Mobil Alternative Energy Inc.

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March 19, 1984

Mr. Samuel N. Simpson
Project Manager
Uranium Licensing Section
Radiation Protection Bureau
Environmental Improvement Division
P. O. Box 968
Santa Fe, New Mexico 87503

RESTORATION PROGRESS REPORT
CROWNPOINT SECTION 9
PILOT IN SITU LEACH TEST

Dear Mr. Simpson:

The purpose of this letter is to provide the New Mexico Environmental Improvement Division and the Bureau of Land Management with an update on Mobil's restoration efforts at the Crownpoint Section 9 Pilot In Situ Leach Test Site.

Restoration Activities

Restoration is currently being accomplished by a "clean water recycle" technique. This consists of withdrawing water from the leach pattern (presently wells 219 and 220 are producers) and processing it through a reverse osmosis (RO) unit. The clean water (RO permeate) produced is then injected back into the leach pattern (via well 218) and into a well on the edge of the leach pattern (well 9u80). The brine stream (RO reject) is routed to the third evaporation pond for disposal. Pumping from the leach pattern is now continuing at approximately 30 GPM, with 25 GPM being treated and reinjected in wells 9u80 and 218 and 5 GPM routed to the evaporation pond.

Samples of the production stream from the wellfield have been taken and analyzed on a regular basis to monitor the changes in chemical concentrations. While significant reductions in chemical concentration levels have been achieved thus far with respect to most parameters, molybdenum concentrations are not changing significantly in the leach pattern. A brief description of the methods employed in our attempt to accomplish a reduction in molybdenum concentrations since our last restoration report of November 5, 1982 is given below.

Sodium sulfide test - In early November 1982, Mobil received permission from the NMEID and MMS to add a reducing agent (sodium sulfide or sodium erythorbate) to the water being circulated to the leach pattern in order to scavenge or eliminate the dissolved oxygen introduced into the water due to contact with

15 pp

the atmosphere in the surface process plant. The addition of the reducing agent was to enable the redox potential to return to pre-leach levels, and reduce the concentrations of dissolved molybdenum. Mobil started adding sodium sulfide to their injection solution on November 8, 1982. Initial testing was conducted using two inverted five-spots consisting of wells 215, 219 and 220 as producers and 217 as an injector, and wells 208, 209 and 213 as producers and 211 as an injector. On February 24, 1983, the test pattern configuration was changed with wells 208, 211, 214, 217 and 220 being used as injectors and wells 209, 213, 215, and 219 being used as producers. Sodium sulfide injection was terminated on April 15, 1983 after approximately 9 million gallons of fluid were circulated through the wellfield.

Parameter concentrations prior to test: (November 1982)

Mo: 11 mg/l, SO_4: 43 mg/l, Na: 250 mg/l, Cl: 360 mg/l, Eh: - 100 MV

(Wells 208, 209, 213, 215, 219, 220)

Parameter concentrations after test: (April 19, 1983)

Mo: 13.25 mg/l, SO_4: 46.5 mg/l, Na: 290 mg/l, Cl: 372.5 mg/l, Eh: - 450 MV

(Wells 209, 213, 215, 219)

A more complete analytical report is enclosed for the April 19, 1983 sampling where twenty-six parameters were analyzed in four individual wells. Post test values shown above for Mo, SO_4 and Cl are average values from this 4/19/83 sampling, while the routine process stream sampling done that week was the source of the Na and Eh values.

"Sit and Soak" - After reductant injection was ceased, the wellfield was allowed to "sit and soak", with just a minimum (one GPM) bleed for approximately three months. At the beginning and the end of this "sit and soak" period the one GPM bleed was sampled. The bleed water was routed to the evaporation ponds for disposal.

Parameters at the beginning of "sit and soak" period: (week of April 25, 1983)

MO: 15.2 mg/l, SO_4: 68 mg/l, Na: 266 mg/l, Cl: 324 mg/l

(Wells 209, 213, 215, 219)

Parameters at the end of "sit and soak" period: (week of July 11, 1983)

MO: 15.1 mg/l, SO_4: 68 mg/l, Na: 263 mg/l, Cl: 327 mg/l

(Wells 209, 213, 215, 219, 220)

"Pore Volume Sweep" - Following the "sit and soak" period a one pore volume (approximately one million gallons) ground water sweep was conducted. This sweep began on July 14, 1983 and was completed on August 3, 1983. The sweep water was routed to the evaporation ponds for disposal.

Parameters at the beginning of "pore volume sweep": (week of July 11, 1983)

Mo: 15.1 mg/l, SO_4: 68 mg/l, Na: 263 mg/l, Cl: 327 mg/l

(Wells 209, 213, 215, 219, 220)

Parameters at end of "pore volume sweep": (week of August 1, 1983)

Mo: 12.7 mg/l, SO_4: 63 mg/l, Na: 260 mg/l, Cl: 323 mg/l

(Wells 209, 213, 215, 219, 220)

Minimum Bleed - Following the one pore volume sweep conducted in July and August 1983, only a minimum bleed (one GPM) was maintained on the wellfield using wells 217, 208, 209, 213, 219, and 220. This was because our amended water appropriation application (submitted March 1983) had not been acted on by the State Engineer. This bleed began on August 10, 1983. Well 217 was pumped continuously and the other wells were alternated daily. The one GPM bleed was routed to the evaporation ponds for disposal.

Parameters after initiating minimum bleed: (August 10, 1983)

Mo: 11.5 mg/l, SO_4: 69 mg/l, Na: 247 mg/l, Cl: 298 mg/l

(Wells 217, 208, 209, 213, 219, 220)

Increased Bleed - After receiving our water appropriation at the end of October 1983, flow was increased to 40 GPM on November 9, 1983. Wells 209, 213, 214, 215, 219 were used for producers. No injection was initiated, therefore just a ground water sweep was conducted. The sweep water was routed to the evaporation ponds for disposal.

Parameters after increasing bleed to 40 GPM: (November 9, 1983)

Mo: 14.3 mg/l, SO_4: 66 mg/l, Na: 205 mg/l, Cl: 206 mg/l

(Wells 209, 213, 214, 215, 219)

Decreased Bleed - On December 16, 1983 flow was decreased from 40 GPM to 20 GPM. Wells 209, 213, 215, and 219 were used as producers. The bleed water was routed to the evaporation ponds for disposal. The decrease in bleed was necessary since the evaporation ponds were almost full.

Parameters after decreasing bleed to 20 GPM: (December 16, 1983)

Mo: 15.9 mg/l, SO_4: 71 mg/l, Na: 188 mg/l, Cl: 156 mg/l

(Wells 209, 213, 215, 219)

"Clean Water Recyle"/Reverse Osmosis - All flow was temporarily stopped on January 13, 1984 and a reverse osmosis unit was brought on line on January 18, 1984. At that time approximately 34 GPM were being pumped from the leach pattern (wells 215, 219, 220) with 25 GPM (RO permeate) being injected into wells 214 and 217. The RO reject (approximately 9 GPM) was routed to the third evaporation pond for disposal.

Parameters after initiating "clean water recycle": (January 31, 1984)

Mo: 18.0 mg/l, SO_4: 65 mg/l, Na: 167 mg/l, Cl: 131 mg/l

(Wells 215, 219, 220)

On February 17, 1984 the production/injection configuration was changed to utilize wells 215, 219, 220 as producers and wells 218 and 9u80 as injectors. Flow rate from the three producing wells is approximately 30 GPM with 25 GPM being treated (RO) and reinjected and 5 GPM going to the evaporation pond for disposal.

Parameters after last pattern configuration change: (February 17, 1984)

Mo: 17.1 mg/l, SO_4: 69 mg/l, Na: 181 mg/l, Cl: 101 mg/l

(Wells 215, 219, 220)

Sample Analyses/Results to Date

Field assays of the production stream corresponding to cumulative gallons produced since October 1, 1980, are shown in Attachment 1. Attachments 2, 3 and 4 are graphical presentations of molybdenum and the majority of the tabular data in Attachment 1. All six parameters have shown very significant drops in concentration since the beginning of restoration efforts and several parameters continue to decrease in concentration as restoration proceeds. The continuation of pumping after the sodium sulfide test was concluded has returned affected ions such as sulfates, sodium, and chlorides to their low pre-test values as anticipated. Reduction in parameter concentrations range from a high of 99.9 percent for uranium to 82 percent for bicarbonate (see Attachment 1).

With respect to trace metals and other minor constituents, the April 1983 analytical data (see Attachments 5 and 6) show the concentrations in the production stream (Wells 209, 213, 215, and 219) for all parameters except molybdenum, arsenic, and selenium are below the New Mexico Standards (Section

3-103 NMWQCC Regulations). Of these three parameters, the average arsenic and selenium values are just slightly above the Standard set in Section 3-103, and selenium exceeds the 3-103 Standard in just one of the wells sampled. Molybdenum, which was approximately 80 mg/l at the start of the restoration effort, has been reduced approximately 84 percent, based on the April 1983 sampling.

No radiometric data other than uranium concentrations (see Attachment 6) was secured at the time of the April 1983 sampling The activity levels for these parameters have shown significant decreases since the beginning of restoration as shown by the last restoration report. The combined radium 226 and 228 was at a level of 27.6 ± 2 pci/l, which is below Section 3-103 NMWQCC Standards, and well within the naturally occurring range (0.0 ± 2.7 to 89.4 pci/l) observed during baseline water quality sampling at the Section 9 Pilot Site location. Percent reductions in radiometric activity levels was shown in Attachment 7 to the November 5, 1982 restoration report, and have not been updated as yet.

In summary, the data available at this time demonstrate that twenty-four out of twenty-seven pertinent parameters listed in Section 3-103 of the NMWQCC Regulations are already less than levels specified in the Regulations. Of these three parameters in excess of Section 3-103 Standards, two (arsenic and selenium) are only slightly above the standard, and are expected to be below the standard when the next total (all wells) leach pattern sampling program is conducted in the second quarter of 1984. With respect to molybdenum we are not optimistic. The molybdenum concentrations from the wellfield for the past 15 months bounce up and down. Most of these changes relate to different wells or combination of wells being sampled as different restoration technologies employing different configurations of production and injection wells have been employed. It is also obvious that little, if any, success has been achieved this past year in reducing molybdenum concentrations in the leach pattern despite our efforts. We feel we have been diligent and innovative in trying to reduce molybdenum concentrations, but have had little results lately to show for it.

Individual Well Variations

As stated in our last report, there are some differences in the parameter concentrations in different wells and this can be seen most markedly with respect to molybdenum concentrations. We still do not believe that there are any problems with individual wells that would prevent successful restoration. The elevated level of molybdenum in several wells is related to both the amount of molybdenum naturally occurring in the formation at that particular location and the degree of sweep efficiency at that location during restoration efforts. By varying the function (injection or production) and flow rates of the wells with time the wells with higher concentrations should slowly come down to levels more consistent with the wellfield average.

U.S.G.S. Observation Well No. 9u-277

In our last restoration report, we reported that an increase in molybdenum did, in fact, occur in Well 9u-277 over the period from March 1981 to October 1981, and that the levels have remained higher than pre-March 1981 levels since the increase was observed. At the last sampling, on January 11, 1984, Well 9u-277 still had elevated levels of molybdenum (7.2 mg/l compared to 11 mg/l on July 14, 1982) but the concentration is slowly decreasing. Well 9u-278 has not been affected (1/11/84 results were 0.02 mg/l Mo). The present pumping program should continue to draw fluids from the area of 9u-277 back into the leach field proper, thus effecting additional clean-up of Well 9u-277.

Future Restoration Plans

It is Mobil's intention to continue the "clean water recycle" program currently underway until the end of the third quarter 1984. A complete ground water sampling program (all leach pattern wells) would be conducted at this time to hopefully establish that all parameters except molybdenum have been restored to required concentration levels. At that time we would propose to discontinue further restoration efforts at the Section 9 Pilot Site. If deemed necessary by the NMEID and BLM, a reduced ground water monitoring program of some sort could be conducted at the site until the leach field area is incorporated as part of an operational area in accordance with our Mine Plan for the South Trend Development Area (STDA). Mobil has committed in its STDA application to incorporate the Section 9 Pilot wellfield into the second wellfield or operational area to be developed/leach mined at the South Unit Area.

In summary, Mobil believes that the most prudent, expedient, and economical way to achieve concentrations of 1.0 mg/l with respect to molybdenum is to resume mining in conjunction with a commercial operation and leach the uranium ore to its economic depletion.

If you have any questions with respect to the information presented here, please contact me at (303) 293-6436.

Sincerely,

Buck Steingraber

W. A. Steingraber
Permitting Coordinator

WAS/gh
Attachments

cc: D. A. Bauer-Hansen (wo/attachments)
G. L. Higgins, Jr. "
J. L. Long "
D. R. Sheets "
T. C. Vogt (w/attachments)

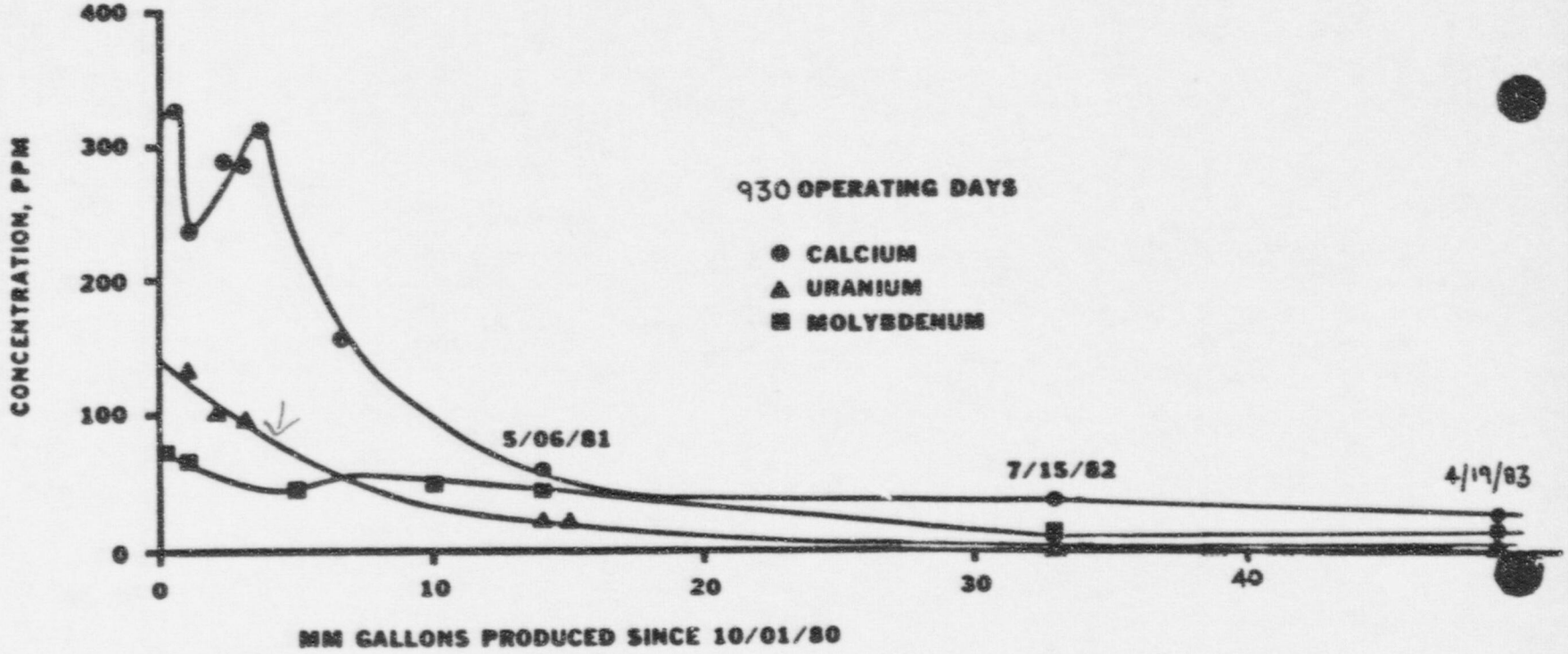
ATTACHMENT 1

PRODUCTION STREAM FIELD ASSAYS

Cumulative Gallons Produced Since 10/1/80	U_3O_8 ppm	Ca ppm	SO_4 ppm	HCO_3 ppm	Na ppm	Cl ppm
-	145	320	1176	1005	1600	1671
374,762	142	326	1150	1023	1650	1671
736,639	132	317	1275	915	1620	1548
1,088,626	125	304	1175	874	1510	1656
1,373,375	103	280	1150	769	1850	1760
1,707,067	106	231	1100	800	1780	1795
2,075,608	97	276	1100	781	1510	1755
2,425,021	101	291	1050	737	1580	1728
2,721,818	89	282	1075	683	1640	1714
3,061,598	72	277	1150	683	1470	1678
3,446,723	72	306	975	698	1710	1860
3,791,287	62	310	925	612	1730	1800
4,117,896	58	282	975	585	1520	1787
5,007,311	48	228	977	622	1506	1639
5,384,309	42	235	902	617	1460	1405
5,757,729	40	193	866	649	1449	1213
6,126,444	34	157	787	634	1070	1010
6,362,630	32	156	775	610	1130	978
10,278,269	26	93	578	552	581	559
13,833,820	4	55	348	415	379	174
34,361,987	0.54	38	43	122	156	150
40,036,014	0.42	18	69	183	181	101
% REDUCTION IN CONCENTRATION	99.9 %	94%	94%	82%	89%	94%

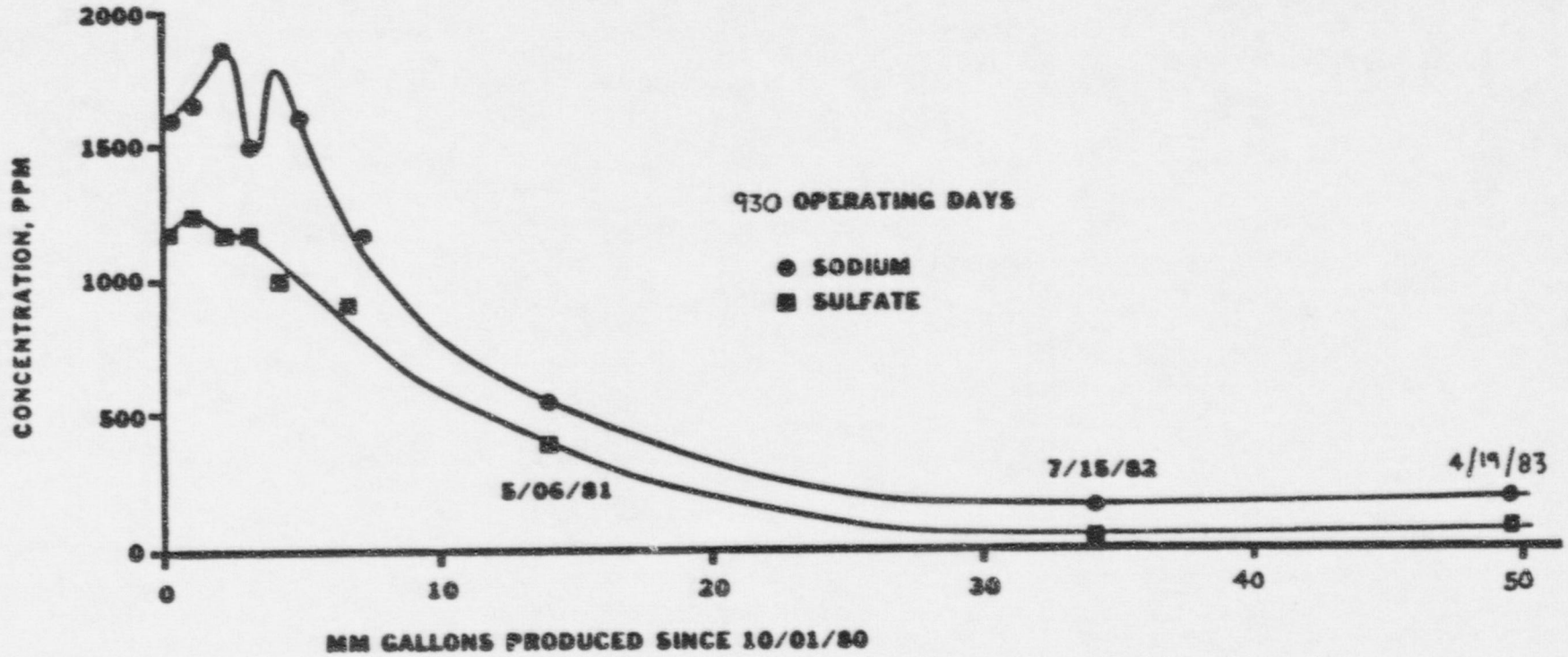
ATTACHMENT 2

CALCIUM, URANIUM, MOLYBDENUM RESTORATION



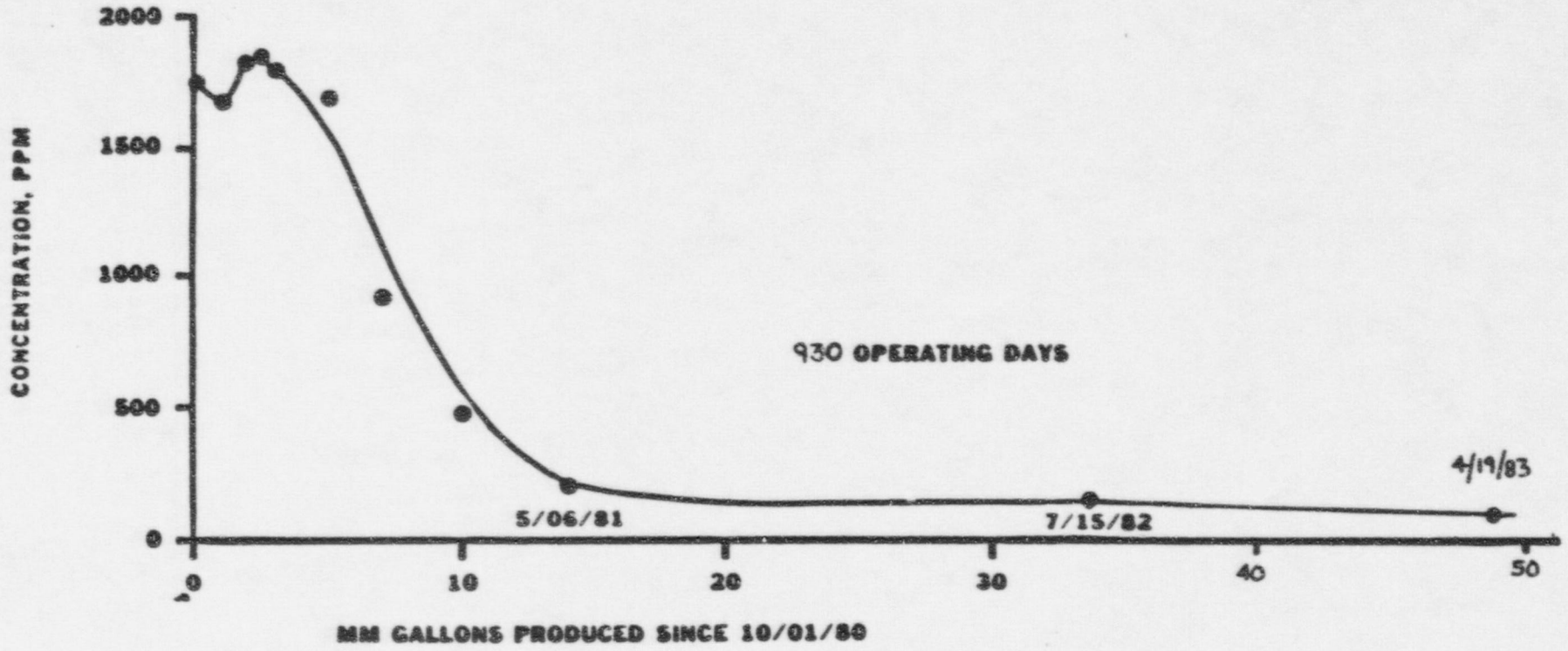
ATTACHMENT 3

SODIUM, SULFATE RESTORATION



ATTACHMENT 4

CHLORIDE RESTORATION



ATTACHMENT 5

Comparison of Parameter Concentrations for Production Stream Versus New Mexico Standards for Ground Water of 10,000 mg/l TDS Concentration or Less

(Samples Taken 7/15/82 and 4/19/83)

Parameter	New Mexico Standard (mg/l)	Production Stream 600 Days of Operation Section 9 Pilot Leach (mg/l)	Production Stream 930 Days of Operation Section 9 Pilot Leach (mg/l)
Aluminum	5.0	<0.5	0.55
Arsenic	0.1	0.079	0.137
Barium	1.0	0.2	0.32
Boron	0.75	0.1	0.1
Cadmium	0.01	<0.005	<0.005
Chloride	250.	150.	* 101.
Chromium	0.05	<0.005	<0.005
Cobalt	0.05	<0.002	<0.02
Copper	1.0	<0.005	<0.005
Cyanide	0.2	<0.005	<0.005
Fluoride	1.6	<0.3	0.52
Iron	1.0	<0.02	0.015
Lead	0.05	<0.02	0.008
Manganese	0.2	0.051	0.14
Molybdenum	1.0	9.7	13.25
Mercury	0.002	<0.0001	<0.0001
Nickel	0.2	<0.002	0.07
Nitrate	10.0	0.07	<0.05
pH	6-9**	9.2	8.5
Phenols	0.005	0.01	0.002
Radium-226 and -228	30.0 pCi/l	27.6 ± 2	NA
Selenium	0.05	0.095	0.066
Silver	0.05	<0.005	<0.005
Sulfate	600.	43.	46.5
TDS	1,000.	587.	840.
Uranium	5.0	0.54	0.42
Zinc	10.0	0.02	0.008

* 2/17/84 SAMPLE

** Dimensionless (units)

ATTACHMENT 6

CDM

environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0468

May 9, 1983

Mr. Bob Peirce
Mobil Corporation
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-16026-4
Section 9
Date Samples Rec'd 4-22-83

REPORT OF ANALYSIS

Lab Designation	8752-16026-4-1	8752-16026-4-2	8752-16026-4-3	8752-16026-4-4
Sponsor Designation	9U-209	9U-213	9U-215	9U-219
	4-19-83	4-19-83	4-19-83	4-19-83
Determination (mg/L)				
Alkalinity	87	79	84	84
Arsenic, dissolved	0.13	0.071	0.24	0.11
Barium, dissolved	<0.2	0.6	0.2	0.3
Cadmium, dissolved	<0.005	<0.005	<0.005	<0.005
Chromium, dissolved	<0.005	<0.005	<0.005	<0.005
Cyanide	<0.005	<0.005	<0.005	<0.005
Fluoride	<0.5	0.6	<0.5	<0.5
Lead, dissolved	0.008	0.012	0.010	<0.005
Mercury, total	<0.0001	<0.0001	<0.0001	0.0001
Nitrate (as N)	<0.05	<0.05	<0.05	<0.05
Selenium, dissolved	0.046	<0.005	0.21	<0.005
Silver, dissolved	<0.005	<0.005	<0.005	<0.005
Chloride	380	420	400	290
Copper, dissolved	<0.005	0.006	<0.005	<0.005
Iron, dissolved	<0.01	0.01	0.01	0.03

Mr. Bob Peirce
Mobil Corporation
May 9, 1983

RE: 8752-16026-4
Section 9
Date Samples Rec'd 4-22-83

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	8752-16026-4-1 9U-209 4-19-83	8752-16026-4-2 9U-213 4-19-83	8752-16026-4-3 9U-215 4-19-83	8752-16026-4-4 9U-219 4-19-83
Determination (mg/L)				
Manganese, dissolved	0.007	0.32	0.010	0.23
Phenol	<0.002	<0.002	0.002	0.005
Sulfate (as SO_4)	40	38	28	80
TDS (at 180°C)	790	830	930	810
Zinc, dissolved	0.006	0.017	0.006	0.006
Aluminum, dissolved	0.5	<0.5	0.7	<0.5
Boron	0.1	0.1	0.1	0.1
Molybdenum, dissolved	25	9.2	9.6	9.2
Cobalt, dissolved	<0.02	<0.02	<0.02	<0.02
Nickel, dissolved	<0.02	0.02	0.02	0.22

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

CDM

environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

11455 West 48th Avenue
Wheat Ridge, Colorado 80033
303 422-0489

May 6, 1983

Mr. Bob Peirce
Mobil Corporation
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-16026-4
Date Samples Rec'd 4-22-83
Section 9, Production Well Analysis

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	8752-16026-4-1 9U-209 4-19-83	8752-16026-4-2 9U-213 4-19-83	8752-16026-4-3 9U-215 4-19-83	8752-16026-4-4 9U-219 4-19-83
Determination				
Uranium (as U) dissolved, mg/L	0.38	0.30	0.59	0.41

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

BY Bud Summers
Bud Summers
Radiochemistry
Supervisor

BS/srf

MOBIL OIL CORPORATION
SECTION 9 PILOT IN-SI[illegible]
URANIUM PRODUCTION LEA[illegible]
CONTINUOUS RADON DATA (PC1/1)

MONTHLY AVERAGES

MONTH	YEAR	AVERAGE	ERROR	CAPTURE
JANUARY	1984	0.4	0.3	96.6%
FEBRUARY	1984	0.4	0.4	92.1%
MARCH	1984	0.4	0.3	99.9%
APRIL	1984	0.2	0.3	81.4%
MAY	1984	****	****	18.1%
JUNE	1984	****	****	0.0%
JULY	1984	0.2	0.3	88.6%
AUGUST	1984	0.2	0.3	76.5%
SEPTEMBER	1984	0.2	0.3	91.9%
OCTOBER	1984	0.1	0.2	95.7%
NOVEMBER	1984	0.2	0.2	97.1%
DECEMBER	1984	0.2	0.3	91.4%

1984 ANNUAL AVERAGE= 0.3
ANNUAL ERROR= 0.3
ANNUAL DATA CAPTURE=77.4%

DATA CAPTURE < 60% => MISSING(****)