section 4.13.	TR Section 3.4.5 begins on p. 3-42; ER Section 4.13 begins on p. 4-80.
	Please provide a map of all wellfields with monitoring wells in the ring and overlying/underlying aquifers.	TR Figure 2.1-3 displays the proposed infrastructure with monitor well rings; Isopach Figures 2.6A-24, 25 and 26 display the aquifers.	TR Figure 2.1-3 is located at the end of Section 2.1; Isopach Figures 2.6A-24, 25 and 26 can be found in TR Addendum 2.6A (p. 29-31)..
	The restricted area boundary needs to be delineated, approximate locations of air samplers and radon detectors should be provided. Include a statement that locations are subject to change based on operational needs.	TR Figure 3-1 displays some of these features; TR Section 5.7.3 discusses air sampling, radon detection and possible monitor location changes; initial monitor locations are found on TR Figure 5-2.	TR Figure 3-1 can be found at the end of Section 3; TR Section 5.7.3 begins on p. 5-31 with Figure 5-2 located at the end of the section.
	Please provide information regarding backup systems. What happens when either important components fail or in the event of sustained power outages? The staff is particularly concerned with dryer filtration systems and automatic shutoff valves.	TR Sections 3.2.1.4 and 3.2.1.7 discuss these concerns.	TR Section 3.2.1.4 begins on p. 3-29; 3.2.1.7 is located on p. 3-33.
TR Section 4.0	Please substantiate the claim that 99% of radon will be recycled.	The language in Section 4.1 has been expanded to clarify these concerns.	This section begins on p. 4-1.
	Please substantiate the claim that the vacuum dryer system is zero emissions.Manufacturer's information could be used for this purpose. Also provide more specificson the dryer monitoring systems and the manner in which emissions removal efficiencycan be confirmed.	TR Section 4.2.1 discusses air particulate effluents.	TR Section 4.2.1 begins on page 4-3.
	Please provide AUC's strategy for addressing 10 CFR 40.65 reporting requirements. If modeling or calculations are to be used then provide more specifics on input data.	This discussion can be found in TR Section 4.2.2	TR Section 4.2.2 begins on page 4-5.
	Surge ponds. Please confirm the purpose of these ponds because the ER and TR state different functions. Also provide slope stability analyses, embankment designs, and locations of monitoring wells around the ponds.	Detailed discussions regarding the backup storage pond system can be found in TR Sections 3.1.8 and 4.3.5, and ER Section 6.4.2.2.7.	TR Section 3.1.8 begins on p. 3-22; 4.3.5 begins on p. 4-11; ER Section 6.4.2.2.7 begins on p. 6-31..
	Please provide a 10 CFR 20.2002 analysis for disposal wells.	Expanded discussions on DDWs are found in TR Sections 3.1.8 and 4.3.6.2.	TR section 3.1.8 begins on p. 3-22; 4.3.6.2 begins on p. 4-16.
TR Section 5.0	The QA manager should be included in Figure 5-1 along with a brief discussion of this person's duties and responsibilities.	The figure in question has been updated. The discussion can be found in TR Section 5.1.4.	TR Section 5.1.4 is on p. 5-3; Figure 5-1 is on p. 5-69.
	Figure 5.7-5 was referenced in the technical report, but no Figure 5.7-5 was found in the report.	The correct figure is Figure 5-2.	TR Figure 5-2 can be found at the end of TR Section 5.
	Please provide one table that includes all of the radiation detectors. The table should also include the a priori lower limit of detection. The equation for the lower limit of detection can be found in RG 8.30. Other information should include model number, type of detector (GM, NaI, etc), and range.	Table 5-1 lists these detectors.	TR Table 5-1 can be found on p. 5-65.
	Please demonstrate the manner in which AUC will determine radon daughter concentrations.	This discussion can be found in TR Sections 5.7.3.2.	TR Section 5.7.3.2 begins on p. 5-35.
	Please provide more details regarding the respiratory protection program, particularly how AUC will use the respirators and if sanitation will be available	A brief summary of this subject is found in TR Section 5.7.3.3	TR Section 5.7.3.3 is on p. 5-36.
	Please identify the restricted and control areas at the proposed Reno Creek facility.	A discussion on restricted and controlled areas is found in TR Section 5.6 Security fencing can be viewed on TR Figure 3-1.	TR Section 5.6 begins on p. 5-20 TR Figure 3-1 can be found at the end of TR Section 3.
	Section 5.7.7 for radon requires some clarification. This section appears to contain information more appropriate for particulate uranium.	TR Section 5.7.7 discusses radon with references to TR Section 2.9 for additional details.	TR Section 5.7.7 begins on p. 5-50.

NRC Comment		Comment Response	Comment Location
	The applicant should review Section 5.7.7 and compare statements from Section 5.7.7 with those in Section 2.9. There appears to be some discrepancies between the two sections and these two sections should be consistent. For example, Section 5.7.7 discusses fish sampling, but fish sampling was not discussed in Section 2.9. If the applicant is making a decision to not sample for fish during the preoperation phase, this should be stated and explained. The applicant should not be silent on a particular sampling medium for the pre-operation phase and then discuss the same sampling medium in the operation phase.	TR Section 2.9.10.4 clarifies and references this concern.	TR Section 2.9.10.4 can be found on p. 2.9-16.
	Section 5.7.7 regarding fish sampling references a Section 2.8.5.5. No Section 2.8.5.5 was found in the report.	The previous incorrect reference has been changed to the correct reference of TR Section 2.8.4.2.6.	
	It is not clear if the applicant plans to sample surface water.	TR Section 5.7.8 clarifies this concern.	TR Section 5.7.8 begins on p. 5-53.
TR Section 5.7.8	Section 5.7.8.1.2. Please commit to sample ore zone baseline ground water quality at wells four times and at least 2 weeks apart for all constituents of concern to establish baseline water quality. Typically, if a constituent is non-detect (ND) in the first two samples, it is not necessary for it to be measured in the 3rd and 4th sampling events.	TR Section 5.7.8.1.2 now includes this commitment.	TR Section 5.7.8.1.2 begins on p. 5-53.
	Section 5.7.8.1.3. Please commit that all overlying, underlying aquifer and perimeter ring monitoring wells will be sampled four times at least 2 weeks apart for all constituents to establish baseline water quality for these wells in case they require restoration. As stated above, if a constituent is ND in the first two samples, it is not necessary for it to be evaluated in the 3rd and 4th samples.	TR Section 5.7.8.1.3 now includes this commitment.	TR Section 5.7.8.1.3 begins on p. 5-54.
	Please provide an approach to distinguish a monitoring well (MW) excursion or surface water impact that may result from coal bed methane produced water from an excursion caused by ISR licensed activities.	A comparison and analysis of CBM disharge water with lixiviant is discussed in TR Section 2.7.2.8.2	TR Section 2.7.2.8.2 begins on p. 2.7-66; the CBM discussion begins on p. 2.7-70.
TR Section 6.1	Section 6.1.3. Please provide a commitment to conduct excursion monitoring until a production unit/wellfield restoration is approved. Applicant can propose a different excursion sampling frequency after restoration stability monitoring is completed.	This commitment is now included in the last paragraph of TR Section 6.1.3.	TR Section 6.1.3 begins on p. 6-4.
	Section 6.1.4.4. Please ensure that NRC restoration standards have been achieved when the applicant requests the start of stability monitoring, from the State of Wyoming. Applicant should also note that NRC regulations require that groundwater concentrations must be ALARA if the applicant did not achieve NRC-approved background or drinking water standards, as required by 10 CFR Part 40 Appendix A Criterion 5B(6).	TR Section 6.1.5 now addresses this concern.	TR Section 6.1.5 can be found on p. 6-9.
	Please provide a discussion of how pore volume or flare is to be determined in the saturated or partially saturated portions of the license area.	At least two discussions can be found regarding pore volumes in the TR: one is in Section 3.1.9 and another in Section 6.1.5.1.	TR Section 3.1.9 begins on p. 3-23; Section 6.1.5.1 begins on p. 6-11.
	Please provide a discussion of how restoration will be modified to ensure sweep of all portions of the partially saturated aquifer which have been exposed to lixiviant (e.g. flipping production/injection wells).	TR Section 6.1.4 discusses this comment.	TR Section 6.1.4 begins on p. 6-5.
	Need to discuss the manner in which spills will be documented and that spill records will be maintained whether or not reporting is required by regulation.	TR Section 5.2.6 addresses this comment.	TR Section 5.2.6 begins on p. 5-12.
	No decommissioning cost estimate provided.	Decommissioning cost estimates can be found in TR Addendum 6-A, the Restoration Action Plan (RAP).	TR Addendum 6-A is located at the end of Section 6.
TR Sections 6.3 & 6.4	Is the residential farmer scenario applicable? If so, why? Why only the external and plant ingestion pathways? What about the other pathways?	TR Sections 6.4.1.2 and 6.4.1.3, and TR Addendum 6-B (RESRAD) discuss and depict this scenario.	TR Section 6.4.1.2 begins on p. 6-26; Addendum 6-B is located at the end of Section 6.
	AUC references RESRAD calculations in Appendix C. However, the staff did not find an Appendix C during the review.	TR Addendum 6-B (RESRAD) is now in the document.	TR Addendum 6-B is located at the end of Section 6.
	Section 6.4.4.1. Please provide a commitment to continue stability monitoring until four consecutive quarters show no statistically significant increasing trends in the constituents of concern.	This commitment is now included in TR Section 6.1.3 with further discussion in Section 6.1.5.	TR Section 6.1.3 begins on p. 6-4; Section 6.1.5 begins on p. 6-9.

NRC Comment		Comment Response	Comment Location
		Environmental Report	
General Observations	NRC will use the Environmental Report (ER) as a starting point for preparing its environmental review. Figures in the SEIS will be published in black and white. The figures in the ER are in color. Consider making certain figures available in black and white to support the NRC review.	Upon request, AUC will provide to the NRC any black and white figures essential to the development of the SEIS.	
	Provide a copy of the UIC permit application, if available.	A copy of this application is now in the document.	TR Addendum 4B includes the UIC permit application.
	Provide any feasibility studies conducted to support the determination to use Class I disposal wells for management of liquid effluent.	A discussion regarding this comment can be found in ER Section 2.1.7 and accompanying Table 2-1.	ER Section 2.1.7 begins on p. 2-8; Table 2-1 can be found at the end of the same section.
Key Observations	Consider providing a stand-alone chapter on the analysis of cumulative impacts. The analysis of cumulative impacts needs to consider past, present, and reasonably foreseeable future activities. Previous cumulative impacts analyses considered future activities out to about 20 years (license term and one renewal). The analysis needs to be conducted on a resource by resource area (e.g. air, water, etc.) and the geographic area to consider will vary by resource.	The Cumulative Impacts section is now a stand-alone section in the ER as Section 5.	
	Consider providing a site-specific analysis of air quality impacts. The existing discussion tiers from the GEIS. The GEIS noted that the primary nonradiological emissions from in-situ recovery facilities include diesel combustion emissions from construction equipment (including drilling rigs) and fugitive dust emissions from vehicle travel on unpaved road. A site-specific analysis of fugitive dust emissions, well drilling emissions, construction equipment emissions, and reclamation equipment emissions should be conducted.	The site-specific analysis of air quality impacts can be found in ER Section 4.6 with accompanying figures and tables. Related discussions can be found in TR Sections 7.1.5, 7.2.5, 7.3.4.	ER Section 4.6 begins on page 4-39; TR Section 7.1.5 begins on p. 7-7.
	Consider environmental justice in the ER. Executive Order 12898 requires Federal agencies to consider environmental justice in their NEPA reviews and NRC conducts such an analysis if an environmental impact statement is being prepared. To conduct such an analysis, the applicant needs to understand the distribution of minority and low income populations within the area to assess whether there would be a disproportionately high and adverse impact to these populations.	A discussion regarding Environmental Justice can be found in ER Section 3.10.4	ER Section 3.10.4 begins on page 3.10-9.
	Consider the initiation of Traditional Cultural Property (TCP) surveys.	A discussion regarding TCPs can be found in ER Section 3.8.4.	ER Section 3.8.4 begins on page 3.8-7.
Other Observations	Please provide a schedule that shows the development of individual wellfields or production areas over time. To assess the environmental impact, NRC staff needs to understand the footprint of the activities that will occur since this will drive the impact analyses.	The discussion in ER Section 1.3 and accompanying figure 1-6 (Gantt Chart) addresses this comment.	ER Section 1.3 begins on p. 1-15; ER Figure 1-6 can be found at the end of ER Section 1.
	Please provide a map that shows the detailed infrastructure (i.e., headerhouses, access roads, overhead lines, wellfields, central processing plant, storage areas etc.) and a table that summarizes the area(s) potentially disturbed (e.g., how many miles of new access road would be constructed and where would it be located?)	ER Figure 1-5 addresses this comment along with ER Table 1-3.	Both the figure and table can be found at the end of ER Section 1.
	How and where will chemicals be stored? How much will be stored at any given time?	ER Section 1.4.8, and TR Section 3.2.2 with accompanying Table 3-2 address this comment.	ER Section 1.4.8 begins on page 1-21; TR Section 3.2.2 begins on page 3-33; Table 3-2 is located at the end of TR Section 3.
	Please clarify the use of the surge ponds (i.e., will they also be used for evaporation?) and ensure their location is shown on a map.	Detailed discussions regarding the backup storage pond system can be found in TR Sections 3.1.8 and 4.3.5, and ER Section 6.4.2.2.7.	TR Section 3.1.8 begins on p. 3-22; 4.3.5 begins on p. 4-11; ER Section 6.4.2.2.7 begins on p. 6-31..
	AUC discusses the potential use of wastewater tanks. Please show the proposed location and size of these tanks.	ER Figure 1-8 displays these tanks with additional information in TR Table 3-2. The water balance discussion in TR Section 3.1.7 briefly refers to these tanks.	The figure is located at the end of ER Section 1 while table can be found at the end of TR Section 3; TR Section 3.1.7 begins on p. 3-19.
	The ER describes various facilities that could be used for disposal of anticipated byproduct material and other waste types. If the anticipated location is known, please provide it. Otherwise, NRC staff will select the most conservative location (e.g., the farthest away) to estimate impacts.	This comment is addressed in ER Section 3.2.2 with accompanying Figure 3.2-3 and Table 3.2-7.	ER Section 3.2.2 begins on page 3.2-2; both the figure and table are located at the end of ER Section 3.2.

NRC Comment		Comment Response	Comment Location
	Table 2-2 is a comparison of alternatives considered, but eliminated from detailed analysis. Quantify the impacts to the extent practicable based on site-specific information.	AUC believes the existing tables and impact discussons located throughtout the TR and ER answer this concern.	Alternatives discussions are located in TR Section 8 and ER Section 2. Various impact discussions are found in TR Section 7, and ER Sections 4 and 5.
	The site encompasses part of the Thunder Basin National Grassland. Please ensure that AUC, LLC understands the implications of undertaking activities in such a designated area.	ER Table 3.1-4 includes the following statement: Although the Thunder Basin National Grassland exists within the Proposed Project area, all lands encompassed by the Grassland are Private. Therefore, none of the mentioned activities are allowed within, nor near, the Proposed Project area.	ER Table 3.1-4 can be found at the end of ER Section 3.1.
	Please ensure the transportation analysis also considers the volume and frequency of chemical supply shipments.	Chemical shipments are considered in ER Section 3.2.2.	ER Section 3.2.2 begins on page 3.2-2.
	Please provide the official wetlands determination from the U.S. Army Corps of Engineers (USACE) once it is received.	ER Section 3.5.4.2.4 discusses wetlands determination; ER Addendum 3.5-G includes USACE letter.	ER Section 3.5.4.2.4 begins on page 3.5-13
Editorial Observations	This SEIS tiers from the GEIS. Please ensure the correct geographic region from the GEIS is referenced (Wyoming East Uranium Milling Region).		
	Please clarify whether the Belle Fourche River is classified as perennial.	ER Section 3.5.4.2.3 notes the Belle Fourche River is classified as an ephemeral channel.	ER Section 3.5.4.2.3 begins on page 3.5-13.
	Please confirm the location of the nearest resident and make sure that it is consistent throughout the document.	This comment is addressed by a similar comment in TR Section 2 regarding nearest resident. Language throughout the TR and ER has been changed accordingly.	ER Section 3.1.5 begins on p. 3.1-4.
	Please ensure that byproduct material is referenced correctly.	This comment has been addressed extensively throughout the TR and ER. Examples are TR Section 4.3 and ER Section 3.12.	TR Section 4.3- begins on p. 4-7 while ER Section 3.12 is a stand-alone section.
	Please clarify whether two or four deep disposal wells are proposed for management of liquid effluent.	TR Section 1 confirms the Proposed Project will consist of up to four DDWs.	TR Section 1- begins on page 1-1.