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8/17/82

UNION 76

ENERGY MINING DIVISION

REPORT ON THE
STATUS OF RESTORATION & STABILIZATION
FOR THE A-3 PILOT PLANT
(WDEQ LICENSE TO EXPLORE NO. 17)
(NRC LICENSE SUA-1223)

by

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W. G. Volk

Union Oil Company of California
Casper, Wyoming

20648

CONTENTS

SUMMARY

Pursuant to a letter dated April 15, 1981, from the Land Quality Division of the Wyoming DEQ, Union initiated further evaluation of the restoration and the stabilization of the A-3 (Red Desert) insitu pilot plant aquifer.

The results of calculations for stability using the technique as outlined in a letter from the Wyoming DEQ dated April 15, 1982 indicated some wells did not meet the stabilization criteria. Observation of the random behavior of the stability analysis led Union to institute a regorous sampling program to:

- Determine the expected analytical precision
- Determine the expected sampling precision
- Determine any seasonal and temporal trends
- Correct any statistical biases introduced into the stability sampling program when sampling was curtailed on those wells with low values.

This report consists of a discussion of Union's additional sampling program and evaluation of the above items in addition to the stability analysis of the past available data.

From a site specific statistical appraisal of these data in terms of sampling and analytical accuracy and precision, it is concluded that aquifer restoration and stabilization has been achieved at the A-3 pilot plant (License to Explore 17).

INTRODUCTION

Subsequent to a meeting held in Cheyenne, Wyoming (April 14, 1981) with Margery Hulbert and Rick Engleman of the WDEQ regarding presentation of the Union's A-3 project groundwater restoration and site decommissioning report (DEQ License to Explore, No. 17), a letter dated April 15, 1981 was received from Rick Engleman stating the following:

1. Wells 5A, 6A, 1B and 5B should be resampled.

2. If the U_3O_8 or Ra-226 concentrations of this sampling fall at or below the levels reported by Union for July 1980 sampling, on a well-by-well basis, then the groundwater restoration will be considered stabilized.

3. Prior to making any comparison as stated in item 2 above Union's July 1980 results would be adjusted upward to account for the analytical and sampling error.

4. The analytical and sampling error adjustment will be made by obtaining the analytic variation that Wyoming Analytical Laboratories of Laramie, Wyoming allows for each parameter at a 95% confidence interval (1.64 Standard Deviations) and multiplying that number by two to allow for the variation in sampling.

5. If the uranium or radium-226 values are observed to remain above the adjusted July 1980 levels (as per items 4 above) then a decision will be made whether or not long-term acceptability of the restoration has been reached.

Pursuant to the above letter, Union on request received a letter (attached as Appendix B) from Wyoming Analytical Laboratories, Laramie, Wyoming stating their analytical precision for U_3O_8 as follows:

- For U_3O_8 10 Mg/L, 0.10 Mg;L = S.D.
- For 10 U_3O_8 100 Mg/L, 1.0 Mg/L = S.D.

The precision data for the U_3O_8 analysis were based on 70 round robbin check samples. The analytical precision for Ra-226, as usual, is determined individually for each sample.

The results of the stability calculations using techniques outlined in the letter from Wyoming DEQ dated April 15, 1981, and as shown in Table 1 indicate that:

1. For U_3O_8, the concentrations in two of the four wells declined and passed the test. The net average change in U_3O_8 for all four wells above, was - 2.6 Mg/L (i.e. down 2.6 Mg/L).

2. For Ra-226, again concentrations in two of the four wells declined and passed the test. The net average change in Ra-226 for all four wells was +10pCi/L (i.e. up 10pCi/L).

TABLE 1

CALCULATIONS FOR RESTORATION STABILITY

Well	July 1980 Sample	Adjusted July Sample	April 1981 Sample
	U_3O_8 (Mg/L)		
5A	5.3	5.6	4.19
6A	3.9	4.2	4.97
1B	3.5	3.8	4.47
5B	5.0	5.3	2.70
	Ra-226 (pCi/L)		
5A	38.1 ± 2.1	40.3	54 ± 4
6A	38.1 ± 2.1	40.3	28 ± 3
1B	26.9 ± 1.4	29.7	28 ± 3
5B	17.3 ± 1.1	19.5	30 ± 3

It should be noted that the increases and decreases in U_3O_8 and Ra-226 concentrations were not consistent with respect to each well. When U_3O_8 went up, Ra-226 went down, and visa versa.

The results of the April 1981 sampling and the stability calculations illustrate the problems of arriving at a decision involving statistical analysis based on questionable assumptions. For example, the assumption that the sum of the sampling and the analytical variations between the July 1980 and the April 1981 samples is the same as twice the analytical variation as determined by a single laboratory is not valid.

A review of the past data by Union, strongly suggests that the analytical and sampling errors used for the stability calculations described above are inconsistent with proper statistical techniques.

Observation of the radom behavior of the stability analysis led Union to institute a vigorous sampling program to:

1. Determine the expected analytical accuracy and precision

2. Determine the expected sampling precision

3. Determine any seasonal or temporal trends

4. Correct any statistical biases introduced into the stability sampling program when sampling was curtailed on those wells with low values.

SAMPLING AND ANALYSIS PROGRAM

On inspection of the initial April 1981 samples, it was decided that more sampling was warranted. Due to their acknowledged analytical capabilities and favorable transportation schedule, Wyoming Analytical Laboratories in Laramie was chosen to do the primary analysis. The objectives of the sampling were threefold:

1. Determine the expected analytical accuracy and precision within and between labs.

2. Determine the minimum accuracy and precision variability attributable to sampling field techniques.

3. After determining the analytical and sampling accuracy and precision, an attempt would be made to determine the confidence with which aquifer stability and restoration could be claimed. Uranium and Ra-226 are the primary constituents of interest. However, other consituents can be shown to support Union's claim of restoration and stability.

Analytical Accuracy And Precision

In order to determine the accuracy and precision of analysis, three splits were taken of samples from randomly selected wells. Two of these splits were sent to Wyoming Analytical Laboratories in Laramie while the third split was sent to CDH Laboratories in Denver, Colorado for analysis. As can be seen in Table 2, splits were not only analyzed using different laboratories, but were further split for analysis by different techniques. Also, analysis of the split samples under different modes of preservation were made.

The results in Table 2, demonstrate absence of any distinct pattern with respect to each laboratory. The flourometric determination of U_3O_8 has a lower coefficient of variance at higher concentrations (5 Mg/l). In comparison the radiometric determination of U_3O_8 has a lower coefficient of variance at lower concentrations and a more consistent coefficient of variation throughout the range of concentrations tested. Consequently, the variations observed could be treated as random and these random errors applied to the A-3 project analysis.

The study of the stability monitoring data for the A-3 project indicates that lab to lab variability plus the analytical methods variability can typically account for a variability of $\pm$ 30% for a single U_3O_8 value at the 95% confidence level, given the conditions at Union's A-3 pilot plant.

For Ra-226, the removal of one high value (30 $\pm$ 8 pCi/L) from the analytical data results in a pattern of accuracy and precision versus concentration as given below.

1. For Ra-226 values greater than about 18 pCi/L, the analytical accuracy and precision coefficient of variation was determined to be $\pm$ 10%.

2. For Ra-226 values lower than 18 pCi/L the coefficient of variations appears to increase asymptotically to values of $\pm$ 30% to $\pm$ 60% at 3 to 1 pCi/L respectively.

The items 1 and 2 above demonstrate the expected variations due to analysis as a result of different laboratories using similar procedures.

Sampling Accuracy And Precision

To determine the variations in U_3O_8 and Ra-226 due to sampling, wells 4A, 6A and 1B were sampled at various short intervals of time in order to diminish any temporal variations, and were analyzed by one lab using one technique in order to diminish analytical variations. In each case the sampling contractor remobilized for each triplicate in order to include variations in sampling which may be created by faulty instrumentation, bad calibration and changes in personnel or equipment etc. Table 4 illustrates the times and results of the short term sampling frequency for each

20648

TABLE 2

SAMPLING AND ANALYTICAL ACCURACY AND PRECISION

U_3O_8 (Mg/L)

Well	Date	WAL Fluor.	WAL Rad.	WAL (dup) Flour.	WAL (dup) Rad.	CDM Flour.	CDM Rad.	Avg.	S.D.	C.V.(%)
1A	7-8-81	0.032	-	0.028	-	0.024	0.02	0.023	0.004	17
1A*	7-8-81	0.017	-	0.019	-	-	-	0.018	0.001	6
1A**	7-8-81	0.021	-	0.015	-	0.027	-	0.021	0.006	29
1A	10-21-81	0.10	0.09	0.06	0.06	0.029	0.08	0.07	0.03	43
6A	7-8-81	5.94	-	5.93	-	5.5	3.4	5.2	1.2	23
6A*	7-8-81	5.80	-	5.43	-	-	-	5.6	0.2	4
6A**	7-8-81	5.64	-	5.05	-	6.3	-	5.7	0.6	11
7A	10-21-81	7.77	5.81	7.82	6.29	9.43	8.3	7.6	1.3	17
1B	7-13-81	5.67	-	-	-	5.4	4.96	5.3	0.4	8
1B	10-22-81	4.88	4.00	4.88	3.84	5.4	6.7	5.0	1.0	20

Avg. = 18
S.D. = 12

Ra-226 (pCi/L)

Well	Date	WAL	WAL dup.	CDM	Avg.	S.D.	C.V.(%)
1A	7-8-81	1.0 ± 0.5	2.2 ± 0.7	0.7 ± 1.9	1.3	0.8	62
1A	10-21-81	2.2 ± 0.8	3.1 ± 1.0	1.8 ± 0.2	2.4	0.7	29
6A	7-8-81	16.6 ± 1.9	19.3 ± 2.1	30 ± 8	12	11	92
7A	10-21-81	39 ± 2	35 ± 3	38 ± 1	37	2	5
1B	7-13-81	27 ± 3.0	-	31 ± 6	29	3	10
1B	10-22-81	29 ± 3	27 ± 1	36 ± 1	31	5	16

Avg. = 36
S.D. = 34

* Field filtered, unpreserved
** Unfiltered, unpreserved
Fluor. - Flourometric analysis
Rad. - Radiometric analysis
WAL - Wyoming Analytical Labs, Larimie, Wyoming
CDM - Camp Dresser and McKee, Wheat Ridge, Colorado

of the three wells. Since the A-3 test site had been sitting without disturbance for a long period of time, it was felt that taking three samples within two weeks of each other could be used to describe the sampling variability for the site.

During sampling on 7-9-81, well 4A was pumped for the normal 2 casing volumes and sampled after the conductivity had stabilized. On 7-12-81, well 4A was pumped 3.9 casing volumes before sampling. The difference in U_3O_8 values seem to correspond to the larger pumped volume. This illustrates the variations in concentration attributable to variations in pumped volume which could easily be attributed to the variations seen in stability samplings prior to 1981.

The data in Table 3 illustrates that when pumping and sampling procedures are held strictly constant the sampling variability

1. For U_3O_8 can be reduced substantially below the analytical variability for U_3O_8. The minimum practical sampling variability for U_3O_8 appears to be 9% of the determined concentration.

2. For Ra-226 the sampling variability for Ra-226 appear to be 9% of the determined concentration, approaching the analytical variability for Ra-226.

The data regarding calculations for restoration stability of wells 5A, 6A, 1B and 5B on samples collected July 1980 and April 1981 modified as per discussion above, are presented in Table 4. Sampling variability values were added to the analytical variability values to perform the test for stability. The results in Table 4 indicates that for U_3O_8 all four wells pass the stability test, while on a well by well basis two wells pass the test for Ra-226. The net average change in Ra-226 values for the four wells is -10pCi/L, indicating an average overall drop in Ra-226 concentration.

Temporal And Seasonal Trends

In order to determine significant temporal or seasonal trends, two techniques were considered proper.

1. Graphical plotting of the constituent values versus time.

2. Analysis of data using a linear model approach.

Graphical Plotting: The stability monitoring at A-3 has proceeded for three years, but sampling time has not been uniform for those years. Visual inspection of time series data is one of the best techniques for detecting significant seasonal trends when data is relatively sparse for the time period under study.

The time series graphical plots for Ra-226 and U_3O_8 (Figures 1 through 26), and the corresponding plots for the average Ra-226 and U_3O_8 by leach pattern site (Figures 27 through 30) are presented in Appendix G. On examinations of these graphs, no cyclic seasonal variations can be observed.

TABLE 3

SAMPLING VARIABILITY

Well	Date	U_3O_8 (Mg/L)	Ra-226 (pCi/L)	Casing Volumes Pumped
4A	7-9-81	0.100	-	2.0
4A	7-12-81	1.060	-	3.9
		$\bar{x}$=0.58		
		s.d.=0.68		
		C.V.=117%		
6A	4-13-81	4.97	28±3	1.8
6A	4-28-81	5.34	27.3±3	2.0
6A	5-13-81	5.69	28±3	2.0
		$\bar{x}$=5.33	$\bar{x}$=2.8	
		s.d.=0.36	s.d.=0.4	
		C.V.=7%	C.V.=1%	
1B	4-15-81	4.47	28±3	1.8
1B	4-29-81	5.04	27±2.9	2.0
1B	5-13-81	5.60	21±2.5	2.0
		$\bar{x}$=5.04	$\bar{x}$=25	
		s.d.=0.56	s.d.= 4	
		C.V.=11%	C.V.=16%	

Average coefficient of variation for U_3O_8 = 9%
Average coefficient of variation for Ra-226 = 9%

* 3 splits of this sample were within 0.01 Mg/L of each other for U_3O_8

To determine the temporal variations or trends, the above time series plots can again be used. Visual inspection of the time series plots indicates that for 11 of the 13 wells the Ra-226 and the U_3O_8 values have peaked and stabilized or are trending downward. When the wells are composited by leach site the time series plots show conclusively that not only are the values stabilized, but that for U_3O_8, they are stabilized below the level for drinking water.

Linear Model Approach: This technique determines the straight line that best fits the data. The slope of the line indicates the average trend of the data points. Analysis of the model can also determine the probability that the data would indicate a trend given that no trend exists. It should be noted however, the linear model approach makes assumptions which when compared to the variations in geochemical populations, makes it heavily biased toward finding trends where there are none. As such the procedure should be considered extremely conservative from an environmental protection standpoint.

In order to determine the stability (slope) of the Ra-226 and U_3O_8 time series data, the time series was linearly modelled in segments. Initially the entire 3 years of stability sampling was fitted to a linear model. Then the successive calendar years were removed from the early data and each new set modelled. Application of such analysis leads one to obtain a clear picture of when stability was realized. A summary of the results of the linear modelling analysis is presented in Table 5. The details of time series data used for each linear model and the results of the model for Ra-226 and U_3O_8 by pattern are shown in Appendix C.

The linear model uses sample sets only for the sampling periods when all the wells were sampled and rejects the sampling periods when only a portion of the wells were sampled. To do otherwise was found to bias the results toward a condition of stability. As shown in Table 5, overall stability has been reached for the two cases, and the values are stable or decreasing.

CONCLUSION

Based on previous and additional samples collected and chemical analysis of these samples, and on the statistical evaluation of the previous and the recent data it is concluded that aquifer restoration and the stabilization has been achieved at the A-3 in situ pilot plant.

TABLE 4

CALCULATIONS FOR RESTORATION STABILITY USING ACTUAL ANALYTICAL AND SAMPLING VARIABILITY

U_3O_8* (Mg/L)

Well	July 1980 Sample	Adjusted July Sample (x+ 1.64 s.d.)	April 1981 Sample
5A	5.3	6.7	4.19
6A	3.9	5.0	4.97
1B	3.5	4.5	4.47
5B	5.0	6.4	2.70

Ra-226** (pCi/L)

Well	July 1980 Sample	Adjusted July Sample (x + Counting Error + 1.64 s.d.)	April 1981 Sample
5A	38.1 ± 2.1	47.4	54 ± 4
6A	38.1 ± 2.1	47.4	28 ± 3
1B	26.9 ± 1.4	33.4	28 ± 3
5B	17.3 ± 1.1	21.7	30 ± 3

* s.d. = (Value) X (0.18 + 0.09) as described in text and on Tables 2 and 3
** s.d. = (Value) X (0.10 + 0.09) as described in text and on Tables 2 and 3

TABLE 5

LINEAR MODEL RESULTS SUMMARY

Constituent	Pattern	Time Period	Slope	Probability that Slope = 0
			(Mg/L per day)	
U_3O_8	A	10-30-78 thru 10-23-81	0.00016	0.82
U_3O_8	A	01-01-79 thru 10-23-81	-0.00027	0.81
U_3O_8	A	01-01-80 thru 10-23-81	-0.000055	0.99*
U_3O_8	A	01-01-81 thru 10-23-81	-0.000055	0.99
U_3O_8	B	10-30-78 thru 10-23-81	0.0015	0.07
U_3O_8	B	01-01-79 thru 10-23-81	0.00062	0.61
U_3O_8	B	01-01-80 thru 10-23-81	0.0038	0.47*
U_3O_8	B	01-01-81 thru 10-23-81	0.0038	0.47
			(pCi/L per day)	
Ra-226	A	10-30-78 thru 10-23-81	0.011	0.12
Ra-226	A	01-01-79 thru 10-23-81	0.011	0.12
Ra-226	A	01-01-80 thru 10-23-81	-0.013	0.71*
Ra-226	A	01-01-81 thru 10-23-81	-0.013	0.71
Ra-226	B	10-30-78 thru 10-23-81	0.017	0.017
Ra-226	B	01-01-79 thru 10-23-81	0.017	0.017
Ra-226	B	01-01-80 thru 10-23-81	0.0091	0.78*
Ra-226	B	01-01-81 thru 10-23-81	0.0091	0.78

*Values are the same as 1981 due to incomplete sample sets for 1980.

APPENDIX A

WYOMING DEQ LETTER OF APRIL 15, 1981
LICENSE TO EXPLORE NO. 17, REVIEW
OF MINERALS EXPLORATION, MARCH 24,
1981 SUBMITTAL

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Department of Environmental Quality

LAND QUALITY DIVISION - DISTRICT II

933 MAIN STREET TELEPHONE 307-332-3047 LANDER, WYOMING 82520

April 15, 1981

cc JAA/DSS
WCV
FRC
Bennett
GTH
Kuntz

Ms. Diana O. Bender
Environmental Engineer
Union Energy Mining Division
Union Oil Co. of California
1846 West Grant Road, Suite 105
Tucson, Ariz. 85705

RE: License to Explore No. 17, Review of Minerals Exploration
March 24, 1981 Submittal

Dear Diana:

In our meeting with you yesterday in Cheyenne, Margery Hulbert and I agreed that Union Energy has adequately addressed the concerns outlined in our March 4, 1981 review letter, with the exception of Comment No. 3. It is our position that Wells 5A, 6A, 1B and 5B must be sampled again due to their increase in uranium and/or radium levels over the past two samplings. We need additional data to verify that these parameters are stabilized over the long term.

It was agreed that if the results of this sampling fall at or below the levels reported from Union's July 1980 sampling, on a well-by-well basis, groundwater restoration will be considered stable. It was further agreed that before the comparison is made, the July 1980 results will be adjusted upward to account for analytic and sampling error. This adjustment will be calculated by obtaining the analytic variation that Wyoming Analytical Labs of Laramie, Wyoming allows for each parameter at a 95% confidence interval (1.68 standard deviations) and multiplying that by two to allow for variation in sampling.

If any uranium or radium - 226 values are found to remain above the adjusted July 1980 levels, then a decision on the long-term acceptability of restoration will be made, based on the number of wells that show increases and the magnitude of the increases.

We hope to hear from you soon about the sampling work.

Sincerely,

Rick Engelmann
District Engineer

RE/MH:mm

cc: R. Shaffer, Margery Hulbert - Cheyenne DEQ-LQD
C. Preston - District II, Lander

APPENDIX B

LETTER FROM WYOMING ANALYTICAL LABORATORIES, INC.
MAY 20, 1981 RE: U_3O_8 ANALYTICAL PRECISION

WYOMING ANALYTICAL LABORATORIES, INC.

Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

20 May 1981

Mr. William G. Volk
Union Oil Company of California
1846 W. Grant Road, Suite 105
Tucson, AZ 85705

Dear Mr. Volk,

With regard to our conversation of 16 April 1981, a statement of our U_3O_8 analytical precision, based on 70 round-robin check samples, is as follows:

For $U_3O_8 \leq 10$ mg/L, 0.10 mg/L = 1 S.D.

For $10 < U_3O_8 < 100$ mg/L, 1.0 mg/L = 1 S.D.

If there are any further questions, please do not hesitate to call.

Sincerely,

Gene F. Hayes
Laboratory Director

GH:vb

cc

20648

APPENDIX C

TIME SERIES DATA FOR LINEAR MODEL

WELL	DATE	U308	RA	WELL	DATE	U308	RA	WELL	DATE	U308	RA
1A	10/30/78	0.15	.	5A	04/13/81	4.190	54.0	8A	07/09/81	1.650	4.8
2A	10/30/78	6.30	.	6A	04/13/81	4.970	28.0	8A	07/09/81	1.650	.
3A	10/30/78	1.10	.	1A	04/14/81	.	1.7	8A	07/09/81	1.610	.
4A	10/30/78	0.80	.	3A	04/14/81	2.880	.	8A	07/09/81	1.650	.
5A	10/30/78	4.20	.	3A	04/14/81	2.880	34.0	8A	07/09/81	1.650	.
6A	10/30/78	4.05	.	7A	04/14/81	6.320	28.0	8A	07/09/81	1.610	.
7A	10/30/78	4.20	.	8A	04/14/81	1.560	7.9	8A	07/09/81	3.930	36.0
8A	10/30/78	1.30	.	4B	04/14/81	0.430	9.1	8A	07/09/81	3.800	.
2B	10/30/78	1.15	.	5B	04/14/81	2.700	30.0	8A	07/09/81	3.930	.
3B	10/30/78	0.84	.	2A	04/15/81	4.190	.	2B	07/10/81	1.650	4.8
4B	10/30/78	0.57	.	2A	04/15/81	4.190	30.0	2B	07/10/81	1.620	.
5B	10/30/78	0.72	.	1B	04/15/81	4.470	28.0	2B	07/10/81	1.590	.
2A	04/25/79	.	.	2B	04/15/81	1.350	10.9	3B	07/10/81	3.020	7.8
5A	04/25/79	.	.	3B	04/15/81	2.420	17.9	3B	07/10/81	2.990	.
7A	04/25/79	.	.	6A	04/28/81	5.340	27.3	3B	07/10/81	2.970	.
8A	04/25/79	.	.	1B	04/29/81	5.040	27.0	4B	07/10/81	0.040	3.7
4B	04/25/79	.	.	6A	05/13/81	5.690	28.0	4B	07/10/81	0.220	.
5B	04/25/79	.	.	1B	05/13/81	5.600	21.0	4B	07/10/81	0.110	.
1A	04/26/79	2.30	1.40	1A	07/08/81	0.032	1.0	5B	07/10/81	2.230	15.8
3A	05/10/79	.	.	1A	07/08/81	0.017	.	5B	07/10/81	2.180	.
4A	05/10/79	.	.	1A	07/08/81	0.021	.	5B	07/10/81	2.230	.
6A	05/10/79	.	.	1A	07/08/81	0.028	2.2	4A	07/12/81	1.060	0.7
1B	05/10/79	.	.	1A	07/08/81	0.019	.	4A	07/12/81	.	.
2B	05/10/79	.	.	1A	07/08/81	0.015	.	4A	07/12/81	.	.
3B	05/10/79	.	.	1A	07/08/81	0.021	0.7	1B	07/13/81	5.670	27.0
2A	07/10/79	6.65	20.46	6A	07/08/81	5.940	16.6	1B	07/13/81	.	.
7A	07/10/79	4.50	22.50	6A	07/08/81	5.800	.	1B	07/13/81	.	.
8A	07/10/79	2.10	5.26	6A	07/08/81	5.640	.	1B	07/13/81	4.600	31.0
1A	07/11/79	1.60	3.50	6A	07/08/81	5.930	19.3	6A	10/20/81	6.200	24.0
3A	07/11/79	2.40	7.90	6A	07/08/81	5.430	.	8A	10/20/81	2.820	6.0
4A	07/11/79	2.70	2.30	6A	07/08/81	5.050	.	1A	10/21/81	0.100	2.2
5A	07/11/79	6.75	6.10	6A	07/08/81	4.700	30.0	1A	10/21/81	0.060	3.1
6A	07/11/79	1.70	26.30	2A	07/09/81	4.070	24.0	1A	10/21/81	0.069	1.8
1B	07/11/79	1.45	14.20	2A	07/09/81	3.860	.	2A	10/21/81	4.440	28.0
2B	07/11/79	5.70	5.00	2A	07/09/81	3.990	.	5A	10/21/81	4.210	34.0
3B	07/11/79	0.59	3.30	3A	07/09/81	2.290	25.0	7A	10/21/81	7.770	39.0
4B	07/11/79	0.56	4.40	3A	07/09/81	2.130	.	7A	10/21/81	7.820	35.0
5B	07/11/79	3.95	5.30	3A	07/09/81	2.450	.	7A	10/21/81	7.000	38.0
2A	07/21/80	.	.	4A	07/09/81	0.100	1.4	3A	10/22/81	2.400	32.0
5A	07/21/80	.	.	4A	07/09/81	0.110	.	4A	10/22/81	0.800	2.3
6A	07/21/80	.	.	4A	07/09/81	0.100	.	1B	10/22/81	4.880	29.0
7A	07/21/80	.	.	5A	07/09/81	3.930	36.0	1B	10/22/81	4.880	27.0
1B	07/21/80	.	.	5A	07/09/81	.	.	1B	10/22/81	5.700	36.0
2B	07/21/80	.	.	7A	07/09/81	6.920	27.0	4B	10/22/81	0.740	8.6
5B	07/21/80	.	.	7A	07/09/81	6.850	.	2B	10/23/81	2.390	7.4
4A	04/13/81	0.70	1.60	7A	07/09/81	6.700	.	3B	10/23/81	3.610	9.8

PATT=A

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: U308

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	0.27532018	0.27532018	0.05	0.8234	0.000669	73.8958
ERROR	75	411.52022499	5.48693633		STD DEV		U308 MEAN
CORRECTED TOTAL	76	411.79554517			2.34242104		3.16989610

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	0.27532018	0.05	0.8234	1	0.27532018	0.05	0.8234

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	1.91071529	0.34	0.7352	5.62759944
DATE	0.00016404	0.22	0.8234	0.00073232

PATT=A

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	527.77481948	527.77481948	2.57	0.1159	0.056486	79.9099
ERROR	43	8815.74343830	205.01728926		STD DEV		RA MEAN
CORRECTED TOTAL	44	9343.51825778			14.31842482		17.91822222

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	527.77481948	2.57	0.1159	1	527.77481948	2.57	0.1159

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-68.19733613	-1.27	0.2111	53.71501265
DATE	0.01115210	1.60	0.1159	0.00695069

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GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: U308

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	10.82389215	10.82389215	3.52	0.0691	0.091309	69.4890
ERROR	35	107.71682677	3.07762362		STD DEV		U308 MEAN
CORRECTED TOTAL	36	118.54071892			1.75431571		2.52459459

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	10.82389215	3.52	0.0691	1	10.82389215	3.52	0.0691

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-8.55414619	-1.45	0.1570	5.91457256
DATE	0.00144618	1.88	0.0691	0.00077115

PATT=B

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	657.39607086	657.39607086	6.68	0.0166	0.224949	59.4944
ERROR	23	2265.02392914	98.47930127		STD DEV		RA MEAN
CORRECTED TOTAL	24	2922.42000000			9.92367378		16.68000000

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	657.39607086	6.68	0.0166	1	657.39607086	6.68	0.0166

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-113.76571651	-2.25	0.0342	50.52706360
DATE	0.01689274	2.58	0.0166	0.00653821

WELL	DATE	U308	RA
2B	04/15/81	1.350	10.9
3B	04/15/81	2.420	17.9
6A	04/28/81	5.340	27.3
1B	04/29/81	5.040	27.0
6A	05/13/81	5.690	28.0
1B	05/13/81	5.600	21.0
1A	07/08/81	0.032	1.0
1A	07/08/81	0.017	.
1A	07/08/81	0.021	.
1A	07/08/81	0.028	2.2
1A	07/08/81	0.019	.
1A	07/08/81	0.015	.
1A	07/08/81	0.021	0.7
6A	07/08/81	5.940	16.6
6A	07/08/81	5.800	.
6A	07/08/81	5.640	.
6A	07/08/81	5.930	19.3
6A	07/08/81	5.430	.
6A	07/08/81	5.050	.
6A	07/08/81	4.700	30.0
2A	07/09/81	4.070	24.0
2A	07/09/81	3.860	.
2A	07/09/81	3.990	.
3A	07/09/81	2.290	25.0
3A	07/09/81	2.130	.
3A	07/09/81	2.450	.
4A	07/09/81	0.100	1.4
4A	07/09/81	0.110	.
4A	07/09/81	0.100	.
5A	07/09/81	3.930	36.0
5A	07/09/81	.	.
7A	07/09/81	6.920	27.0
7A	07/09/81	6.850	.
7A	07/09/81	6.700	.
8A	07/09/81	1.650	4.8
8A	07/09/81	1.650	.
8A	07/09/81	1.610	.
8A	07/09/81	1.650	.
8A	07/09/81	1.650	.
8A	07/09/81	1.610	.
8A	07/09/81	3.930	36.0
8A	07/09/81	3.800	.
8A	07/09/81	3.930	.
2B	07/10/81	1.650	4.8
2B	07/10/81	1.620	.
2B	07/10/81	1.590	.

WELL	DATE	U308	RA
2A	04/25/79	.	.
5A	04/25/79	.	.
7A	04/25/79	.	.
8A	04/25/79	.	.
4B	04/25/79	.	.
5B	04/25/79	.	.
1A	04/26/79	2.30	1.40
3A	05/10/79	.	.
4A	05/10/79	.	.
6A	05/10/79	.	.
1B	05/10/79	.	.
2B	05/10/79	.	.
3B	05/10/79	.	.
2A	07/10/79	6.65	20.46
7A	07/10/79	4.50	22.50
8A	07/10/79	2.10	5.26
1A	07/11/79	1.60	3.50
3A	07/11/79	2.40	7.90
4A	07/11/79	2.70	2.30
5A	07/11/79	6.75	6.10
6A	07/11/79	1.70	26.30
1B	07/11/79	1.45	14.20
2B	07/11/79	5.70	5.00
3B	07/11/79	0.59	3.30
4B	07/11/79	0.56	4.40
5B	07/11/79	3.95	5.30
2A	07/21/80	.	.
5A	07/21/80	.	.
6A	07/21/80	.	.
7A	07/21/80	.	.
1B	07/21/80	.	.
2B	07/21/80	.	.
5B	07/21/80	.	.
4A	04/13/81	0.70	1.60
5A	04/13/81	4.19	54.00
6A	04/13/81	4.97	28.00
1A	04/14/81	.	1.70
3A	04/14/81	2.88	.
3A	04/14/81	2.88	34.00
7A	04/14/81	6.32	28.00
8A	04/14/81	1.56	7.90
4B	04/14/81	0.43	9.10
5B	04/14/81	2.70	30.00
2A	04/15/81	4.19	.
2A	04/15/81	4.19	30.00
1B	04/15/81	4.47	28.00

WELL	DATE	U308	RA
3B	07/10/81	3.020	7.8
3B	07/10/81	2.990	.
3B	07/10/81	2.970	.
4B	07/10/81	0.040	3.7
4B	07/10/81	0.220	.
4B	07/10/81	0.110	.
5B	07/10/81	2.230	15.8
5B	07/10/81	2.180	.
5B	07/10/81	2.230	.
4A	07/12/81	1.060	0.7
4A	07/12/81	.	.
4A	07/12/81	.	.
1B	07/13/81	5.670	27.0
1B	07/13/81	.	.
1B	07/13/81	.	.
1B	07/13/81	4.600	31.0
6A	10/20/81	6.200	24.0
8A	10/20/81	2.820	6.0
1A	10/21/81	0.100	2.2
1A	10/21/81	0.060	3.1
1A	10/21/81	0.069	1.8
2A	10/21/81	4.440	28.0
5A	10/21/81	4.210	34.0
7A	10/21/81	7.770	39.0
7A	10/21/81	7.820	35.0
7A	10/21/81	7.000	38.0
3A	10/22/81	2.400	32.0
4A	10/22/81	0.800	2.3
1B	10/22/81	4.880	29.0
1B	10/22/81	4.880	27.0
1B	10/22/81	5.700	36.0
4B	10/22/81	0.740	8.6
2B	10/23/81	2.390	7.4
3B	10/23/81	3.610	9.8
5B	10/23/81	2.550	33.0

PATT=A

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: U308

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	0.33244209	0.33244209	0.06	0.8085	0.000883	73.6452
ERROR	67	376.09763574	5.61339755		STD DEV		U308 MEAN
CORRECTED TOTAL	68	376.43007783			2.36926097		3.21713043

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	0.33244209	0.06	0.8085	1	0.33244209	0.06	0.8085

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	5.32107865	0.62	0.5405	8.65020030
DATE	-0.00027083	-0.24	0.8085	0.00111288

PATT=A

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	527.77481948	527.77481948	2.57	0.1159	0.056486	79.9099
ERROR	43	8815.74343830	205.01728926		STD DEV		RA MEAN
CORRECTED TOTAL	44	9343.51825778			14.31842482		17.91?22222

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	527.77481948	2.57	0.1159	1	527.77481948	2.57	0.1159

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-68.19733613	-1.27	0.2111	53.71501265
DATE	0.01115210	1.60	0.1159	0.00695069

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GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: U30@

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R SQUARE	C.V.
MODEL	1	0.92102610	0.92102610	0.27	0.6047	0.008744	67.1935
ERROR	31	104.40652542	3.36795243		STD DEV		U30@ MEAN
CORRECTED TOTAL	32	105.32755152			1.83519820		2.73121212

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	0.92102610	0.27	0.6047	1	0.92102610	0.27	0.6047

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-2.05263264	-0.22	0.8240	9.15353292
DATE	0.00061682	0.52	0.6047	0.00117951

PATT=B

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	657.39607086	657.39607086	6.68	0.0166	0.224949	59.4944
ERROR	23	2265.02392914	98.47930127		STD DEV		RA MEAN
CORRECTED TOTAL	24	2922.42000000			9.92367378		16.68000000

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	657.39607086	6.68	0.0166	1	657.39607086	6.68	0.0166

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-113.76571651	-2.25	0.0342	50.52706360
DATE	0.01689274	2.58	0.0166	0.00653821

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WELL	DATE	U308	RA
2A	07/21/80	.	.
5A	07/21/80	.	.
6A	07/21/80	.	.
7A	07/21/80	.	.
1B	07/21/80	.	.
2B	07/21/80	.	.
5B	07/21/80	.	.
4A	04/13/81	0.700	1.6
5A	04/13/81	4.190	54.0
6A	04/13/81	4.970	28.0
1A	04/14/81	.	1.7
3A	04/14/81	2.880	.
3A	04/14/81	2.880	34.0
7A	04/14/81	6.320	28.0
8A	04/14/81	1.560	7.9
4B	04/14/81	0.430	9.1
5B	04/14/81	2.700	30.0
2A	04/15/81	4.190	.
2A	04/15/81	4.190	30.0
1B	04/15/81	4.470	28.0
2B	04/15/81	1.350	10.9
3B	04/15/81	2.420	17.9
6A	04/28/81	5.340	27.3
1B	04/29/81	5.040	27.0
6A	05/13/81	5.690	28.0
1B	05/13/81	5.600	21.0
1A	07/08/81	0.032	1.0
1A	07/08/81	0.017	.
1A	07/08/81	0.021	.
1A	07/08/81	0.028	2.2
1A	07/08/81	0.019	.
1A	07/08/81	0.015	.
1A	07/08/81	0.021	0.7
6A	07/08/81	5.940	16.6
6A	07/08/81	5.800	.
6A	07/08/81	5.640	.
6A	07/08/81	5.930	19.3
6A	07/08/81	5.430	.
6A	07/08/81	5.050	.
6A	07/08/81	4.700	30.0
2A	07/09/81	4.070	24.0
2A	07/09/81	3.860	.
2A	07/09/81	3.990	.
3A	07/09/81	2.290	25.0
3A	07/09/81	2.130	.
3A	07/09/81	2.450	.
4A	07/09/81	0.100	1.4
4A	07/09/81	0.110	.
4A	07/09/81	0.100	.
5A	07/09/81	3.930	36.0
5A	07/09/81	.	.
7A	07/09/81	6.920	27.0
7A	07/09/81	6.850	.
7A	07/09/81	6.700	.
8A	07/09/81	1.650	4.8
8A	07/09/81	1.650	.
8A	07/09/81	1.610	.
8A	07/09/81	1.650	.
8A	07/09/81	1.650	.
8A	07/09/81	1.610	.
8A	07/09/81	3.930	36.0
8A	07/09/81	3.800	.
8A	07/09/81	3.930	.
2B	07/10/81	1.650	4.8
2B	07/10/81	1.620	.
2B	07/10/81	1.590	.
3B	07/10/81	3.020	7.8
3B	07/10/81	2.990	.
3B	07/10/81	2.970	.
4B	07/10/81	0.040	3.7
4B	07/10/81	0.220	.
4B	07/10/81	0.110	.
5B	07/10/81	2.230	15.8
5B	07/10/81	2.180	.
5B	07/10/81	2.230	.
4A	07/12/81	1.060	0.7
4A	07/12/81	.	.
4A	07/12/81	.	.
1B	07/13/81	5.670	27.0
1B	07/13/81	.	.
1B	07/13/81	.	.
1B	07/13/81	4.600	31.0
6A	10/20/81	6.200	24.0
8A	10/20/81	2.820	6.0
1A	10/21/81	0.100	2.2
1A	10/21/81	0.060	3.1
1A	10/21/81	0.069	1.8
2A	10/21/81	4.440	28.0
5A	10/21/81	4.210	34.0
7A	10/21/81	7.770	39.0
7A	10/21/81	7.820	35.0
7A	10/21/81	7.000	38.0
3A	10/22/81	2.40	32.0
4A	10/22/81	0.80	2.3
1B	10/22/81	4.88	29.0
1B	10/22/81	4.88	27.0
1B	10/22/81	5.70	36.0
4B	10/22/81	0.74	8.6
2B	10/23/81	2.39	7.4
3B	10/23/81	3.61	9.8
5B	10/23/81	2.55	33.0

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GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: U30B

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	0.00061883	0.00061883	0.00	0.9919	0.000002	76.2272
ERROR	58	342.52611511	5.90562267		STD DEV		U30B MEAN
CORRECTED TOTAL	59	342.52673393			2.43014869		3.18803333

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	0.00061883	0.00	0.9919	1	0.00061883	0.00	0.9919

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	3.62215378	0.09	0.9322	42.41025841
DATE	-5.5192637E-05	-0.01	0.9919	0.00539175

PATT=A

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	32.24841765	32.24841765	0.14	0.7130	0.004030	77.5618
ERROR	34	7969.29713791	234.39109229		STD DEV		RA MEAN
CORRECTED TOTAL	35	8001.54555556			15.30983646		19.73888889

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	32.24841765	0.14	0.7130	1	32.24841765	0.14	0.7130

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	121.56703300	0.44	0.6607	274.53829610
DATE	-0.01293576	-0.37	0.7130	0.03487452

PATT=B

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: U308

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	1.73147137	1.73147137	0.55	0.4661	0.020608	63.9599
ERROR	26	82.28587149	3.16484121		STD DEV		U308 MEAN
CORRECTED TOTAL	27	84.01734286			1.77900006		2.78142857

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	1.73147137	0.55	0.4661	1	1.73147137	0.55	0.4661

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-26.96204963	-0.67	0.5085	40.21381137
DATE	0.00378067	0.74	0.4661	0.00511137

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GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	9.87778028	9.87778028	0.08	0.7784	0.004512	57.1932
ERROR	18	2179.57021972	121.08723443		STD DEV		RA MEAN
CORRECTED TOTAL	19	2189.44800000			11.00396449		19.24000000

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	9.87778028	0.08	0.7784	1	9.87778028	0.08	0.7784

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-51.95302256	-0.21	0.8372	249.27463541
DATE	0.00904641	0.29	0.7784	0.03167350

WELL	DATE	U308	RA
4A	04/13/81	0.700	1.6
5A	04/13/81	4.190	54.0
6A	04/13/81	4.970	28.0
1A	04/14/81	.	1.7
3A	04/14/81	2.880	.
3A	04/14/81	2.880	34.0
7A	04/14/81	6.320	28.0
8A	04/14/81	1.560	7.9
4B	04/14/81	0.430	9.1
5B	04/14/81	2.700	30.0
2A	04/15/81	4.190	.
2A	04/15/81	4.190	30.0
1B	04/15/81	4.470	28.0
2B	04/15/81	1.350	10.9
3B	04/15/81	2.420	17.9
6A	04/28/81	5.340	27.3
1B	04/29/81	5.040	27.0
6A	05/13/81	5.690	28.0
1B	05/13/81	5.600	21.0
1A	07/08/81	0.032	1.0
1A	07/08/81	0.017	.
1A	07/08/81	0.021	.
1A	07/08/81	0.028	2.2
1A	07/08/81	0.019	.
1A	07/08/81	0.015	.
1A	07/08/81	0.021	0.7
6A	07/08/81	5.940	16.6
6A	07/08/81	5.800	.
6A	07/08/81	5.640	.
6A	07/08/81	5.930	19.3
6A	07/08/81	5.430	.
6A	07/08/81	5.050	.
6A	07/08/81	4.700	30.0
2A	07/09/81	4.070	24.0
2A	07/09/81	3.860	.
2A	07/09/81	3.990	.
3A	07/09/81	2.290	25.0
3A	07/09/81	2.130	.
3A	07/09/81	2.450	.
4A	07/09/81	0.100	1.4
4A	07/09/81	0.110	.
4A	07/09/81	0.100	.
5A	07/09/81	3.930	36.0
5A	07/09/81	.	.
7A	07/09/81	6.920	27.0
7A	07/09/81	6.850	.

WELL	DATE	U308	RA
7A	07/09/81	6.700	.
8A	07/09/81	1.650	4.8
8A	07/09/81	1.650	.
8A	07/09/81	1.610	.
8A	07/09/81	1.650	.
8A	07/09/81	1.650	.
8A	07/09/81	1.610	.
8A	07/09/81	3.930	36.0
8A	07/09/81	3.800	.
8A	07/09/81	3.930	.
2B	07/10/81	1.650	4.8
2B	07/10/81	1.620	.
2B	07/10/81	1.590	.
3B	07/10/81	3.020	7.8
3B	07/10/81	2.990	.
3B	07/10/81	2.970	.
4B	07/10/81	0.040	3.7
4B	07/10/81	0.220	.
4B	07/10/81	0.110	.
5B	07/10/81	2.230	15.8
5B	07/10/81	2.180	.
5B	07/10/81	2.230	.
4A	07/12/81	1.060	0.7
4A	07/12/81	.	.
4A	07/12/81	.	.
1B	07/13/81	5.670	27.0
1B	07/13/81	.	.
1B	07/13/81	.	.
1B	07/13/81	4.600	31.0
6A	10/20/81	6.200	24.0
8A	10/20/81	2.820	6.0
1A	10/21/81	0.100	2.2
1A	10/21/81	0.060	3.1
1A	10/21/81	0.069	1.8
2A	10/21/81	4.440	28.0
5A	10/21/81	4.210	34.0
7A	10/21/81	7.770	39.0
7A	10/21/81	7.820	35.0
7A	10/21/81	7.000	38.0
3A	10/22/81	2.400	32.0
4A	10/22/81	0.800	2.3
1B	10/22/81	4.880	29.0
1B	10/22/81	4.880	27.0
1B	10/22/81	5.700	36.0
4B	10/22/81	0.740	8.6
2B	10/23/81	2.390	7.4
3B	10/23/81	3.61	9.8
5B	10/23/81	2.55	33.0

20648

PATT=A

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: U308

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	0.00061883	0.00061883	0.00	0.9919	0.000002	76.2272
ERROR	58	342.52611511	5.90562267		STD DEV		U308 MEAN
CORRECTED TOTAL	59	342.52673393			2.43014869		3.18903333

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	0.00061883	0.00	0.9919	1	0.00061883	0.00	0.9919

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	3.62215378	0.09	0.9322	42.41025841
DATE	-5.5192637E-05	-0.01	0.9919	0.00539175

PATT=A

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	32.24841765	32.24841765	0.14	0.7130	0.004030	77.3618
ERROR	34	7969.29713791	234.39109229		STD DEV		RA MEAN
CORRECTED TOTAL	35	8001.54555556			15.30983646		19.79888889

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	32.24841765	0.14	0.7130	1	32.24841765	0.14	0.7130

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	121.56703300	0.44	0.6607	274.53829610
DATE	-0.01293576	-0.37	0.7130	0.03487452

PATT=B

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: U308

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	1.73147137	1.73147137	0.55	0.4661	0.020608	63.9599
ERROR	26	82.28587149	3.16484121		STD DEV		U308 MEAN
CORRECTED TOTAL	27	84.01734286			1.77900006		2.78142857

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	1.73147137	0.55	0.4661	1	1.73147137	0.55	0.4661

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-26.96204963	-0.67	0.5085	40.21381137
DATE	0.00378067	0.74	0.4661	0.00511137

PATT=B

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RA

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	9.87778028	9.87778028	0.08	0.7784	0.004512	57.1932
ERROR	18	2179.57021972	121.08723443		STD DEV		RA MEAN
CORRECTED TOTAL	19	2189.44800000			11.00396449		19.24000000

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DATE	1	9.87778028	0.08	0.7784	1	9.87778028	0.08	0.7784

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-51.95302256	-0.21	0.8372	249.27463541
DATE	0.00904641	0.29	0.7784	0.03167350

READY

APPENDIX D

TIME SERIES GRAPHICAL PLOTS FOR Ra-226 AND U_3O_8
(FIGURES 1 - 30)

FIGURES 1-26: TIME SERIES GRAPHICAL PLOTS OF
Ra-226 AND U_3O_8

FIGURES 27-30: TIME SERIES GRAPHICAL PLOTS OF AVERAGE
Ra-226 AND U_3O_8 BY LEACH PATTERN SITE

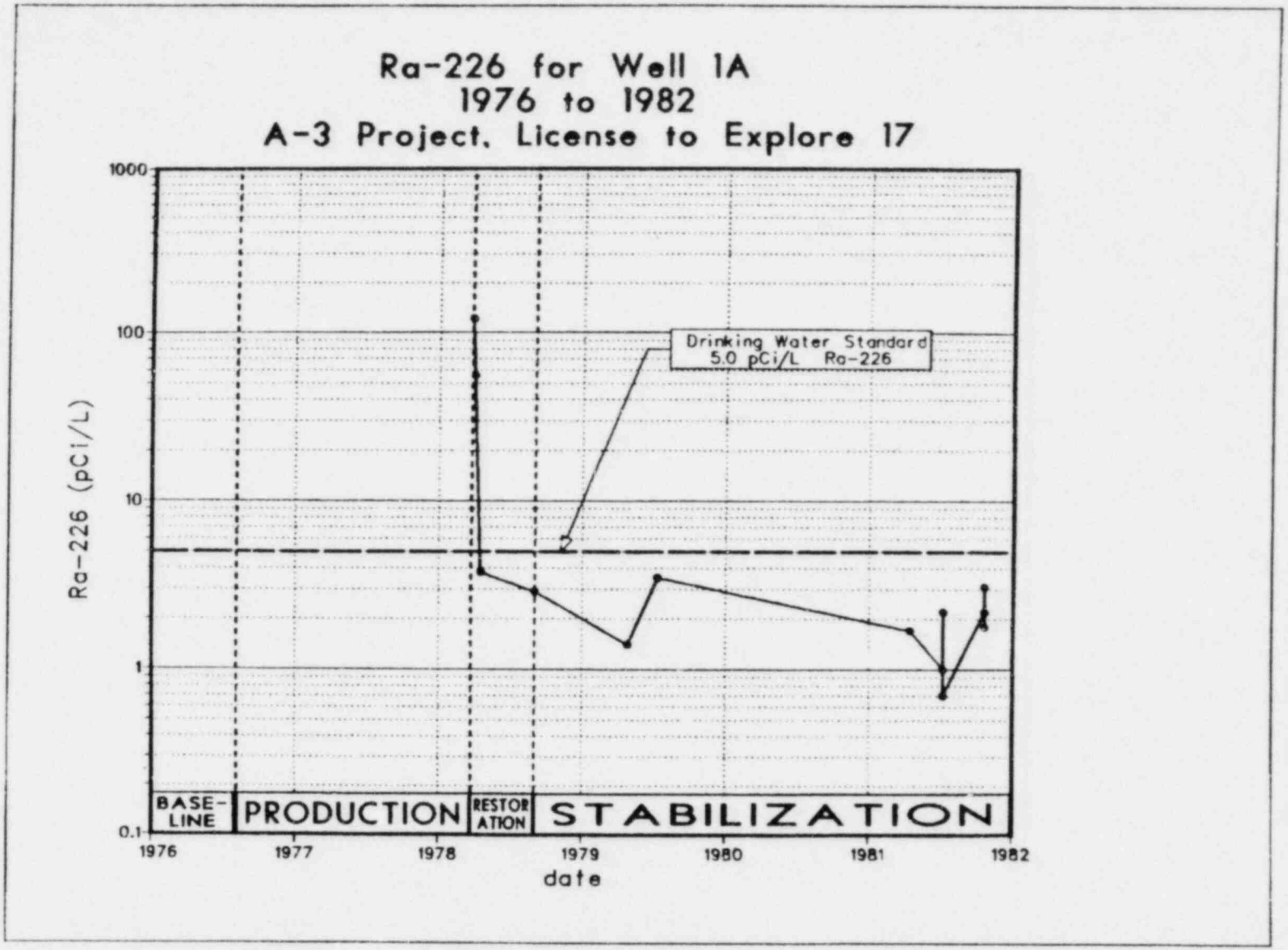
Ra-226 for Well 1A
1976 to 1982
A-3 Project, License to Explore 17
Ra-226 (pCi/L)
1000
100
10
1
0.1
Drinking Water Standard
5.0 pCi/L Ra-226
BASE-LINE
PRODUCTION
RESTOR ATION
STABILIZATION
1976
1977
1978
1979
1980
1981
1982
date

FIG. 1

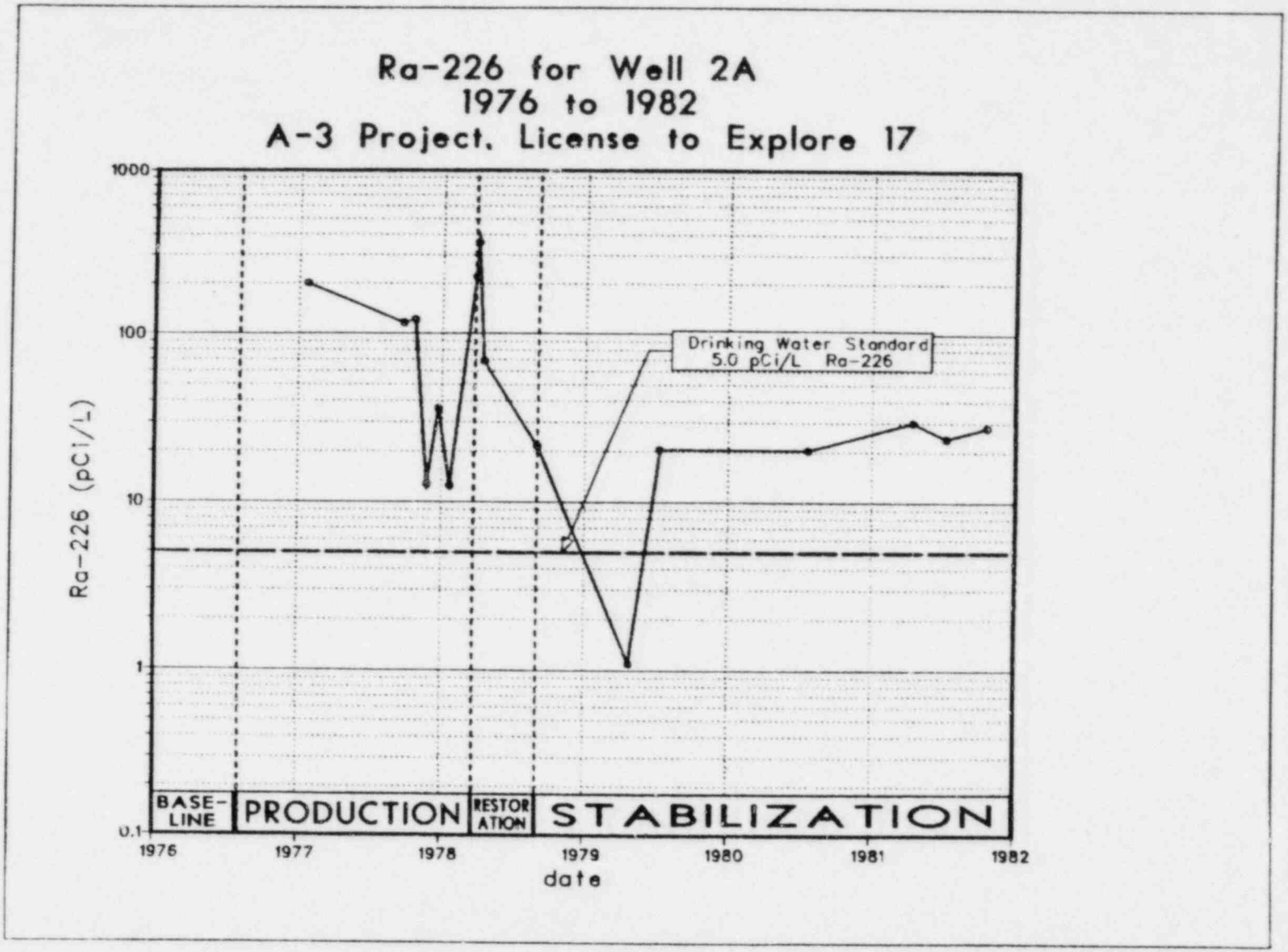
Ra-226 for Well 2A
1976 to 1982
A-3 Project, License to Explore 17
1000
100
10
1
0.1
Ra-226 (pCi/L)
Drinking Water Standard
5.0 pCi/L Ra-226
BASE-LINE
PRODUCTION
RESTOR ATION
STABILIZATION
1976
1977
1978
1979
1980
1981
1982
date

FIG. 2

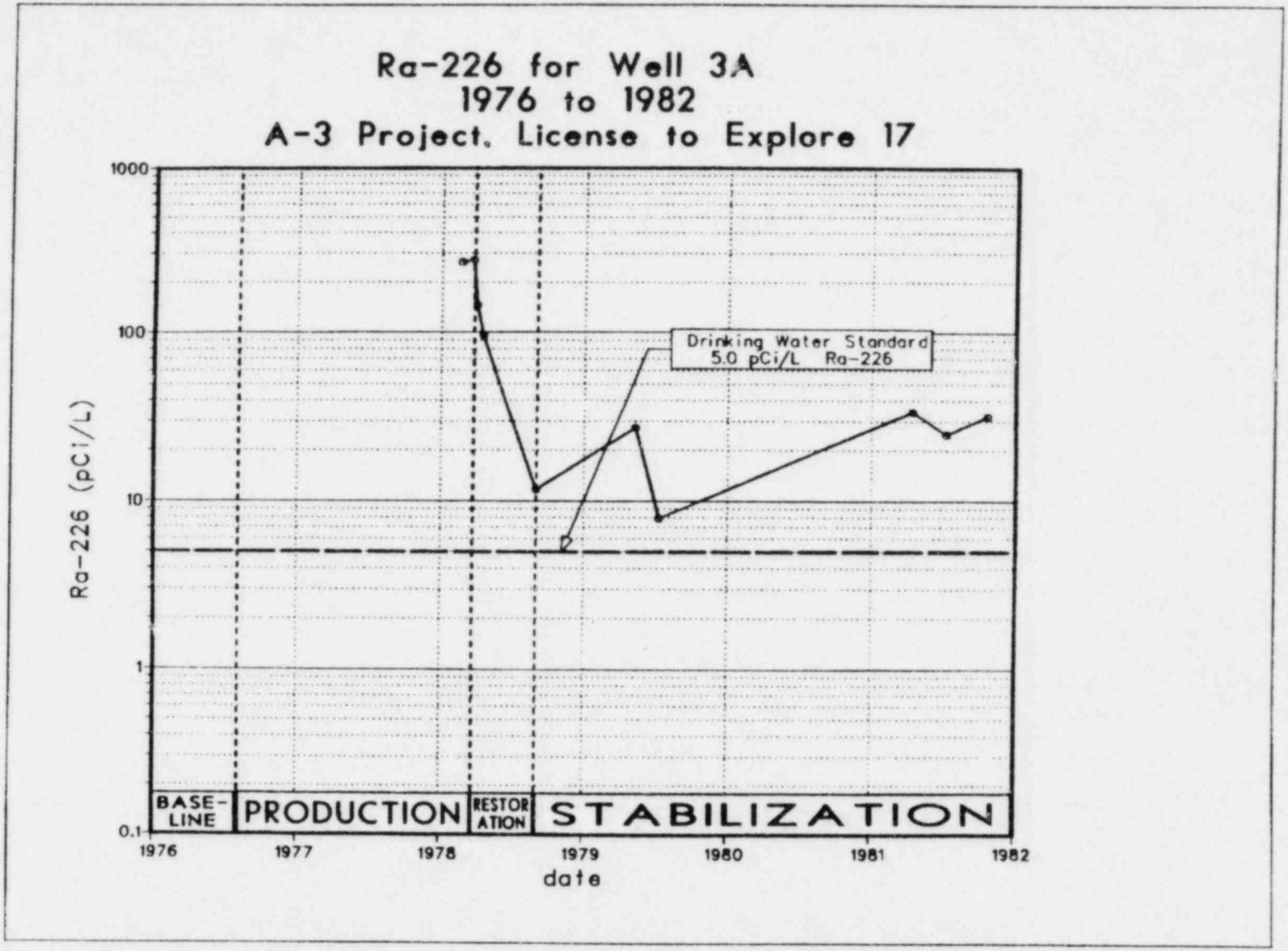
Ra-226 for Well 3A
1976 to 1982
A-3 Project, License to Explore 17
Ra-226 (pCi/L)
1000
100
10
1
0.1
Drinking Water Standard
5.0 pCi/L Ra-226
BASE-LINE
PRODUCTION
RESTOR ATION
STABILIZATION
1976
1977
1978
1979
1980
1981
1982
date

FIG. 3

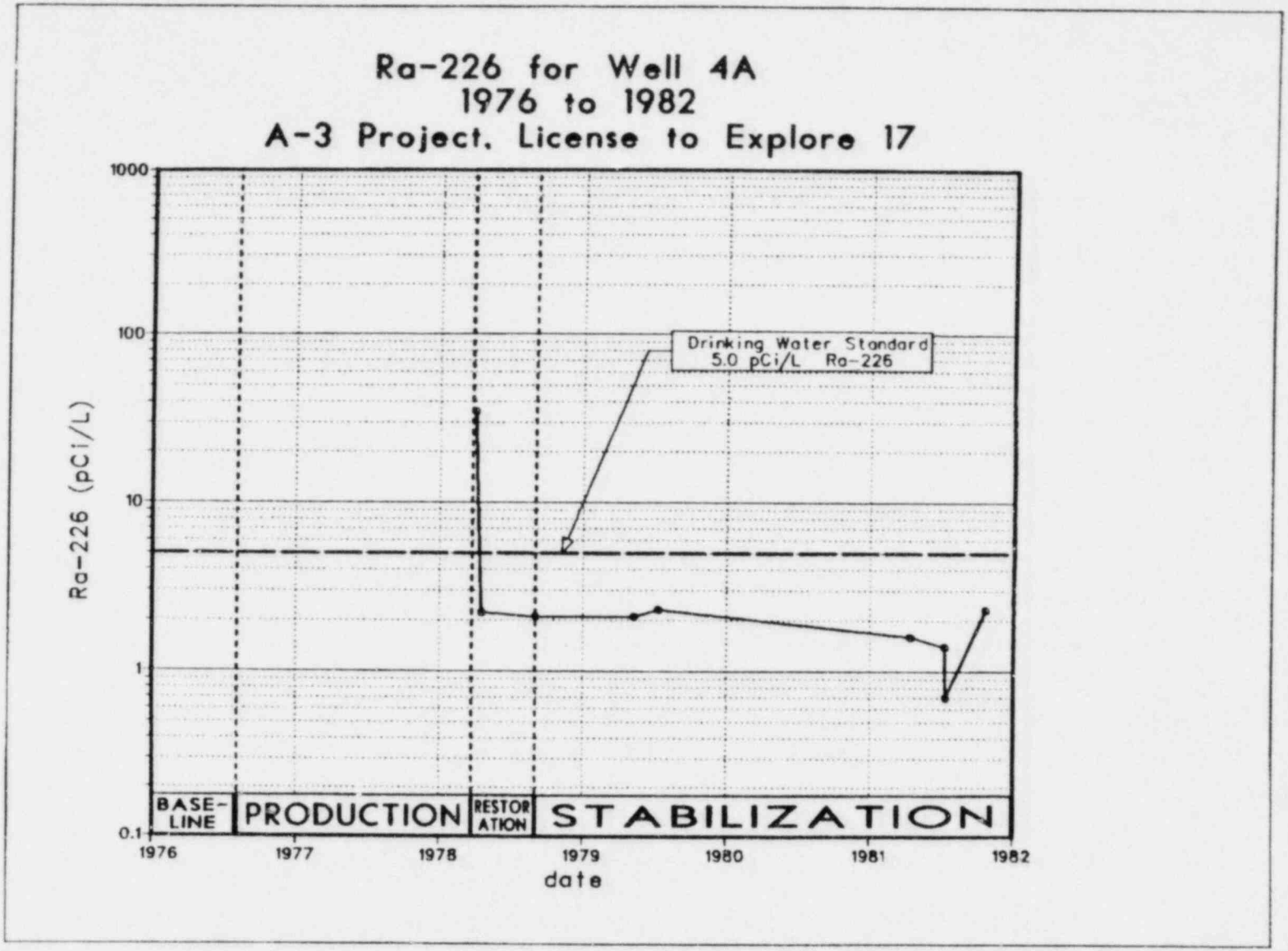

FIG. 4

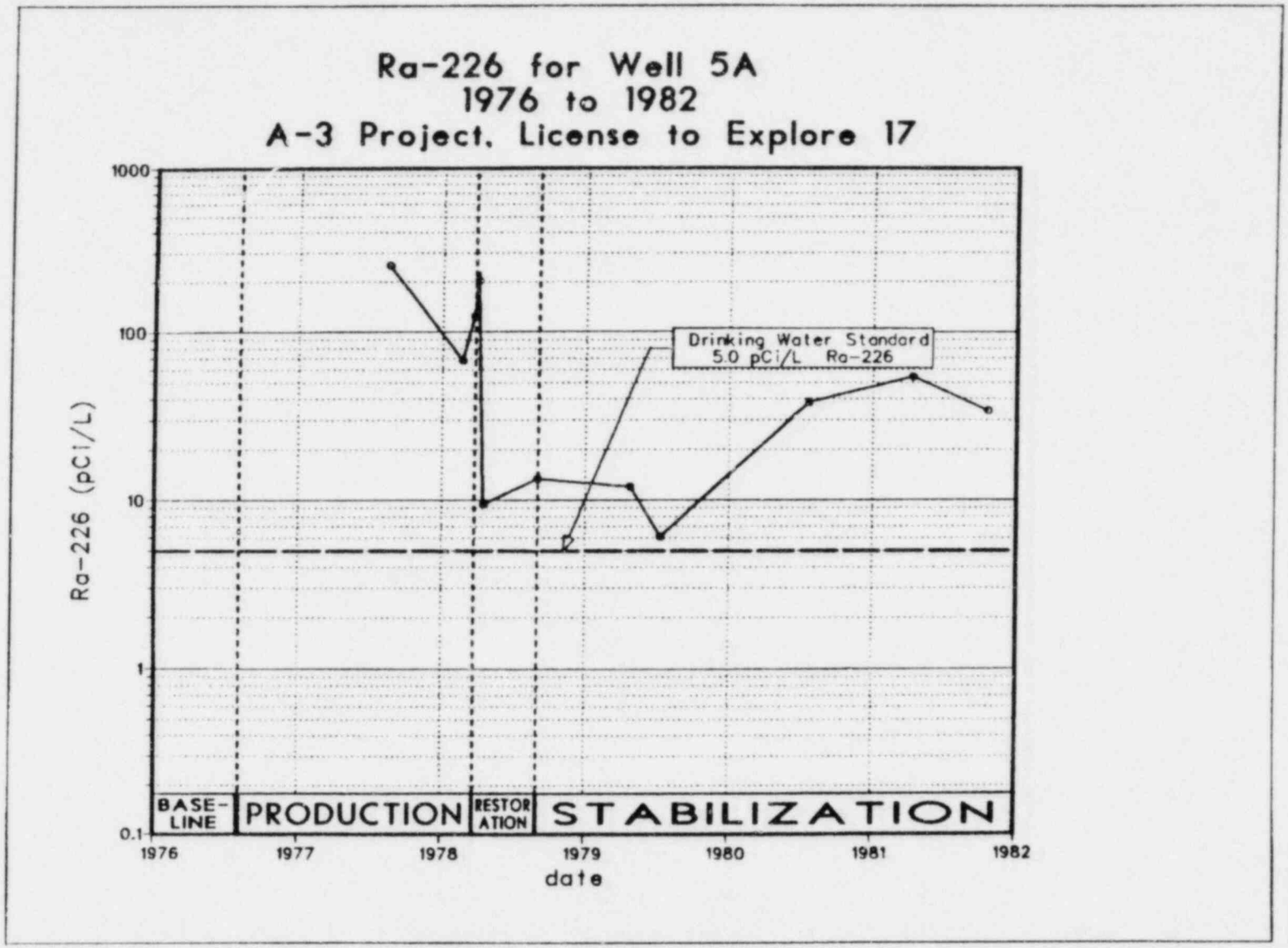

FIG. 5

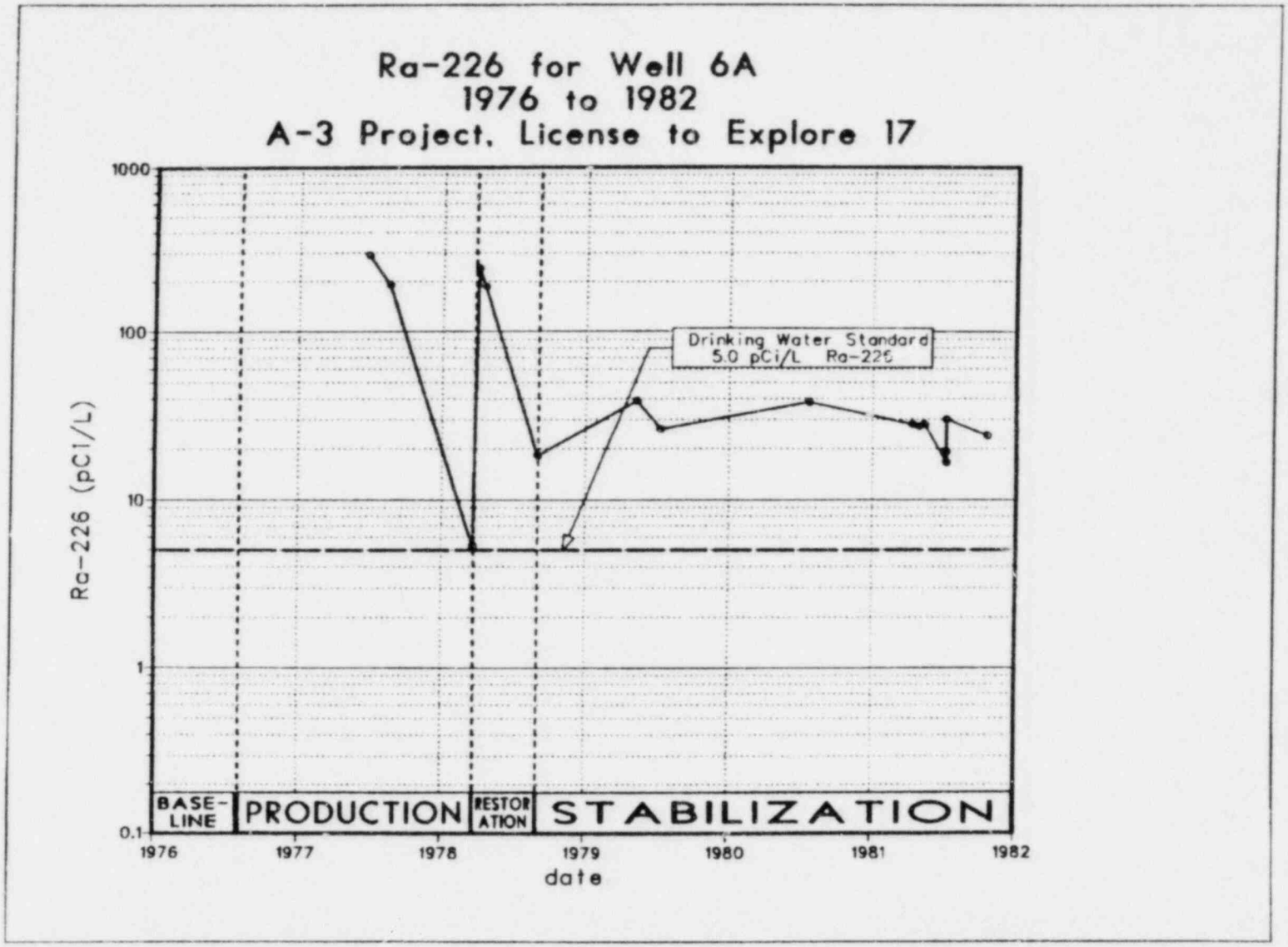

FIG. 6

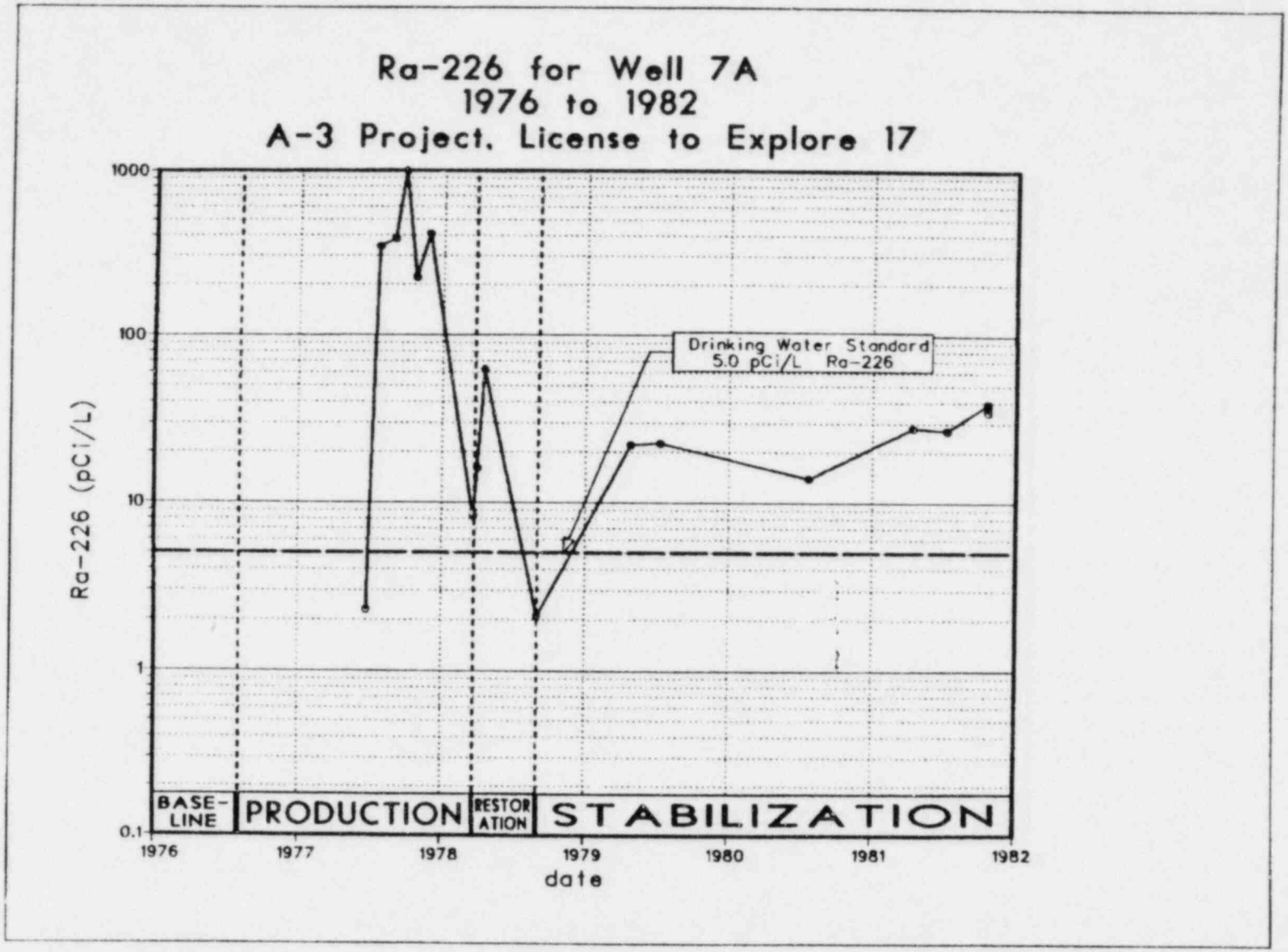

FIG. 7

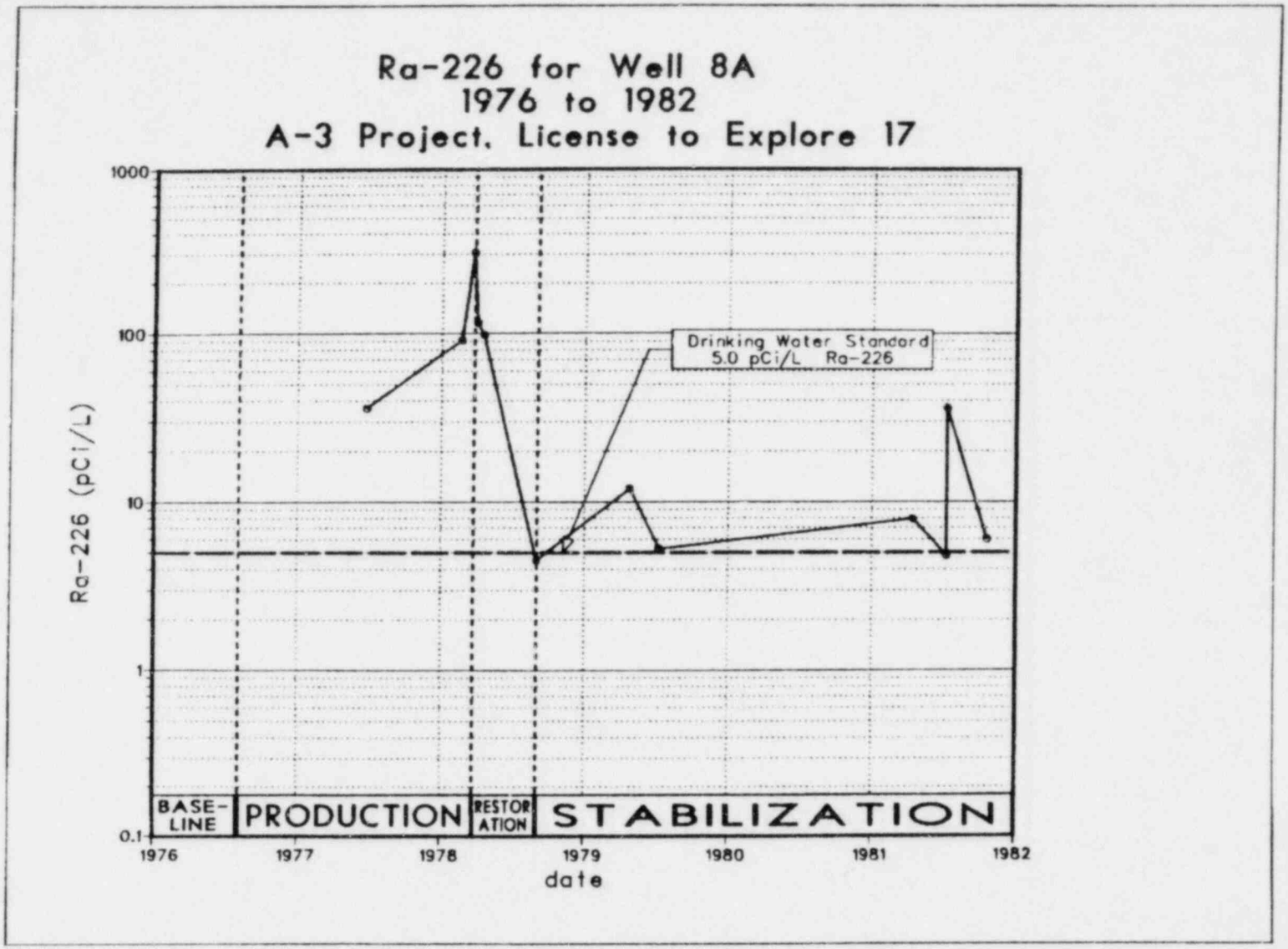
Ra-226 for Well 8A
1976 to 1982
A-3 Project, License to Explore 17
Ra-226 (pCi/L)
1000
100
10
1
0.1
Drinking Water Standard
5.0 pCi/L Ra-226
BASE-LINE
PRODUCTION
RESTOR-ATION
STABILIZATION
1976
1977
1978
1979
1980
1981
1982
date

FIG. 8

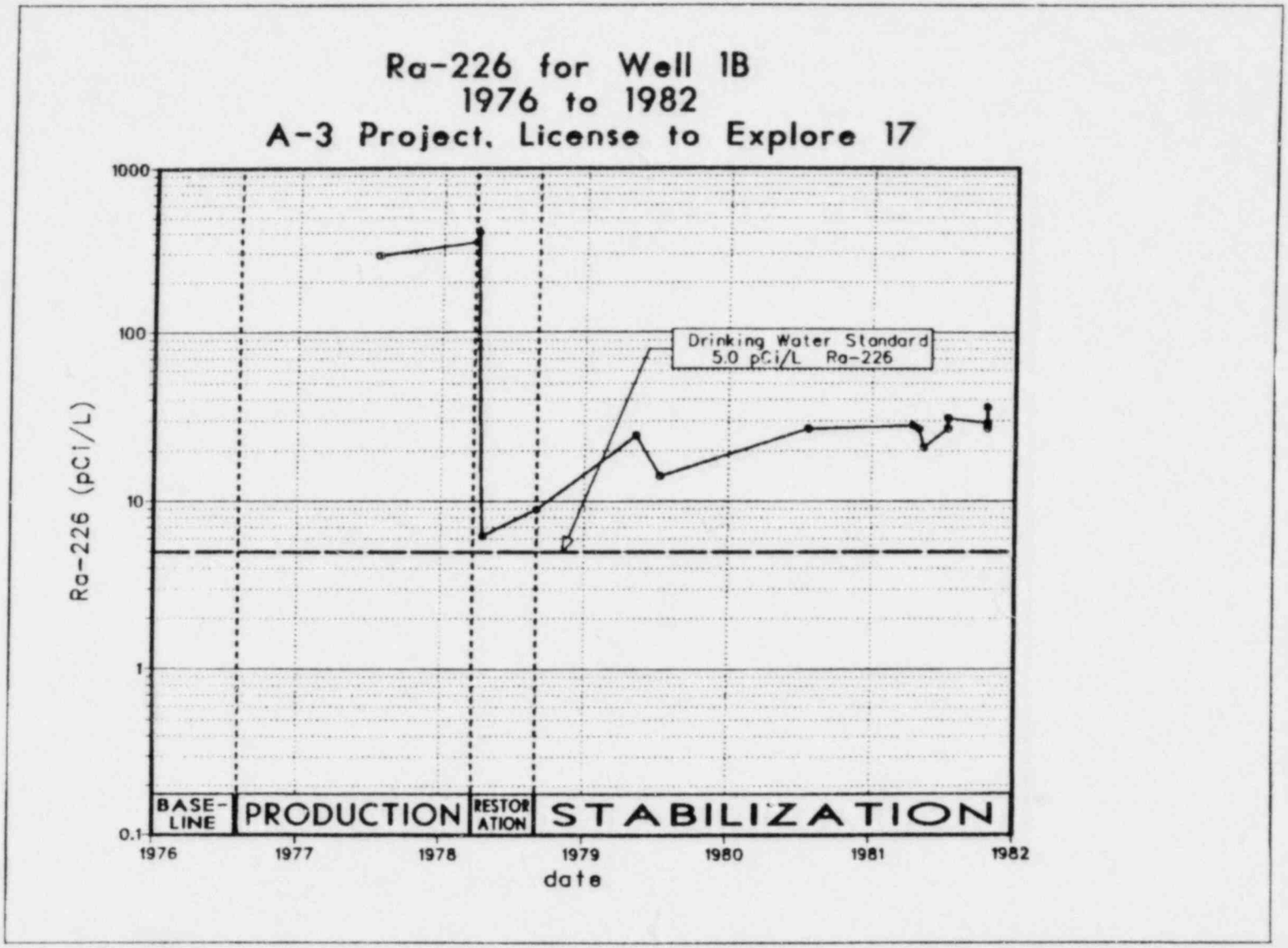
Ra-226 for Well 1B
1976 to 1982
A-3 Project, License to Explore 17
Ra-226 (pCi/L)
1000
100
10
1
0.1
Drinking Water Standard
5.0 pCi/L Ra-226
BASE-LINE
PRODUCTION
RESTOR ATION
STABILIZATION
1976
1977
1978
1979
1980
1981
1982
date

FIG. 9

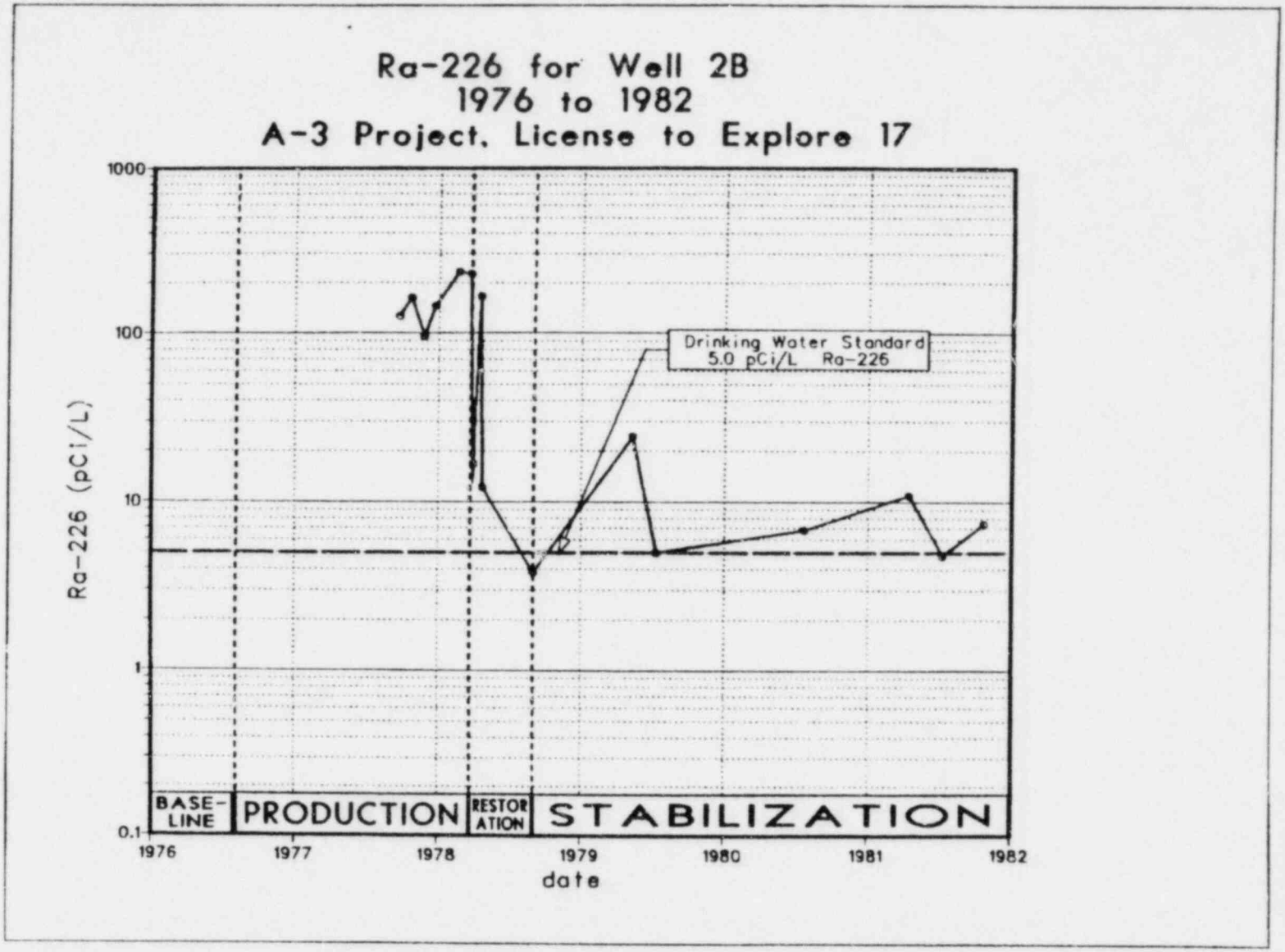
Ra-226 for Well 2B
1976 to 1982
A-3 Project, License to Explore 17
1000
100
10
1
0.1
Ra-226 (pCi/L)
Drinking Water Standard
5.0 pCi/L Ra-226
BASE-LINE
PRODUCTION
RESTOR ATION
STABILIZATION
1976
1977
1978
1979
1980
1981
1982
date

FIG. 10

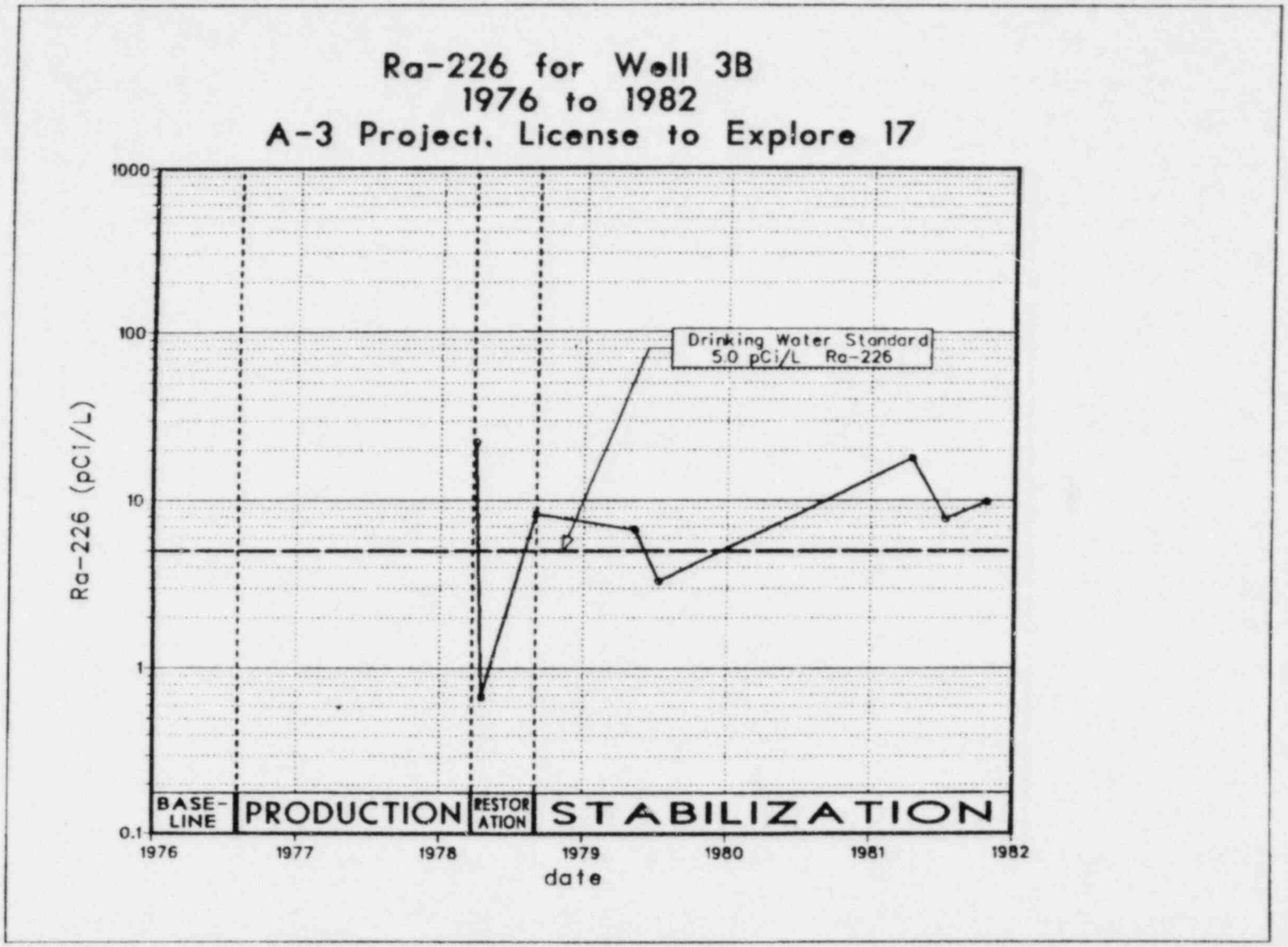
Ra-226 for Well 3B
1976 to 1982
A-3 Project, License to Explore 17
Ra-226 (pCi/L)
1000
100
10
1
0.1
Drinking Water Standard
5.0 pCi/L Ra-226
BASE-LINE
PRODUCTION
RESTOR ATION
STABILIZATION
1976
1977
1978
1979
1980
1981
1982
date

FIG. 11

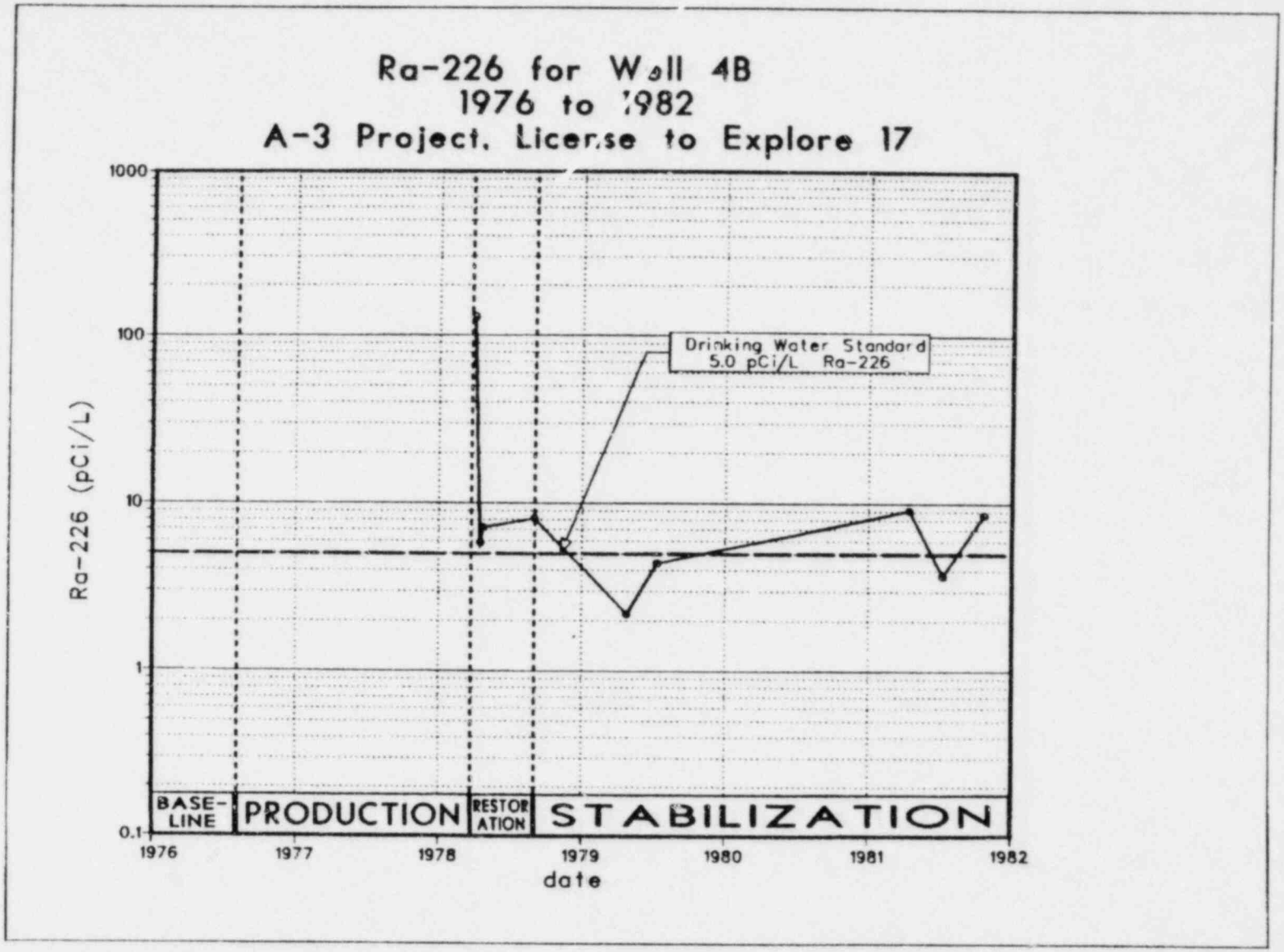
Ra-226 for Well 4B
1976 to 1982
A-3 Project, License to Explore 17
Ra-226 (pCi/L)
1000
100
10
1
0.1
Drinking Water Standard
5.0 pCi/L Ra-226
BASE-LINE
PRODUCTION
RESTOR ATION
STABILIZATION
1976
1977
1978
1979
1980
1981
1982
date

FIG. 12

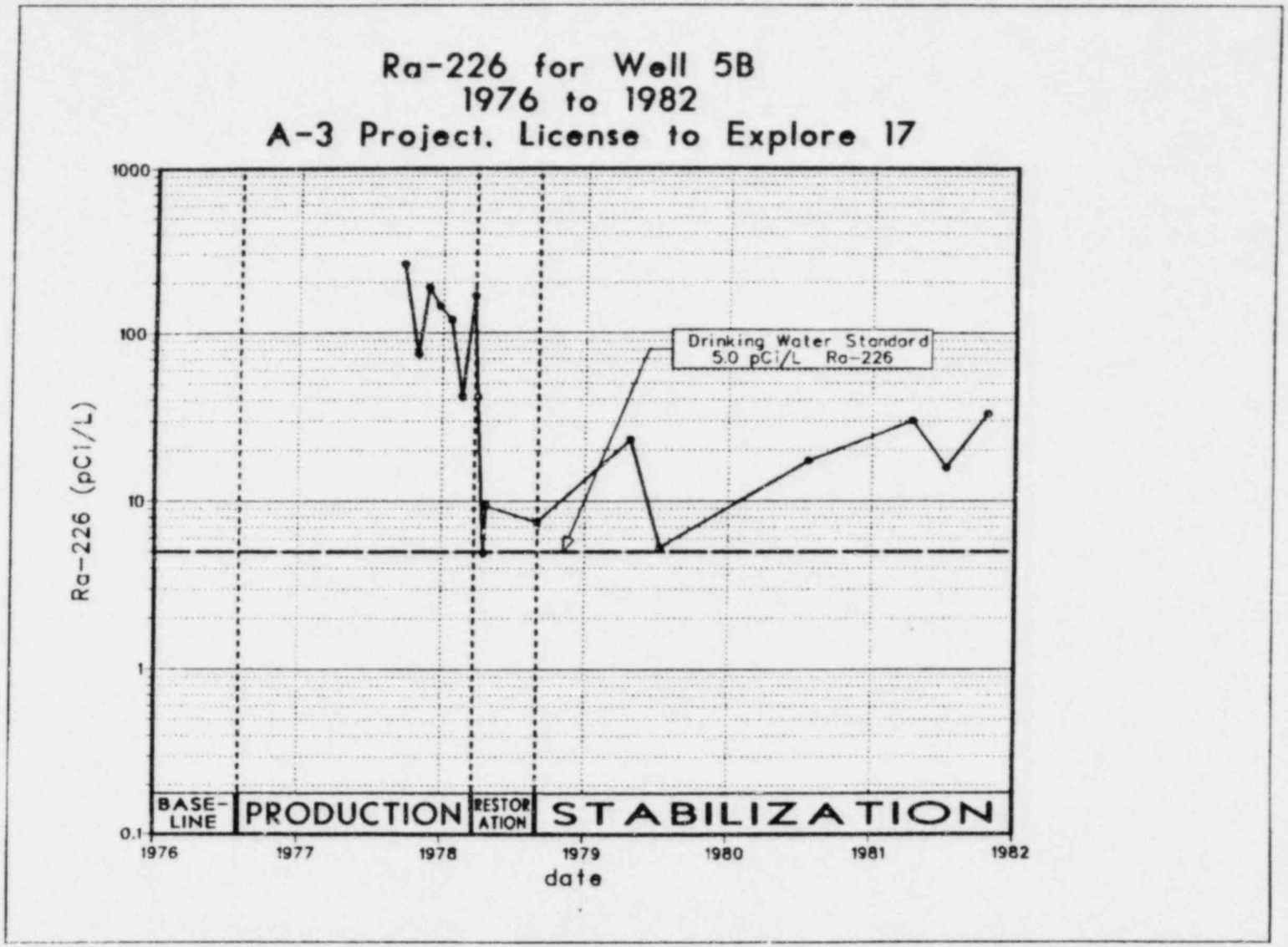

FIG. 13

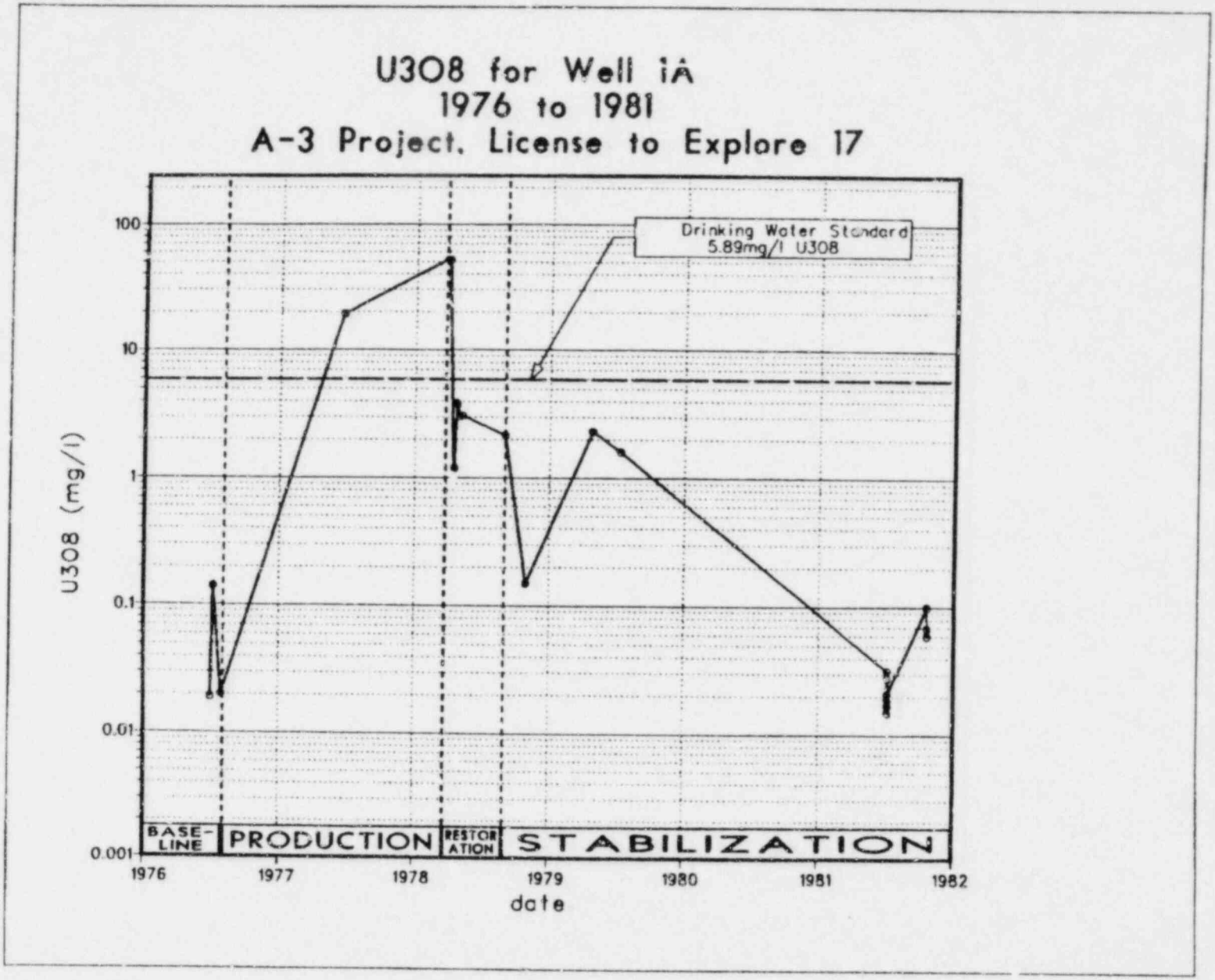

FIG. 14

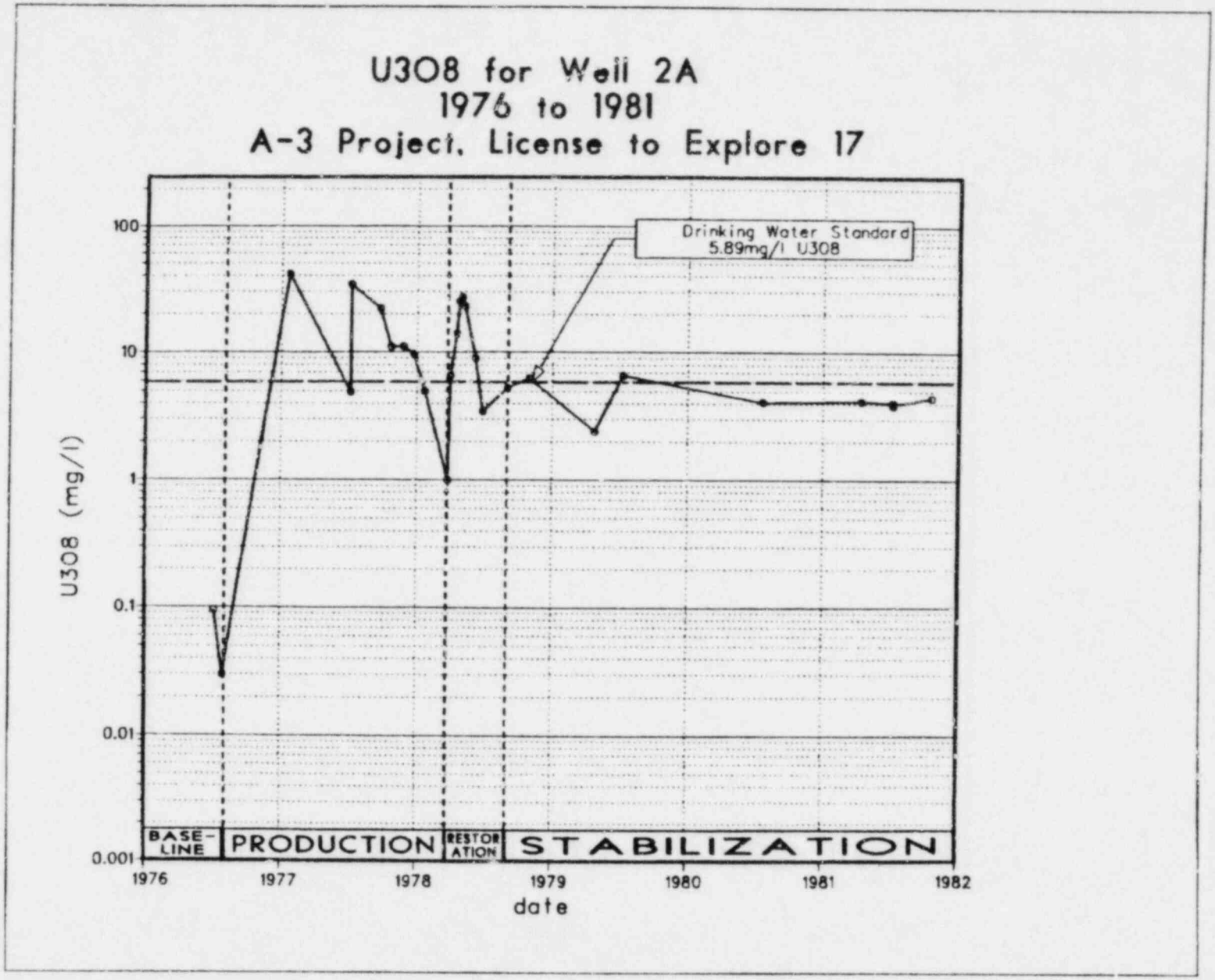

FIG. 15

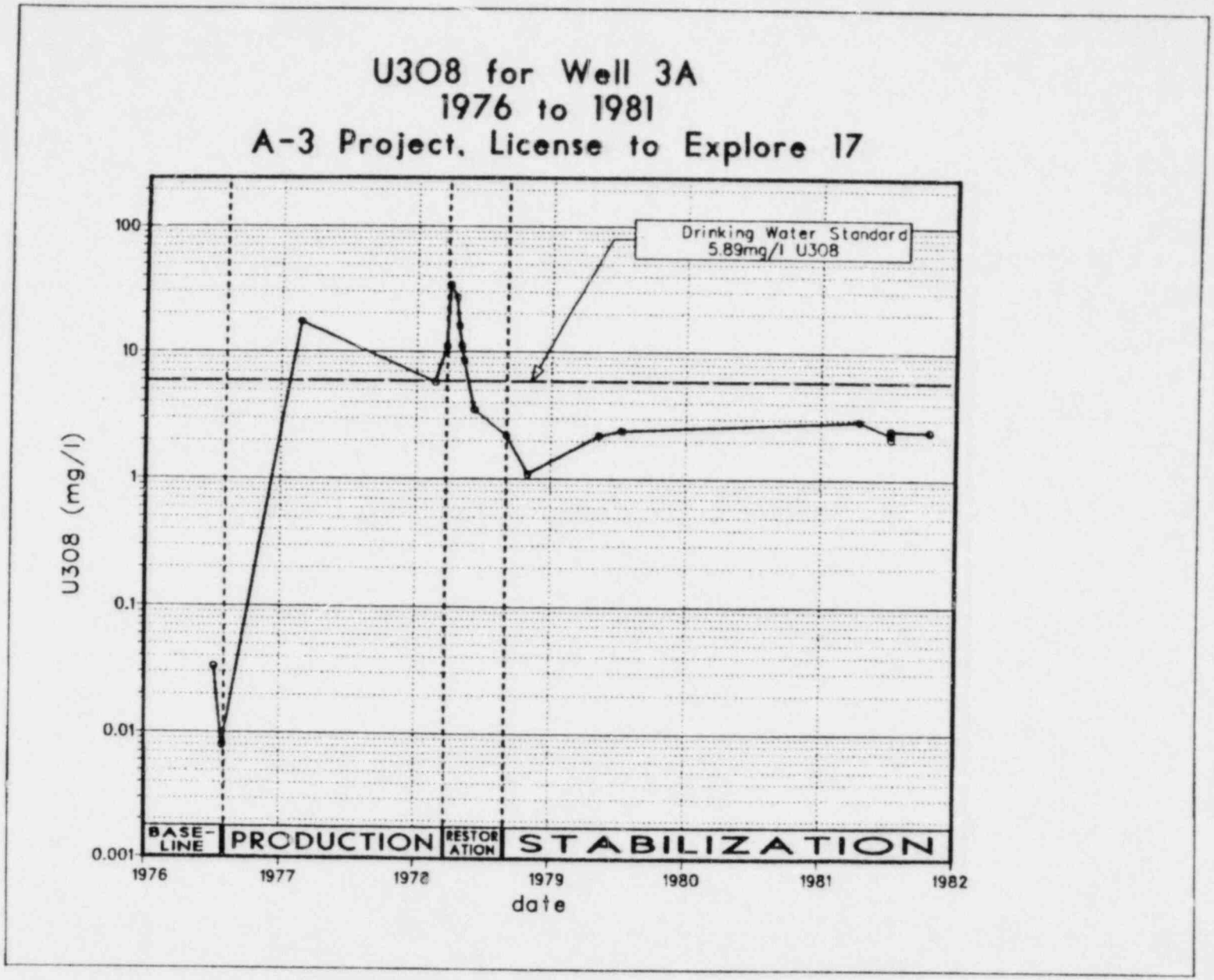

FIG. 16

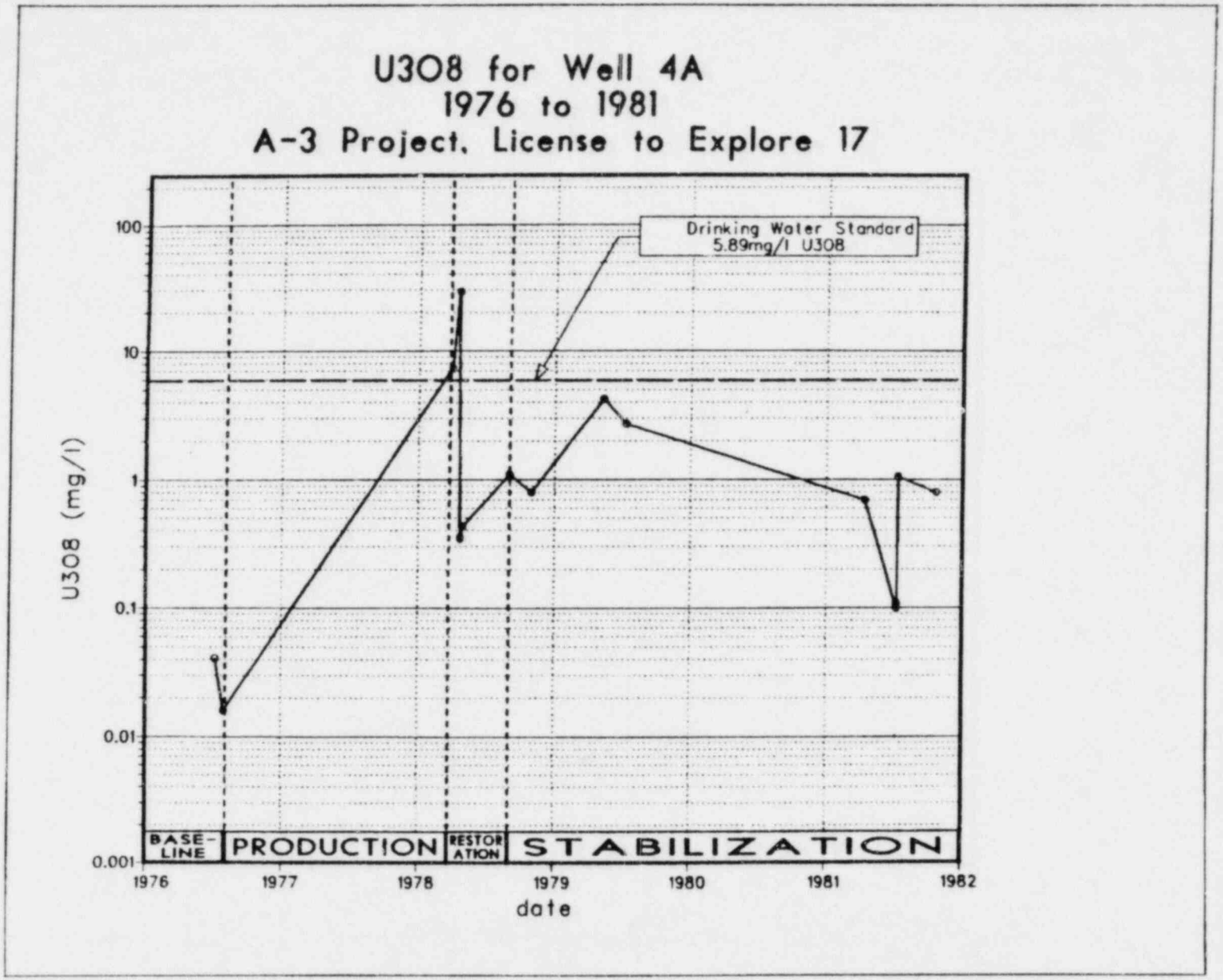

FIG. 17

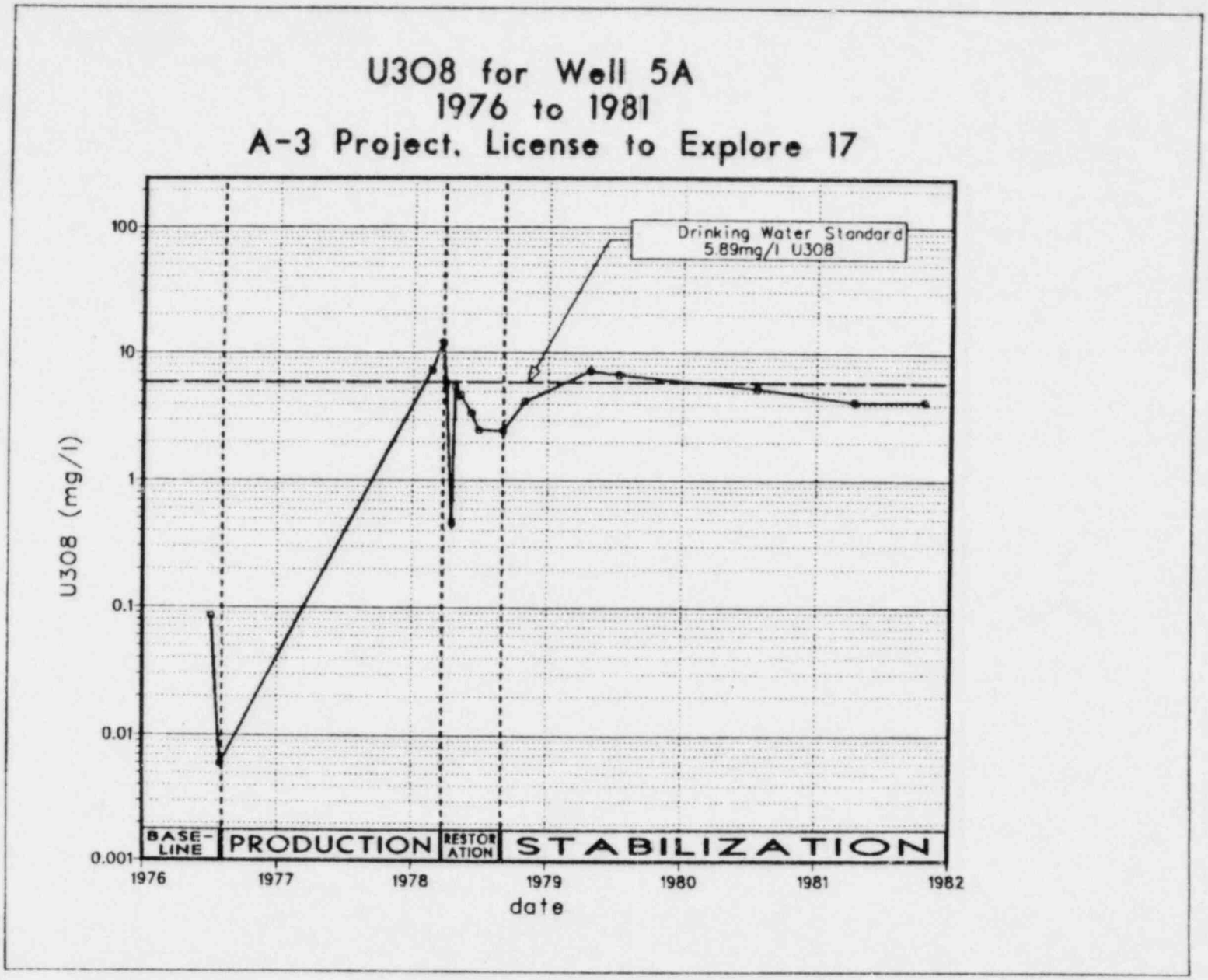

FIG. 18

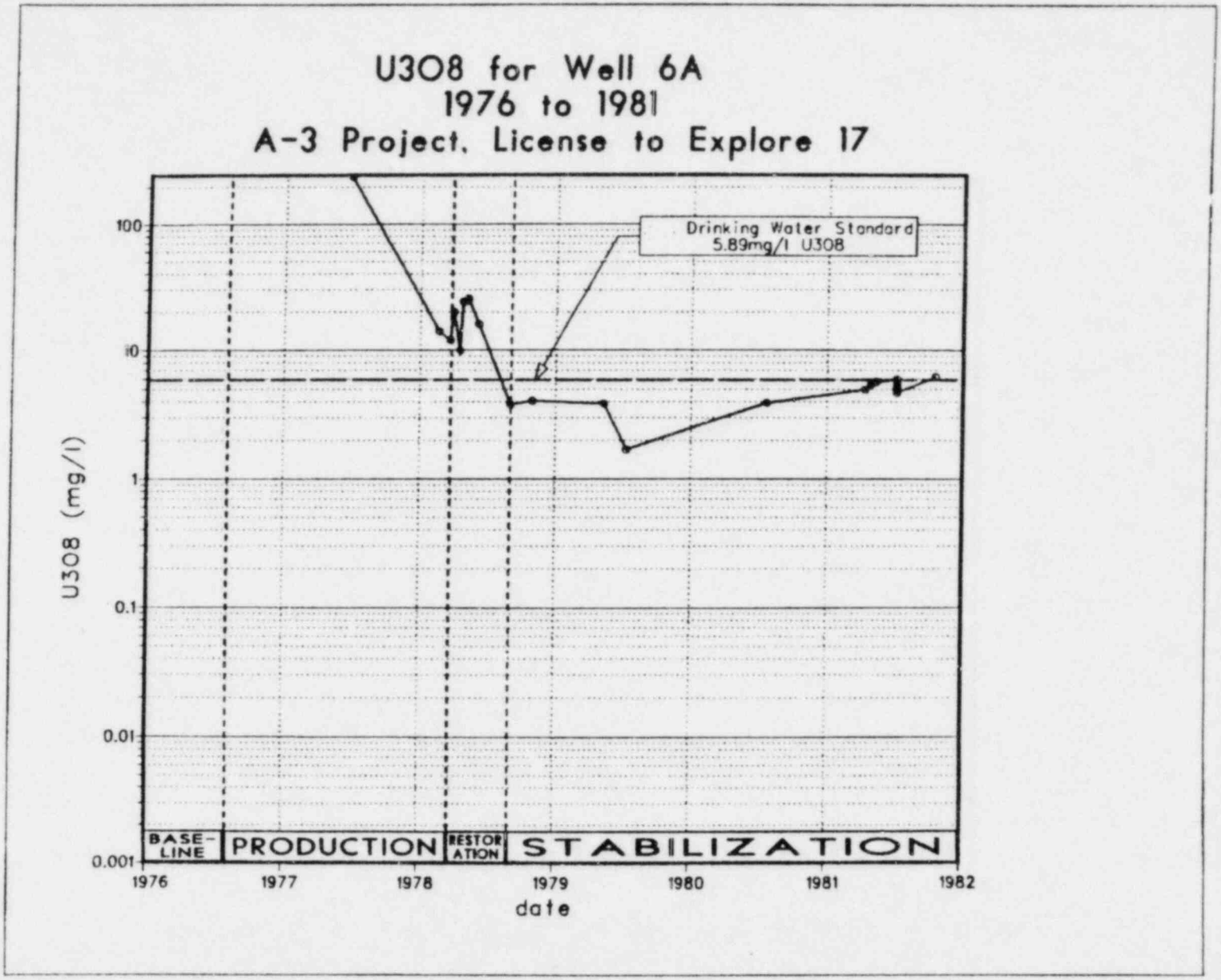

FIG. 19

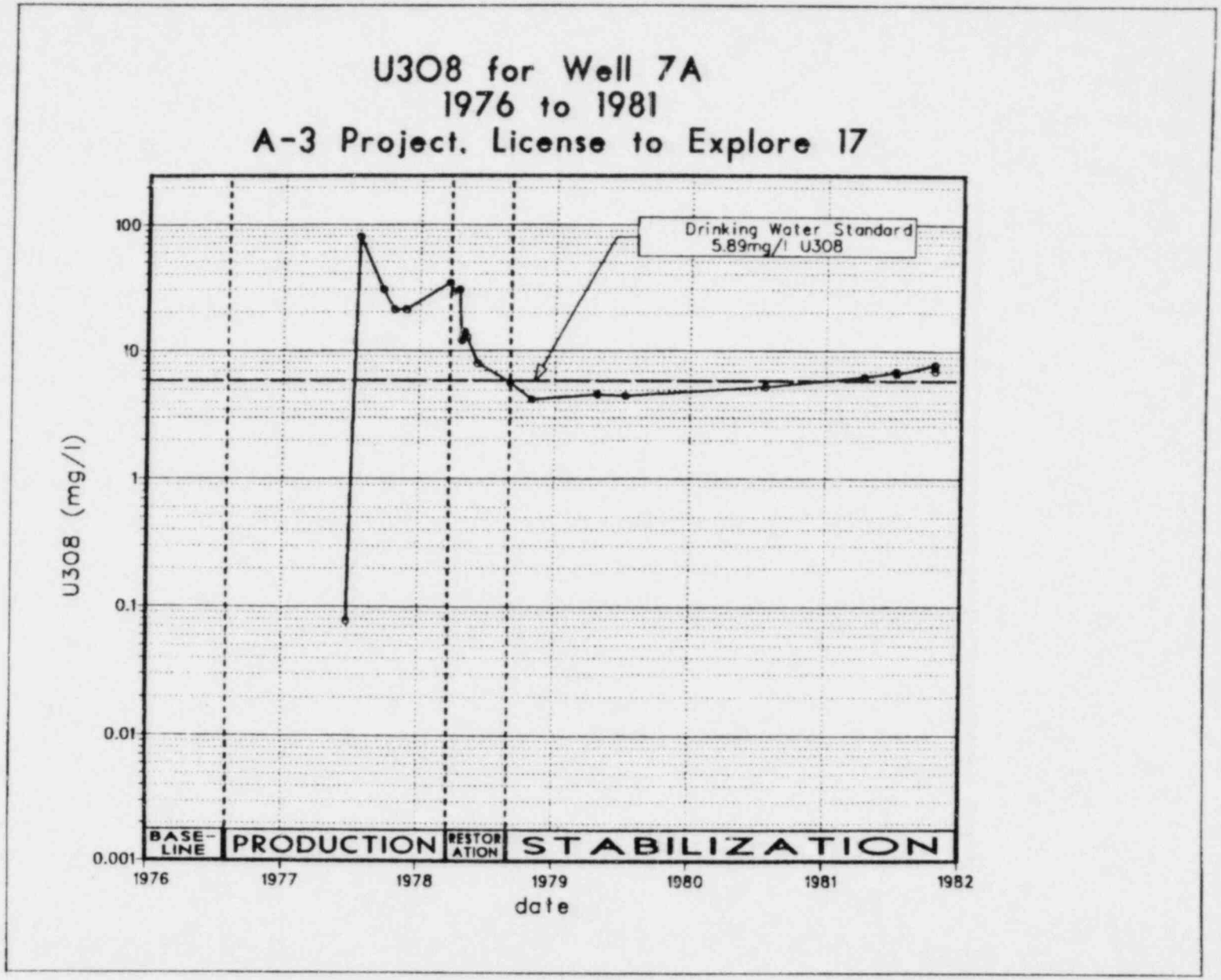

FIG. 20

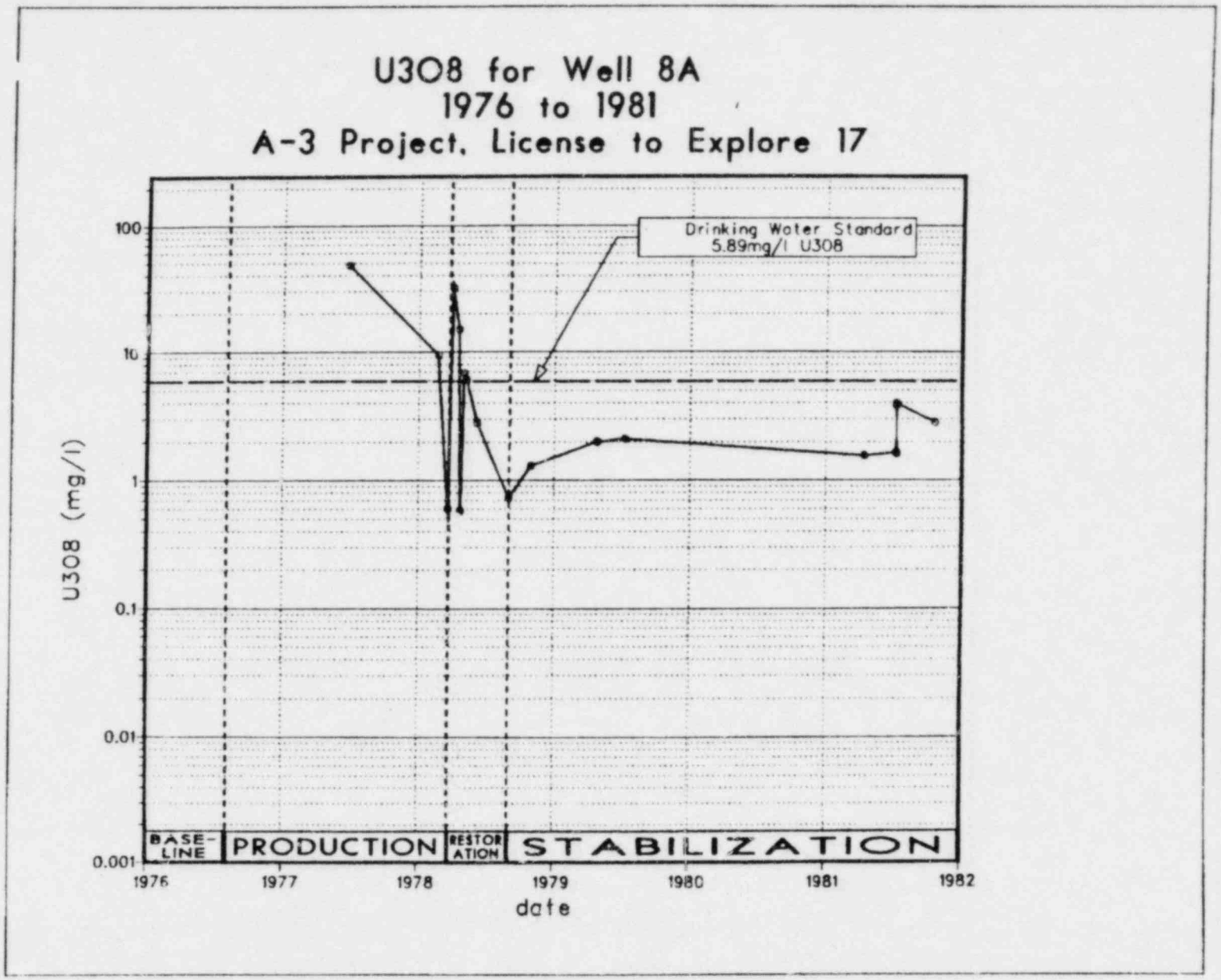

FIG. 21

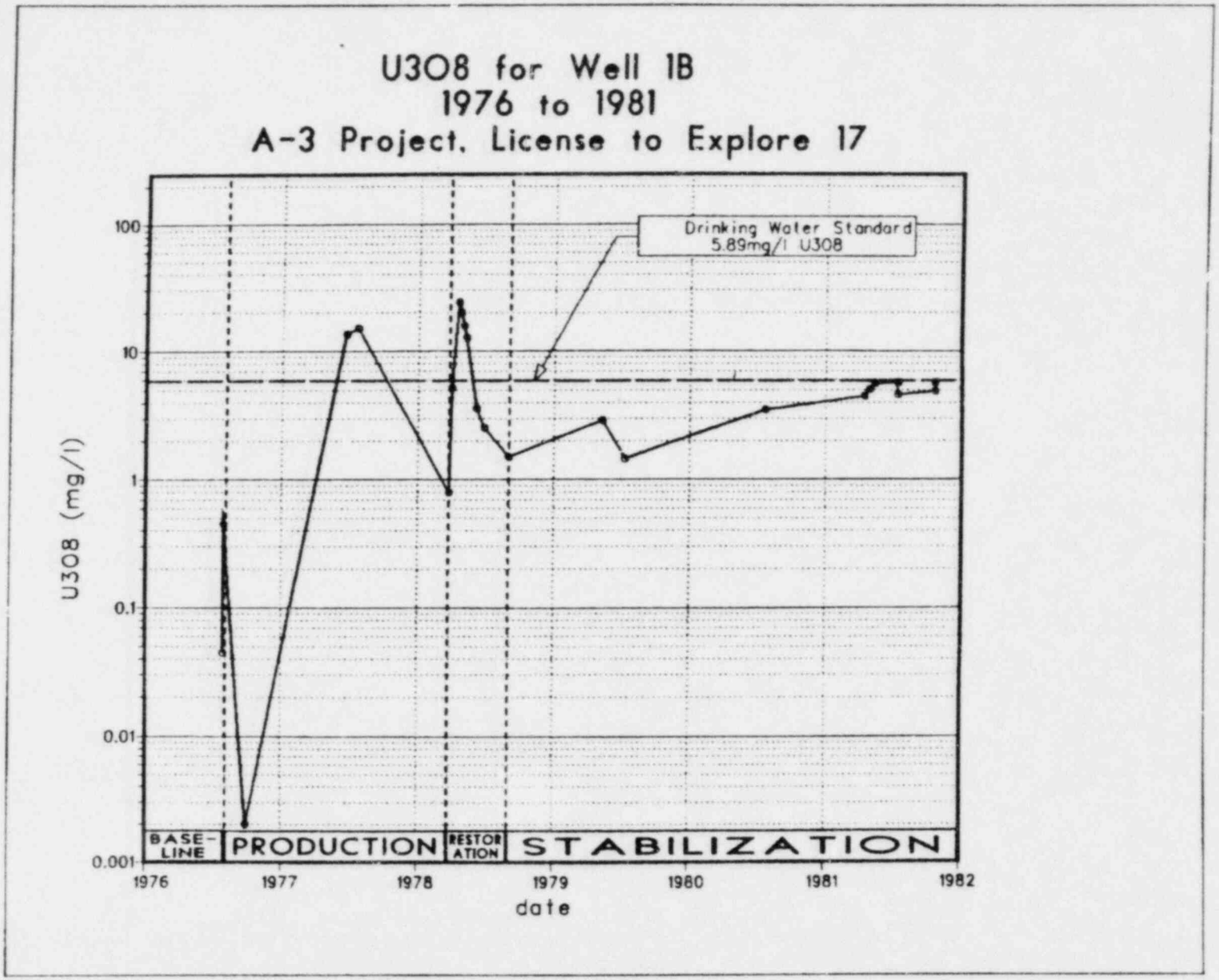

FIG. 22

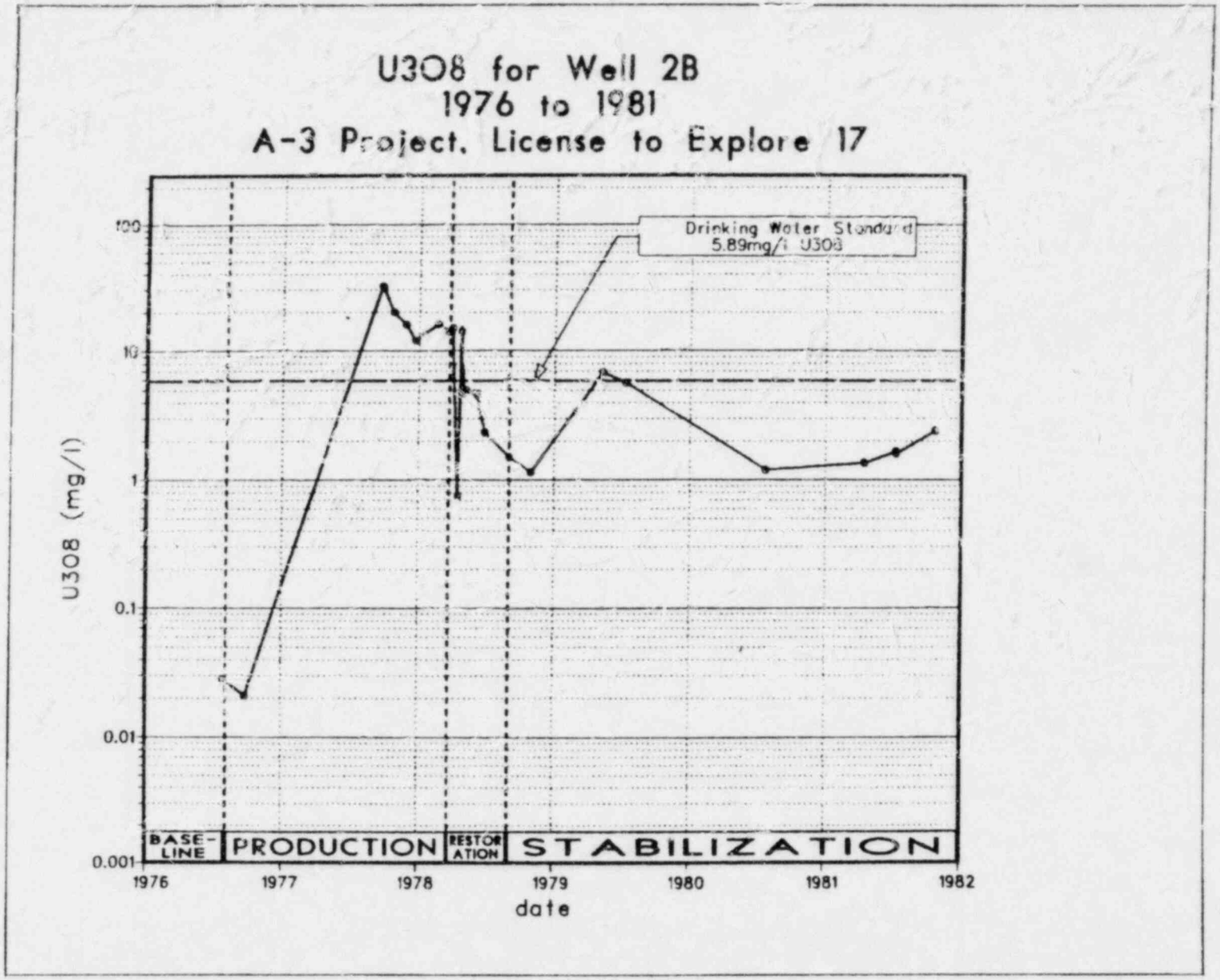
U308 for Well 2B
1976 to 1981
A-3 Project, License to Explore 17
Drinking Water Standard
5.89mg/l U308
U308 (mg/l)
100
10
1
0.1
0.01
0.001
BASE-LINE
PRODUCTION
RESTOR ATION
STABILIZATION
1976
1977
1978
1979
1980
1981
1982
date

FIG. 23

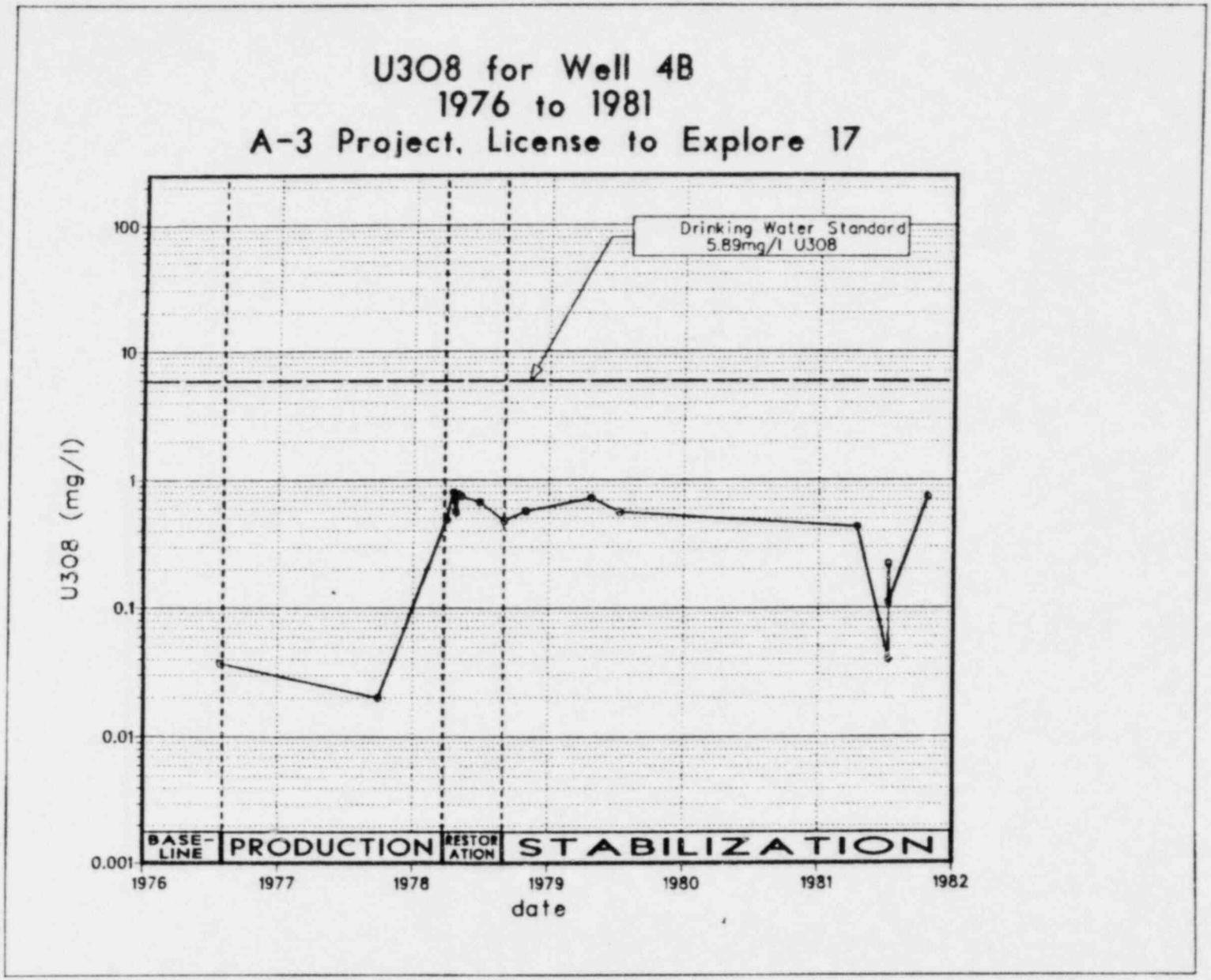
U308 for Well 4B
1976 to 1981
A-3 Project, License to Explore 17
Drinking Water Standard
5.89mg/l U308
U308 (mg/l)
100
10
1
0.1
0.01
0.001
BASE-LINE
PRODUCTION
RESTOR ATION
STABILIZATION
1976
1977
1978
1979
1980
1981
1982
date

FIG. 25

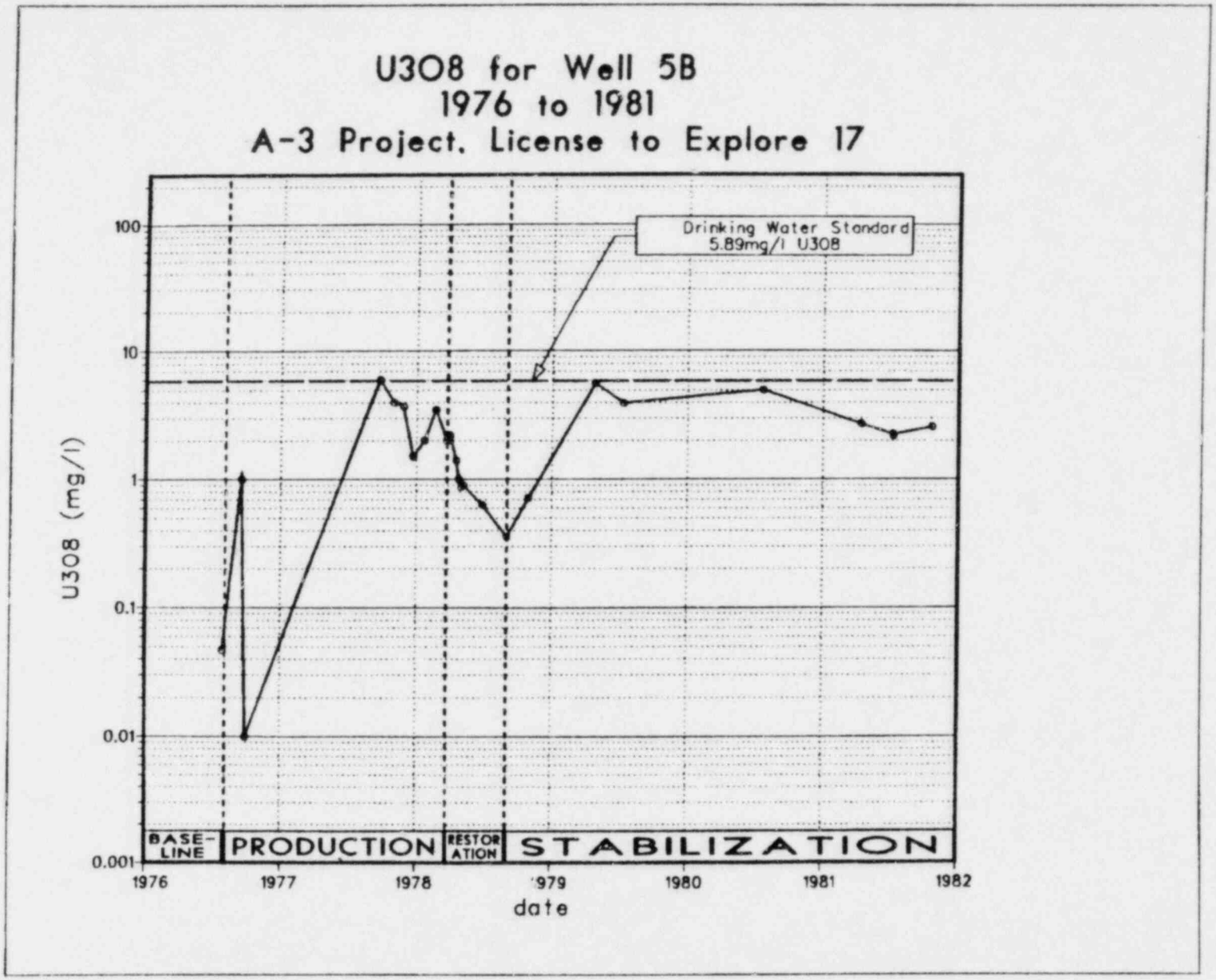
U3O8 for Well 5B
1976 to 1981
A-3 Project, License to Explore 17
Drinking Water Standard
5.89mg/l U3O8
100
10
1
0.1
0.01
0.001
U3O8 (mg/l)
BASE-LINE
PRODUCTION
RESTOR ATION
STABILIZATION
1976
1977
1978
1979
1980
1981
1982
date

FIG. 2

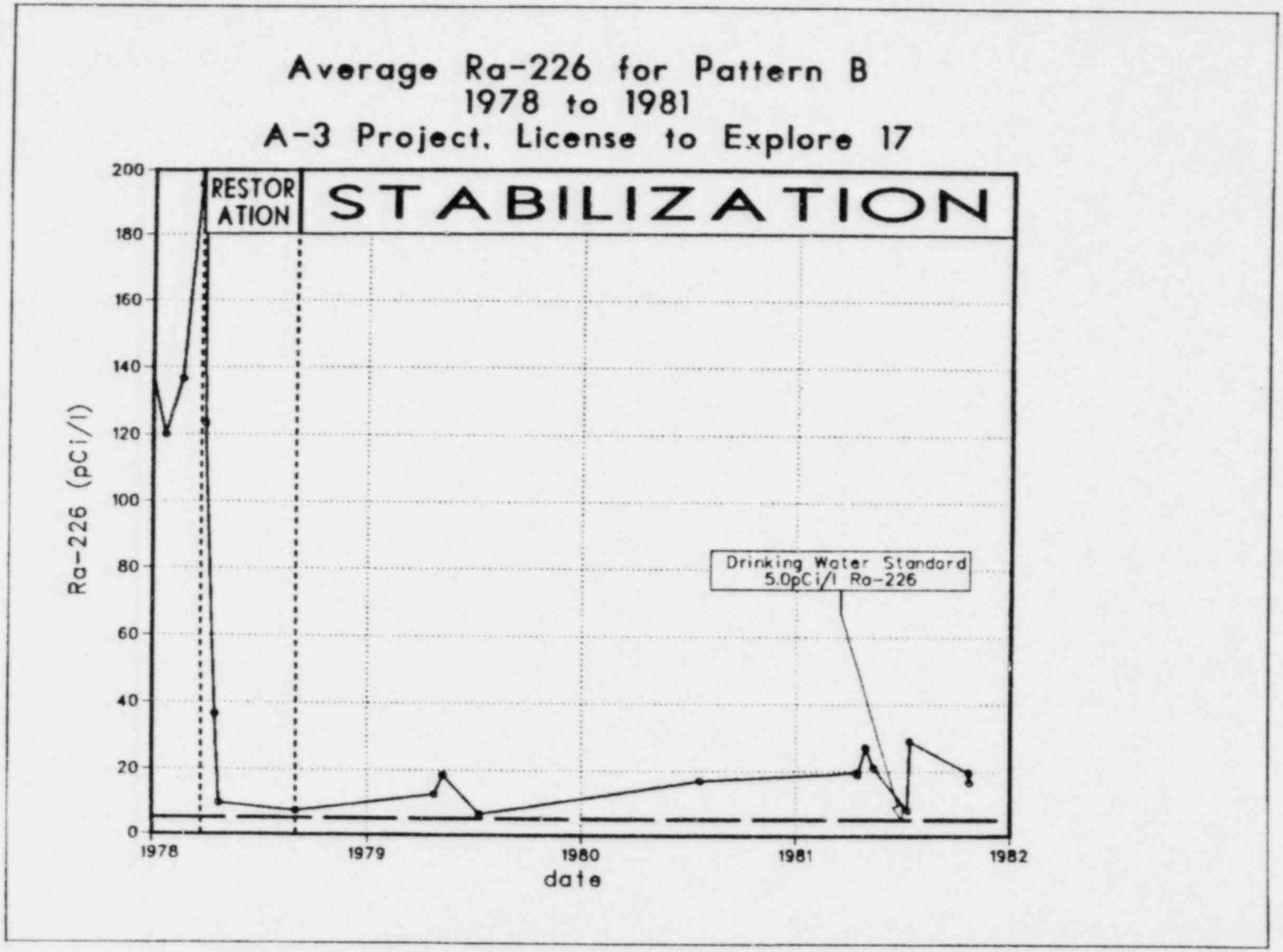
Average Ra-226 for Pattern B
1978 to 1981
A-3 Project, License to Explore 17
RESTOR ATION
STABILIZATION
Drinking Water Standard
5.0pCi/l Ra-226
Ra-226 (pCi/l)
200
180
160
140
120
100
80
60
40
20
0
1978
1979
1980
1981
1982
date

FIG. 27

8790e

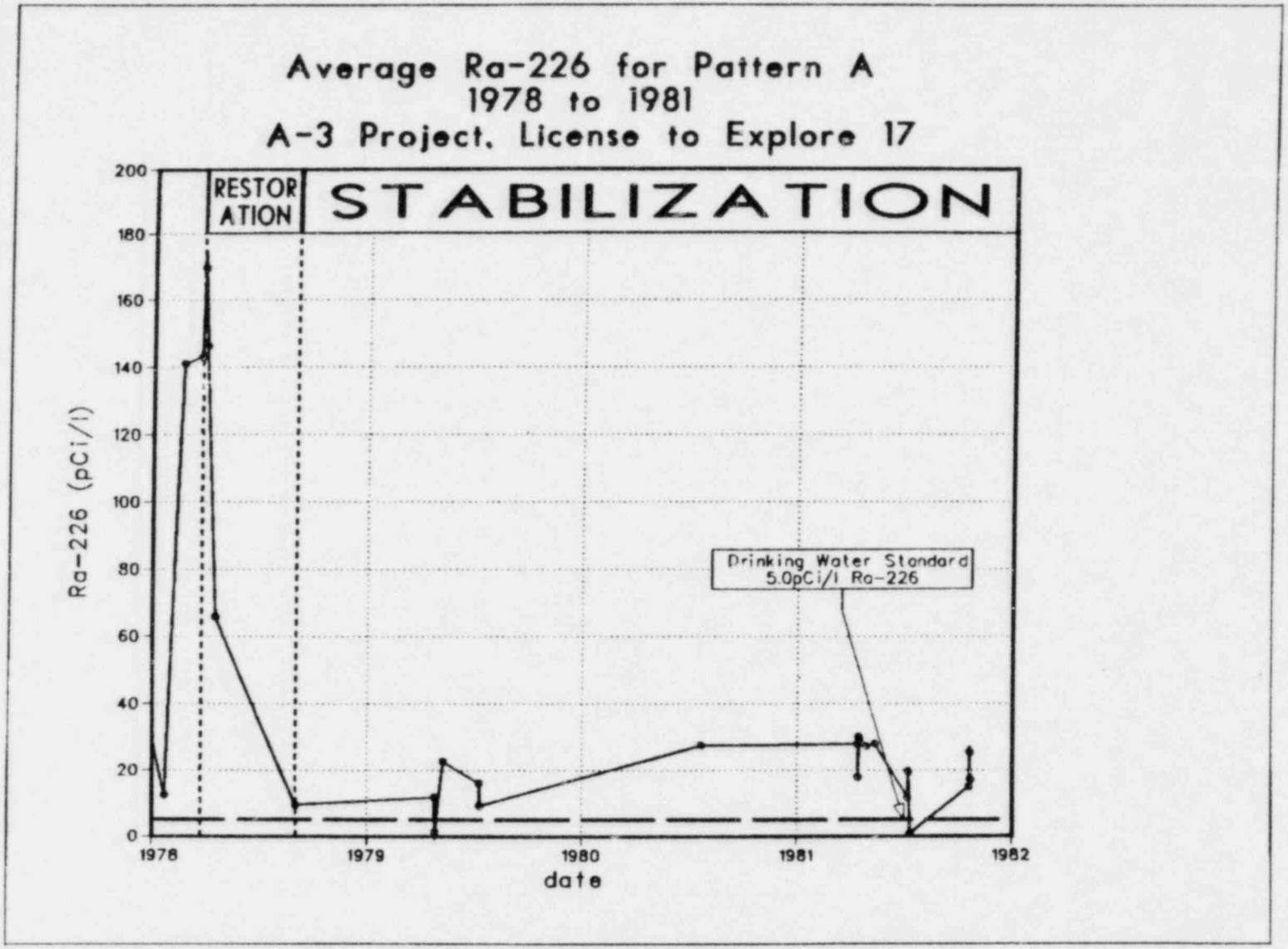

FIG. 28

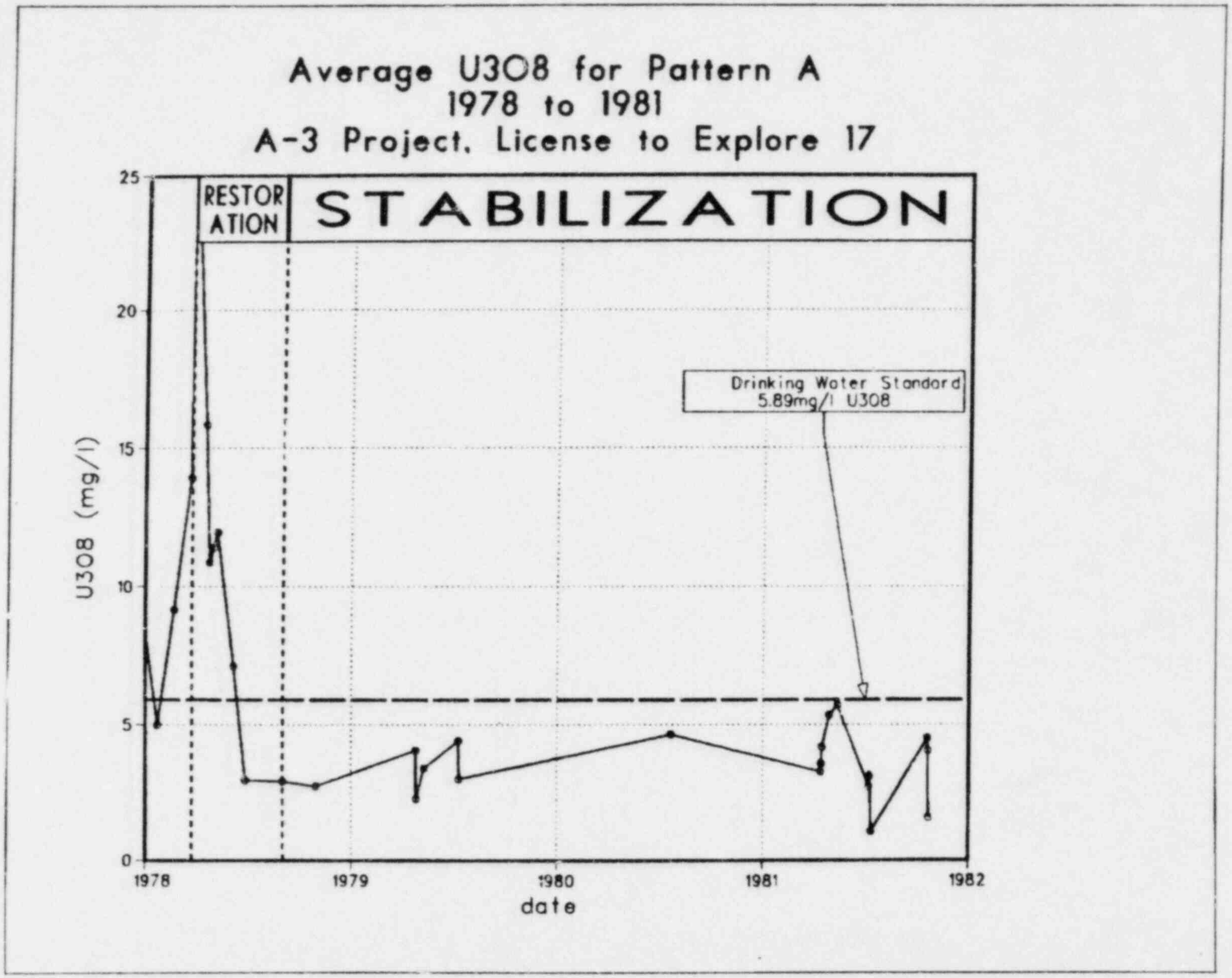

FIG. 29

20648

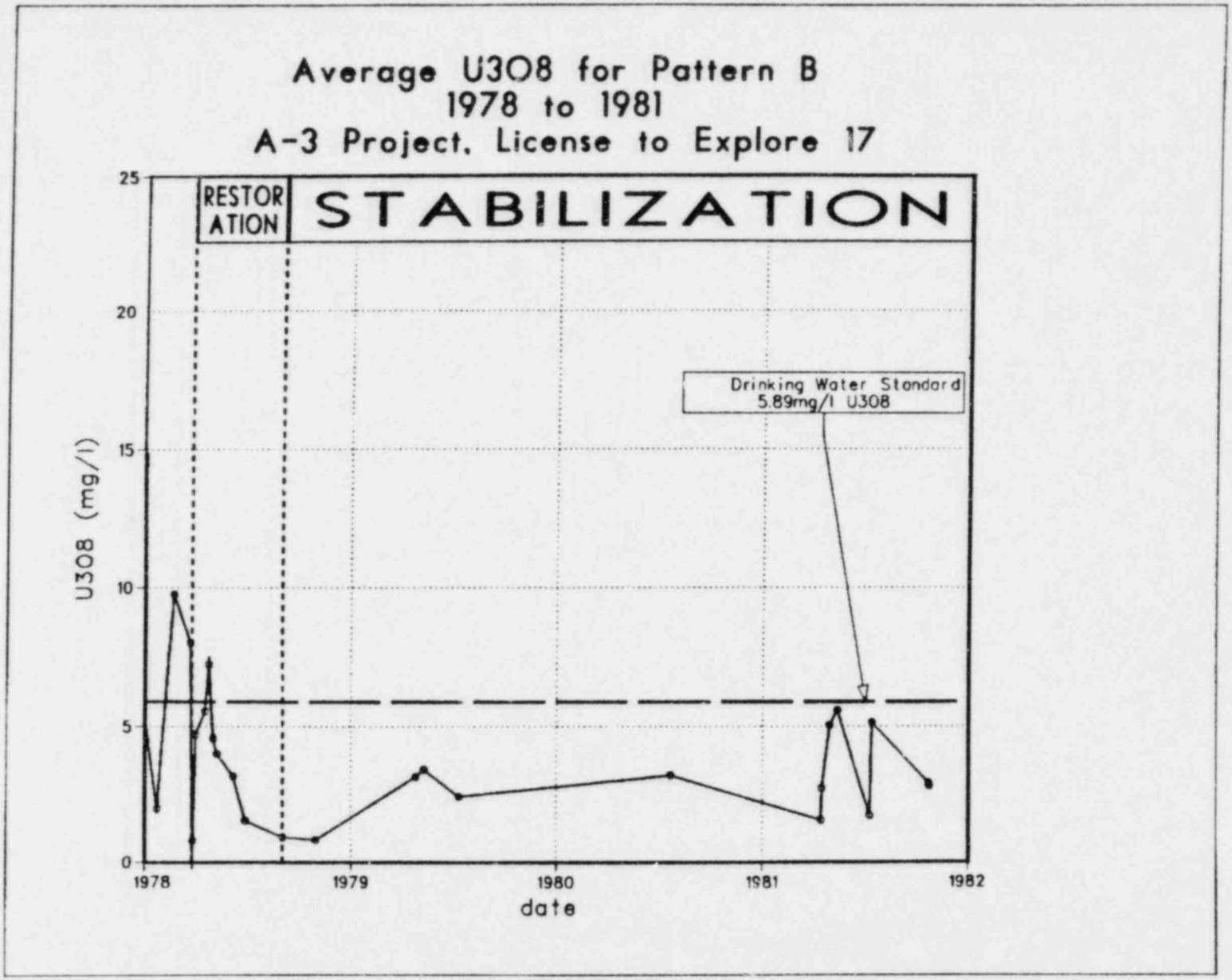

FIG. 30

APPENDIX E

WATER QUALITY ANALYSIS REPORTS

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L-20-4A 4-13-81, 1105
Lab No.		5822
Bicarbonate (as $CaCO_3$)	mg/L	93.7
Carbonate (as $CaCO_3$)	mg/L	7.5
NO_2+ NO_3	mg/L	0.82
Chloride	mg/L	2.2
Fluoride	mg/L	--
Sulfate	mg/L	54.3
TDS	mg/L	162
Conductivity	µmho	230
Uranium (as U_3O_8)	mg/L	0.70
Calculated Charge Balance		
Sum of Cations	meq/L	2.9
Sum of Anions	meq/L	3.2
Sum of Ions	meq/L	6.2
Imbalance	%	-4.6
pH		8.6

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L-20-4A 4-13-81, 1105
Lab No.		5822
Calcium	mg/L	3.7
Copper (total)	mg/L	--
Iron (total)	mg/L	--
Lead (total)	mg/L	--
Magnesium	mg/L	0.15
Manganese (total)	mg/L	--
Potassium	mg/L	0.53
Selenium (total)	mg/L	--
Sodium	mg/L	62.8
Zinc (total)	mg/L	--
SiO_2	mg/L	4.3

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L-20-5A 4-13-81, 1420	L-20-6A 4-13-81, 1725
Lab No.		5823	5824
Bicarbonate (as $CaCO_3$)	mg/L	152	149
Carbonate (as $CaCO_3$)	mg/L	0	0
NO_2 + NO_3	mg/L	0.81	2.28
Chloride	mg/L	3.2	2.8
Fluoride	mg/L	--	--
Sulfate	mg/L	56.0	63.0
TDS	mg/L	236	244
Conductivity	µmho	320	327
Uranium (as U_3O_8)	mg/L	4.19	4.97
Calculated Charge Balance			
Sum of Cations	meq/L	4.5	4.6
Sum of Anions	meq/L	4.3	4.4
Sum of Ions	meq/L	8.8	9.0
Imbalance	%	+2.1	+1.6
pH		7.8	7.8

Copy of Results to:
CH_2M Hill

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L-20-5A 4-13-81, 1420	L-20-6A 4-13-81, 1725
Lab No.		5823	5824
Calcium	mg/L	24.5	26.5
Copper (total)	mg/L	--	--
Iron (total)	mg/L	--	--
Lead (total)	mg/L	--	--
Magnesium	mg/L	0.75	0.76
Manganese (total)	mg/L	--	--
Potassium	mg/L	1.11	1.20
Selenium (total)	mg/L	--	--
Sodium	mg/L	73.0	72.1
Zinc (total)	mg/L	--	--
SiO_2	mg/L	4.1	3.2

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road
Room 105
Tucson, Arizona 85705

Request No. 688-109
Date: 17 June 1981

REPORT OF ANALYSIS

	Sample ID L-20-4A, 4-13-81, 1105 Lab No. 5822			Sample ID L-20-5A, 4-13-81, 1420 Lab No. 5823			Sample ID L-20-6A, 4-13-81, 1725 Lab No. 5824		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	$10^{-9}\mu Ci/mL$			$10^{-9}\mu Ci/mL$			$10^{-9}\mu Ci/mL$		
Radium-226	1.6	$\pm$0.6	1.0	54	$\pm$4	1.0	28	$\pm$3	1.0

Copy of results to:
CH_2M Hill

Gene F. Hayes
Laboratory Director

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WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road
Room 105
Tucson, Arizona 85705

Request No. 693-109
Date: 24 April 1981

REPORT OF ANALYSIS

Customer ID		L-20-3A 4-14-81, 1550	L-20-7A 4-14-81, 1001	L-20-8A 4-14-81, 1300
Lab No.		5853	5854	5855
Bicarbonate (as $CaCO_3$)	mg/L	122	154	135
Carbonate (as $CaCO_3$)	mg/L	0	0	0
$NO_2 + NO_3$	mg/L	<.50	<.50	<.50
Chloride	mg/L	1.9	4.6	2.5
✓ Fluoride	mg/L	--	--	--
Sulfate	mg/L	73.7	107	66.7
TDS	mg/L	246	304	253
Conductivity	µMHO	240	317	270
Uranium (as U_3O_8)	mg/L	2.88	6.32	1.56
Calculated Charge Balance				
Sum of Cations	meq/L	3.6	4.8	4.1
Sum of Anions	meq/L	4.0	5.4	4.2
Sum of Ions	meq/L	7.6	10.2	8.2
Imbalance	%	-5.5	-6.4	-1.3
pH		7.6	7.9	8.1

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L-20-3A 4-14-81, 1550	L-20-7A 4-14-81, 1001	L-20-8A 4-14-81, 1300
Lab No.		5853	5854	5855
Calcium	mg/L	15.1	19.9	10.8
Copper (total)	mg/L	--	--	--
Iron (total)	mg/L	--	--	--
Lead (total)	mg/L	--	--	--
Magnesium	mg/L	0.44	0.50	0.23
Manganese (total)	mg/L	--	--	--
Potassium	mg/L	1.31	1.51	1.23
Selenium (total)	mg/L	--	--	--
Sodium	mg/L	63.9	85.2	79.6
Zinc (total)	mg/L	--	--	--
SiO_2	mg/L	3.2	3.4	3.3

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

Customer ID		LS-1 4-14-81, 1534	LS-2 4-14-81, 1549	GM-1 4-14-81, 0900
Lab No.		5856	5857	5858
Bicarbonate (as $CaCO_3$)	mg/L	153	151	159
Carbonate (as $CaCO_3$)	mg/L	0	0	0
$NO_2 + NO_3$	mg/L	1.81	1.26	<.50
Chloride	mg/L	61	50	6.1
Fluoride	mg/L	--	--	--
Sulfate	mg/L	198	144	53.9
TDS	mg/L	565	469	258
Conductivity	µMHO	630	580	280
Uranium (as U_3O_8)	mg/L	1.60	1.16	<.10
Calculated Charge Balance				
Sum of Cations	meq/L	9.0	7.8	4.2
Sum of Anions	meq/L	8.9	7.4	4.5
Sum of Ions	meq/L	17.9	15.2	8.7
Imbalance	%	+0.4	+2.1	-3.0
pH		7.8	7.9	7.8

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		LS-1 4-14-81, 1534	LS-2 4-14-81, 1549	GM-1 4-14-81, 0900
Lab No.		5856	5857	5858
Calcium	mg/L	90.8	65.2	9.2
Copper (total)	mg/L	--	--	--
Iron (total)	mg/L	--	--	--
Lead (total)	mg/L	--	--	--
Magnesium	mg/L	8.10	6.58	0.41
Manganese (total)	mg/L	--	--	--
Potassium	mg/L	2.80	2.48	0.84
Selenium (total)	mg/L	--	--	--
Sodium	mg/L	85.9	89.7	85.0
Zinc (total)	mg/L	--	--	--
SiO_2	mg/L	6.5	5.8	7.7

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		GM-2 4-14-81 1145	GM-3 4-14-81, 1328	GM-4 4-14-81, 1508
Lab No.		5859	5860	5861
Bicarbonate (as $CaCO_3$)	mg/L	90	86	92.7
Carbonate (as $CaCO_3$)	mg/L	0	0	4.3
$NO_2 + NO_3$	mg/L	1.77	0.97	<.50
Chloride	mg/L	8.3	10.1	7.8
Fluoride	mg/L	--	--	--
Sulfate	mg/L	126	137	74.9
TDS	mg/L	301	342	231
Conductivity	µMHO	301	223	248
Uranium (as U_3O_8)	mg/L	1.18	0.75	0.42
Calculated Charge Balance				
Sum of Cations	meq/L	4.7	5.3	3.6
Sum of Anions	meq/L	4.7	4.9	3.7
Sum of Ions	meq/L	9.4	10.1	7.4
Imbalance	%	+0.6	+3.9	-0.9
pH		7.6	7.7	8.4

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		GM-2 4-14-81, 1145	GM-3 4-14-81, 1328	GM-4 4-14-81, 1508
Lab No.		5859	5860	5861
Calcium	mg/L	50.7	62.4	22.9
Copper (total)	mg/L	--	--	--
Iron (total)	mg/L	--	--	--
Lead (total)	mg/L	--	--	--
Magnesium	mg/L	2.39	2.82	1.30
Manganese (total)	mg/L	--	--	--
Potassium	mg/L	1.94	1.99	0.91
Selenium (total)	mg/L	--	--	--
Sodium	mg/L	45.1	42.9	54.6
Zinc (total)	mg/L	--	--	--
SiO_2	mg/L	6.5	6.9	5.7

Gene F. Hayes
Laboratory Director

20048

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		GM-7 4-14-81, 1638
Lab No.		5862
Bicarbonate (as $CaCO_3$)	mg/L	558
Carbonate (as $CaCO_3$)	mg/L	0
$NO_2 + NO_3$	mg/L	<.50
Chloride	mg/L	13.6
Fluoride	mg/L	--
Sulfate	mg/L	1.2
TDS	mg/L	411
Conductivity	µMHO	830
Uranium (as U_3O_8)	mg/L	<.10
Calculated Charge Balance		
Sum of Cations	meq/L	6.8
Sum of Anions	meq/L	11.6
Sum of Ions	meq/L	18.4
Imbalance	%	-25.6
pH		7.6

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		GM-7 4-14-81, 1638
Lab No.		5862
Calcium	mg/L	54.7
Copper (total)	mg/L	--
Iron (total)	mg/L	--
Lead (total)	mg/L	--
Magnesium	mg/L	5.60
Manganese (total)	mg/L	--
Potassium	mg/L	13.3
Selenium (total)	mg/L	--
Sodium	mg/L	76.2
Zinc (total)	mg/L	--
SiO_2	mg/L	11.3

*Copy of results to:

CH_2M Hill

Gene F. Hayes
Laboratory Director

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WYOMING ANALYTICAL LABORATORIES, INC.

Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road
Room 105
Tucson, Arizona 85705

Request No. 693-109
Date: November 6 1981*

REPORT OF ANALYSIS

Sample ID
L-20-8A,
4-14-81, 1300

Lab No.
5855

	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL		
Radium-226	7.9	±1.4	1.0

* This report is a correction of Request No. 693-109, dated June 17, 1981.

Gene F. Hayes
Laboratory Director

20648

Customer ID		L-20-8A 4-14-81, 1300
Lab No.		5855
Calcium	mg/L	10.8
Copper (total)	mg/L	--
Iron (total)	mg/L	--
Lead (total)	mg/L	--
Magnesium	mg/L	0.23
Manganese (total)	mg/L	--
Potassium	mg/L	1.23
Selenium (total)	mg/L	--
Sodium	mg/L	79.6
Zinc (total)		--
SiO_2	mg/L	3.3

*This report is a correction of Request No. 693-109, dated April 24, 1981.

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

20648

WYOMING ANALYTICAL LABORATORIES, INC.

Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road
Room 105
Tucson, Arizona 85705

Request No. 693-109
Date: 6 November 1981*

REPORT OF ANALYSIS

Customer ID	L-20-8A
	4-14-81, 1300
Lab No.	5855

Bicarbonate (as $CaCO_3$)	mg/L	135
Carbonate (as $CaCO_3$)	mg/L	0
$NO_2 + NO_3$	mg/L	<.50
Chloride	mg/L	2.5
Fluoride	mg/L	--
Sulfate	mg/L	66.7
TDS	mg/L	253
Conductivity	µMHO	270
Uranium (as U_3O_8)	mg/L	1.56
Calculated Charge Balance		
Sum of Cations	meq/L	4.1
Sum of Anions	meq/L	4.2
Sum of Ions	meq/L	8.2
Imbalance	%	-1.3
pH		8.1

*This report is a correction of Request No.693-109, dated April 24, 1981

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road
Room 105
Tucson, Arizona 85705

Request No. 693-109
Date: 17 June 1981

REPORT OF ANALYSIS

	Sample ID L-20-3A, 4-14-81, 1550 Lab No. 5853			Sample ID L-20-7A, 4-14-81, 1001 Lab No. 5854			Sample ID L-20-8A, 4-14-81, 0100 Lab No. 5855		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Radium-226	34	±3	1.0	28	±3	1.0	7.9	±1.4	1.0

Gene F. Hayes
Laboratory Director

20678

WYOMING ANALYTICAL LABORATORIES, INC.
Box 538 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Union Oil of California Page 2 Request No. 693-109

	Sample ID LS-1, 4-14-81, 1534 Lab No. 5856			Sample ID LS-2, 4-14-81, 1549 Lab No. 5857			Sample ID GM-1, 4-14-81, 0900 Lab No. 5858		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Radium-226	2.0	±0.7	1.0	2.4	±0.8	1.0	1.2	±0.5	1.0

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

	Sample ID GM-2, 4-14-81, 1145 Lab No. 5859			Sample ID GM-3, 4-14-81, 1328 Lab No. 5860			Sample ID GM-4, 4-14-81, 1508 Lab No. 5861		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Radium-226	2.1	±0.7	1.0	3.0	±0.9	1.0	0.7	±0.4	1.0

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

	Sample ID GM-7, 4-14-81, 1638		Lab No. 5862
	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL		
Radium-226	5.6	±1.2	1.0

Copy of results to:

CH_2M Hill

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road
Room 105
Tucson, Arizona 85705

Request No. 694-109
Date: 24 April 1981

REPORT OF ANALYSIS

Customer ID		L-20-1A 4-14-81, 1830	L-29-2B 4-15-81, 0445	L-29-3B 4-15-81, 0200
Lab No.		5863	5864	5865
Bicarbonate (as $CaCO_3$)	mg/L	126	102	141
Carbonate (as $CaCO_3$)	mg/L	22	0	0
$NO_2 + NO_3$	mg/L	<.50	<.50	<.50
Chloride	mg/L	3.2	7.5	1.8
Fluoride	mg/L	--	--	--
Sulfate	mg/L	59.7	63.0	48.1
TDS	mg/L	195	224	240
Conductivity	µMHO	231	248	259
Uranium (as U_3O_8)	mg/L	<.10	1.35	2.42
Calculated Charge Balance				
Sum of Cations	meq/L	3.0	3.5	3.9
Sum of Anions	meq/L	4.3	3.6	3.9
Sum of Ions	meq/L	7.3	7.0	7.8
Imbalance	%	-18.2	-1.3	+0.9
pH		8.7	8.3	7.7

20048

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L-20-1A 4-14-81, 1830	L-29-2B 4-15-81, 0445	L-29-3B 4-15-81, 0200
Lab No.		5863	5864	5865
Calcium	mg/L	4.1	8.1	17.3
Copper (total)	mg/L	--	--	--
Iron (total)	mg/L	--	--	--
Lead (total)	mg/L	--	--	--
Magnesium	mg/L	0.09	0.20	0.60
Manganese (total)	mg/L	--	--	--
Potassium	mg/L	0.464	0.914	1.60
Selenium (total)	mg/L	--	--	--
Sodium	mg/L	63.0	69.5	68.6
Zinc (total)	mg/L	--	--	--
SiO_2	mg/L	5.8	2.5	2.6

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L-29-4B 4-14-81, 2350	L-29-5B 4-14-81, 2030
Lab No.		5866	5867
Bicarbonate (as $CaCO_3$)	mg/L	139	157
Carbonate (as $CaCO_3$)	mg/L	0	0
$NO_2 + NO_3$	mg/L	<.50	<.5C
Chloride	mg/L	2.3	4.5
Fluoride	mg/L	--	--
Sulfate	mg/L	46.1	57.2
TDS	mg/L	224	270
Conductivity	µMHO	259	298
Uranium (as U_3O_8)	mg/L	0.43	2.70
Calculated Charge Balance			
Sum of Cations	meq/L	3.7	4.4
Sum of Anions	meq/L	3.8	4.5
Sum of Ions	meq/L	7.5	8.8
Imbalance	%	-0.9	-1.1
pH		7.5	7.6

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L-29-4B 4-14-81, 2350	L-29-5B 4-14-81, 2030
Lab No.		5866	5867
Calcium	mg/L	15.5	22.4
Copper (total)	mg/L	--	--
Iron (total)	mg/L	--	--
Lead (total)	mg/L	--	--
Magnesium	mg/L	0.59	0.92
Manganese (total)	mg/L	--	--
Potassium	mg/L	0.981	1.72
Selenium (total)	mg/L	--	--
Sodium	mg/L	66.4	71.8
Zinc (total)	mg/L	--	--
SiO_2	mg/L	2.8	3.4

*Copy of results to:

CH_2M Hill

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road
Room 105
Tucson, Arizona 85705

Request No. 694-109
Date: 17 June 1981

REPORT OF ANALYSIS

	Sample ID L-20-1A, 4-14-81, 1830		Lab No. 5863	Sample ID L-29-2B, 4-15-81, 0445		Lab No. 5864	Sample ID L-29-3B, 4-15-81, 0200		Lab No. 5865
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Radium-226	1.7	±0.7	1.0	10.9	±1.7	1.0	17.9	±2.1	1.0

Gene F. Hayes
Laboratory Director

20698

WYOMING ANALYTIC... LABORATORIES,INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

	Sample ID L-29-4B, 4-14-81, 2350 Lab No. 5866			Sample ID L-28-5B, 4-14-81, 2030 Lab No. 5867		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL		
Radium-226	9.1	±1.5	1.0	30	±3	1.0

Copy of results to:

CH_2M Hill

Gene F. Hayes
Laboratory Director

20048

Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road
Room 105
Tucson, Arizona 85705

Request No. 696-109

REPORT OF ANALYSIS

Customer ID		GM-5 4-15-81, 1837	GM-6 4-15-81, 1801	GM-8 4-15-81, 1912
Lab No.		5888	5889	5890
Bicarbonate (as $CaCO_3$)	mg/L	158	93.7	174
Carbonate (as $CaCO_3$)	mg/L	0	4.26	0
$NO_2 + NO_3$	mg/L	5.5	3.2	7.2
Chloride	mg/L	9.0	13.8	20.7
Fluoride	mg/L	--	--	--
Sulfate	mg/L	84.7	45.2	97.1
TDS	mg/L	313	237	304
Conductivity	µMHO	430	273	413
Uranium (as U_3O_8)	mg/L	0.16	0.25	0.12
Calculated Charge Balance				
Sum of Cations	meq/L	4.9	2.9	4.9
Sum of Anions	meq/L	5.3	3.5	6.2
Sum of Ions	meq/L	10.1	6.4	11.1
Imbalance	%	-3.8	-9.8	-11.2
pH		7.8	8.4	7.8

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		GM-5 4-15-81, 1837	GM-6 4-15-81, 1801	GM-8 4-15-81, 1912
Lab No.		5888	5889	5890
Calcium	mg/L	37.8	8.2	36.6
Copper (total)	mg/L	--	--	--
Iron (total)	mg/L	--	--	--
Lead (total)	mg/L	--	--	--
Magnesium	mg/L	2.16	0.56	2.88
Manganese (total)	mg/L	--	--	--
Potassium	mg/L	3.35	0.62	3.21
Selenium (total)	mg/L	--	--	--
Sodium	mg/L	62.8	55.5	64.4
Zinc (total)	mg/L	--	--	--
SiO_2	mg/L	6.8	6.4	8.5

Gene F. Hayes
Laboratory Director

2648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L-20-2A 4-15-81, 2035	L-29-1B 4-15-81, 1325
Lab No.		5891	5892
Bicarbonate (as $CaCO_3$)	mg/L	166	410
Carbonate (as CaCO3)	mg/L	0	0
$NO_2 + NO_3$	mg/L	<.5	<.5
Chloride	mg/L	32.0	7.3
Fluoride	mg/L	--	--
Sulfate	mg/L	61.7	69.1
TDS	mg/L	269	284
Conductivity	µmho	342	352
Uranium (as U_3O_8)	mg/L	4.19	4.47
Calculated Charge Balance			
Sum of Cations	meq/L	4.1	4.2
Sum of Anions	meq/L	5.5	9.6
Sum of Ions	meq/L	9.6	13.8
Imbalance	%	-14.9	-39.3
pH		8.2	7.6

87102

Corrected Copy

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L-20-2A 4-15-81, 2035	L-29-1B 4-15-81, 1325
Lab No.		5891	5892
Calcium	mg/L	24.7	27.9
Copper (total)	mg/L	--	--
Iron (total)	mg/L	--	--
Lead (total)	mg/L	--	--
Magnesium	mg/L	0.93	0.98
Manganese (total)	mg/L	--	--
Potassium	mg/L	1.09	1.08
Selenium (total)	mg/L	--	--
Sodium	mg/L	63.2	61.9
Zinc (total)	mg/L	--	--
SiO_2	mg/L	4.3	3.6

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Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road
Room 105
Tucson, Arizona 85705

Request No. 696-109
Date: 17 June 1981

REPORT OF ANALYSIS

	Sample ID GM-5, 4-15-81, 1837 Lab No. 5888			Sample ID GM-6, 4-15-81, 1801 Lab No. 5889			Sample ID GM-8, 4-15-81, 1912 Lab No. 5890		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Radium-226	3.6	±1.0	1.0	1.0	±0.5	1.0	5.5	±1.2	1.0

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

	Sample ID L-20-2A, 4-15-81, 2035 Lab No. 5891			Sample ID L-29-1B, 4-15-81, 1325 Lab No. 5892		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL		
Radium-226	30	±3	1.0	28	±3	1.0

Copy of results to:

CH_2M Hill

Gene F. Hayes
Laboratory Director

84 902

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road
Room 105
Tucson, Arizona 85705

Request No. 720-109
Date: 12 May 1981

REPORT OF ANALYSIS

Customer ID		L-29-1B, 4-29-81, 0230	L-20-6A, 4-28-81, 2359
Lab No.		6027	6028
Bicarbonate (as $CaCO_3$)	mg/L	154	149
Carbonate (as $CaCO_3$)	mg/L	0	0
$NO_2 + NO_3$	mg/L	<.5	<.5
Chloride	mg/L	3.9	4.7
Fluoride	mg/L	--	--
Sulfate	mg/L	16.5	20.2
TDS	mg/L	264	279
Conductivity	µmho	355	368
Uranium (as U_3O_8)	mg/L	5.04	5.34
pH		7.7	7.9
Calculated Charge Balance			
Sum of Cations	meq/L	4.6	4.7
Sum of Anions	meq/L	3.5	3.5
Sum of Ions	meq/L	8.2	8.2
Imbalance	meq/L	+13.5	+14.0

Gene F. Hayes
Laboratory Director

20078

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L-29-1B, 4-29-81, 0230	L-20-6A, 4-28-81, 2359
Lab No.		6027	6028
Calcium	mg/L	23.9	23.1
Copper (total)	mg/L	--	--
Iron (total)	mg/L	--	--
Lead (total)	mg/L	--	--
Magnesium	mg/L	0.840	0.790
Manganese (total)	mg/L	--	--
Potassium	mg/L	1.15	1.29
Selenium (total)	mg/L	--	--
Sodium	mg/L	76.9	78.8
Zinc (total)	mg/L	--	--
SiO_2	mg/L	3.0	2.8

Copy of results to:

CH_2M Hill

Gene F. Hayes
Laboratory Director

WYOMING ANALYTIC. LABORATORIES, INC.

Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

Union Oil of California Request No. 720-109

	Sample ID	Lab No.	Sample ID	Lab No.	Sample ID	Lab No.
	L-29-1B, 4-29-81, 0230	6027	L-20-6A, 4-28-81, 2359	6028		
	Conc. Err.Est.	LLD	Conc. Err.Est.	LLD	Conc. Err.Est.	LLD
	10^{-9} µCi/mL		10^{-9} µCi/mL		10^{-9} µCi/mL	
Thorium-230		0.2		0.2		0.2
Radium-226	27± 2.9	0.2	27.3± 3	0.2		0.2
Lead-210		1.0		1.0		1.0
Polonium-210		1.0		1.0		1.0

20698

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road
Room 105
Tucson, Arizona 85705

Request No. 741-109
Date: 21 May 1981

REPORT OF ANALYSIS

Customer ID		L20-6A, 5-13-81, 1145	L29-1B, 5-13-81, 1545
Lab No.		6173	6174
Bicarbonate (as $CaCO_3$)	mg/L	154	152
Carbonate (as $CaCO_3$)	mg/L	0	0
$NO_2 + NO_3$	mg/L	<0.50	<0.50
Chloride	mg/L	8.8	5.9
Fluoride	mg/L	--	--
Sulfate	mg/L	72.0	65.8
TDS	mg/L	230	226
Conductivity	µmho	300	290
Uranium (as U_3O_8)	mg/L	5.69	5.60
Calculated Charge Balance			
Sum of Cations	meq/L	4.8	4.6
Sum of Anions	meq/L	4.8	4.6
Sum of Ions	meq/L	9.6	9.2
Imbalance	%	-0.4	+0.8
pH		7.7	7.7

20648

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Customer ID		L20-6A, 5-13-81, 1145	L29-1B, 5-13-81, 1545
Lab No.		6173	6174
Calcium	mg/L	23.7	23.4
Copper (total)	mg/L	--	--
Iron (total)	mg/L	--	--
Lead (total)	mg/L	--	--
Mangesium	mg/L	0.81	0.88
Manganese (total)	mg/L	--	--
Potassium	mg/L	1.36	1.28
Selenium (total)	mg/L	--	--
Sodium	mg/L	80.5	77.6
Zinc (total)	mg/L	--	--
SiO_2	mg/L	2.7	3.0

Copy of results to:

CH_2M Hill

Gene F. Hayes
Laboratory Director

20978

Union Oil of California

Request No. 741-109

	Sample ID L20-6A, 5-13-81, 1145		Lab No. 6173	Sample ID L29-1B, 5-13-81, 1545		Lab No. 6174	Sample ID		Lab No.
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Thorium-230	--	--	0.2	--	--	0.2			0.2
Radium-226	28	±3	0.2	21.0	±2.5	0.2			0.2
Lead-210	--	--	1.0	--	--	1.0			1.0
Polonium-210	--	--	1.0	--	--	1.0			1.0
Uranium (as U)	--	--	0.2	--	--	0.2			0.2

Gene F. Hayes
Laboratory Director

87902

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

WYOMING ANALYTIC. . LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road, Room 105
Tucson, AZ 85705

Request No. 800-109
Date: 16 July 1981

REPORT OF ANALYSIS

Customer ID		L20-1A, 18:21, 7-8-81	L20-6A, 15:34, 7-8-81	ID, AGGVVSLK	L20-1A 1821-7-8-81 2D, ATTD-DTUD
Lab No.		6574	6575	6576	6577
Bicarbonate (as $CaCO_3$)	mg/L	81.4	148	148	81.9
Carbonate (as $CaCO_3$)	mg/L	7.4	0	0	7.4
Conductivity	µmho	298	415	420	299
$NO_2 + NO_3$	mg/L	<.50	<.50	<.50	<.50
pH	mg/L	8.6	8.0	7.8	8.6
Chloride	mg/L	4.7	8.1	7.2	5.1
Sulfate	mg/L	58.4	76.1	77.4	58.0
TDS	mg/L	164	257	262	169
SiO_2	mg/L	5.8	3.2	3.4	5.1

Gene F. Hayes
Laboratory Director

84902

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

Union Oil of California Page 2 Request No. 800-109

Customer ID		field filtered-preserved L20-1A, 18:21, 7-8-81	L20-6A, 15:34, 7-8-81	L20-6A 15:34 7-8-81 ID, AGGVVSLK	L20-1A 18:21 7-8-81 2D, ATTD-DTUD
Lab No.		6574	6575	6576	6577
Calcium	mg/L	3.76	26.3	26.2	3.42
Magnesium	mg/L	0.080	0.810	0.800	0.074
Potassium	mg/L	0.514	1.38	1.38	0.520
Sodium	mg/L	70.3	78.5	77.8	67.4
Uranium (as U_3O_8)	mg/L	0.032	5.94	5.93	0.028
Calculated Charge Balance					
Sum of Cations	meq/L	3.3	4.8	4.8	3.1
Sum of Anions	meq/L	3.1	4.8	4.8	3.1
Sum of Ions	meq/L	6.4	9.6	9.6	6.3
Imbalance	%	+2.2	+0.6	+0.2	-0.2

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

field filtered-unpreserved

Customer ID		L20-1A, 18:21, 7-8-81	L20-6A, 15:34, 7-8-81	L20-6A 15:34 7-8-81 ID, AGGVVSLK	L20-1A 18:21 7-8-81 2D, ATTD-DTUD
Lab No.		6574	6575	6576	6577
Calcium	mg/L	3.10	26.7	26.1	3.09
Magnesium	mg/L	0.064	0.760	0.760	0.063
Potassium	mg/L	0.493	1.27	1.26	0.490
Sodium	mg/L	68.5	80.8	79.4	67.8
Uranium (as U_3O_8)	mg/L	0.017	5.80	5.43	0.019

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Union Oil of California Page 4 Request No. 800-109

unfiltered-unpreserved

Customer ID		L20-1A, 18:21, 7-8-81	L20-6A, 15:34, 7-8-81	L20-6A 15:34 7-8-81 ID, AGGVVSLK	L20-1A 18:21 7-8-81 2D, ATTD-DTUD
Lab No.		6574	6575	6576	6577
Calcium	mg/L	3.12	26.4	26.3	3.07
Magnesium	mg/L	0.066	0.770	0.760	0.062
Potassium	mg/L	0.486	1.28	1.26	0.487
Sodium	mg/L	69.5	80.9	79.5	67.5
Uranium (as U_3O_8)	mg/L	0.021	5.64	5.05	0.015

Copy of results to:

CH_2M Hill

Gene F. Hayes
Laboratory Director

20648

Union Energy Mining Division Request No. 800-109 16 September 1981

L20-6A 15:34 7-8-81

	Sample ID L20-1A, 18:21, 7-8-81 Lab No. 6574			Sample No. L20-6A, 15:34, 7-8-81 Lab No. 6575			Sample ID ID, AGGVVSLK Lab No. 6576		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat			0.2			0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	1.0	0.5	0.2	16.6	1.9	0.2	19.3	2.1	0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

	Sample ID L20-1A 18-21 7-8-81 2D,ATTD-DTUD	Lab No. 6577		Sample No.	Lab No.		Sample ID	Lab No.	
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat			0.2			0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	2.2	0.7	0.2			0.2			0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road, Room 105
Tucson, AZ 85705

Request No. 802-109
Date: 17 July 1981

REPORT OF ANALYSIS

Customer ID		L-20-7A, 7-9-81, 10:55	L-20-8A, 7-9-81, 10:55
Lab No.		6584	6585
Bicarbonate (as $CaCO_3$)	mg/L	155	138
Carbonate (as $CaCO_3$)	mg/L	0	0
Conductivity	µmho	410	353
$NO_2 + NO_3$	mg/L	<.50	<.50
pH	mg/L	7.9	8.1
Chloride	mg/L	7.2	5.4
Sulfate	mg/L	82.3	67.9
TDS	mg/L	268	226
SiO_2	mg/L	3.2	3.2

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

field filtered-preserved

Customer ID		L-20-7A, 7-9-81, 10:55	L-20-8A, 7-9-81, 10:55
Lab No.		6584	6585
Calcium	mg/L	21.9	17.3
Magnesium	mg/L	0.590	0.263
Potassium	mg/L	1.52	1.20
Sodium	mg/L	88.3	82.0
Uranium (as U_3O_8)	mg/L	6.92	1.65
Calculated Charge Balance			
Sum of Cations	meq/L	5.0	4.5
Sum of Anions	meq/L	5.0	4.3
Sum of Ions	meq/L	10.0	8.8
Imbalance	%	+0.1	+1.8

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-79[illegible] LARAMIE, WYOMING 82070

Union Oil of California Page 3 Request No. 802-109

field filtered-unpreserved

Customer ID		L-20-7A, 7-9-81, 10:55	L-20-8A, 7-9-81, 10:55
Lab No.		6584	6585
Calcium	mg/L	21.9	10.8
Magnesium	mg/L	0.590	0.250
Potassium	mg/L	1.51	1.19
Sodium	mg/L	87.7	83.0
Uranium (as U_3O_8)	mg/L	6.85	1.65

Gene F. Hayes
Laboratory Director

87906

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

unfiltered-unpreserved

Customer ID		L-20-7A, 7-9-81, 10:55	L-20-8A, 7-9-81, 10:55
Lab No.		6584	6585
Calcium	mg/L	22.0	10.5
Magnesium	mg/L	0.600	0.251
Potassium	mg/L	1.50	1.19
Sodium	mg/L	87.3	83.5
Uranium (U_3O_8)	mg/L	6.70	1.61

Copy of results to:

CH_2M Hill

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.

Box 608 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road, Room 105
Tucson, AZ 85705

Request No. 802-109
Date: 6 November 1981*

REPORT OF ANALYSIS

Customer ID	L20-8A, 7/9/81, 1321
Lab No.	6585

Bicarbonate (as $CaCO_3$)	mg/L	138
Carbonate (as $CaCO_3$)	mg/L	0
Conductivity	µmho	353
$NO_2 + NO_3$	mg/L	<.50
pH		8.1
Chloride	mg/L	5.4
Sulfate	mg/L	67.9
TDS	mg/L	226
SiO_2	mg/L	3.2

*This report is a correction of Request No. 802-109, dated July 17, 1981.

Gene F. Hayes
Laboratory Director

20648

field filtered-preserved

Customer ID	L20-8A, 7/9/81, 1321
Lab No.	6585

Calcium	mg/L	17.3
Magnesium	mg/L	0.263
Potassium	mg/L	1.20
Sodium	mg/L	82.0
Uranium (as U_3O_8)	mg/L	1.65
Calculated Charge Balance		
Sum of Cations	meq/L	4.5
Sum of Anions	meq/L	4.3
Sum of Ions	meq/L	8.8
Imbalance	%	+1.8

*This report is a correction of Request No. 802-109, dated July 17, 1981.

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

20648

field filtered-unpreserved

Customer ID		L20-8A, 7/9/81, 1321
Lab No.		6585
Calcium	mg/L	10.8
Magnesium	mg/L	0.250
Potassium	mg/L	1.19
Sodium	mg/L	83.0
Uranium (as U_3O_8)	mg/L	1.65

*This report is a correction of Request No. 802-109, dated July 17, 1981.

Gene F. Hayes
Laboratory Director

unfiltered-unpreserved

Customer ID		L20-8A, 7/9/81, 1321
Lab No.		6585
Calcium	mg/L	10.5
Magnesium	mg/L	0.251
Potassium	mg/L	1.19
Sodium	mg/L	83.5
Uranium (U_3O_8)	mg/L	1.61

*This report is a correction of Request No. 802-109, dated July 17, 1981.

Gene F. Hayes
Laboratory Director

Union Energy Mining Division Request No. 802-109 16 September 1981

	Sample ID L20-7A, 10:55, 7-9-81		Lab No. 6584	Sample No. L20-8A, 13:21, 7-9-81		Lab No. 6585	Sample ID		Lab No.
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat			0.2			0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	27	3	0.2	4.8	1.1	0.2			0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road, Room 105
Tucson, AZ 85705

Request No. 805-109
Date: 23 July 1981

REPORT OF ANALYSIS

Customer ID		L20-2A, 7-9-81, 15:55	L20-3A, 7-9-81, 23:19	L20-4A, 7-9-81, 20:54	L20-5A, 7-9-81, 18:28	L29-4B, 7-10-81, 16:01	L29-5B, 7-10-81, 13:17
Lab No.		6596	6597	6598	6599	6600	6601
Bicarbonate (as $CaCO_3$)	mg/L	168	121	65	162	142	153
Carbonate (as $CaCO_3$)	mg/L	0	0	30	0	0	0
Conductivity	µmho	287	222	200	276	230	271
$NO_2 + NO_3$	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
pH	mg/L	8.2	8.3	9.0	8.1	8.1	8.1
Chloride	mg/L	8.08	6.68	8.51	9.37	5.60	10.2
Sulfate	mg/L	42.0	32.1	40.3	50.2	36.2	55.1
TDS	mg/L	258	198	172	250	208	246
SiO_2	mg/L	4.5	3.1	4.4	5.5	3.3	3.0

Gene F. Hayes
Laboratory Director

WYOMING ANALYTIC[illegible] LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

field filtered-preserved

Customer ID		L20-2A, 7-9-81, 15:55	L20-3A, 7-9-81, 23:19	L20-4A, 7-9-81, 20:54	L20-5A, 7-9-81, 18:28	L29-4B, 7-10-81, 16:01	L29-5B, 7-10-81, 13:17
Lab No.		6596	6597	6598	6599	6600	6601
Calcium	mg/L	28.2	14.5	3.40	25.2	15.9	22.3
Magnesium	mg/L	0.810	0.389	0.061	0.740	0.590	0.900
Potassium	mg/L	1.19	1.21	0.529	1.25	1.05	1.69
Sodium	mg/L	77.3	71.2	65.9	82.2	73.9	81.7
Uranium (as U_3O_8)	mg/L	4.07	2.29	0.10	3.93	0.04	2.23
Calculated Charge Balance							
Sum of Cations	meq/L	4.9	3.9	3.1	4.9	4.1	4.8
Sum of Anions	meq/L	4.5	3.3	3.0	4.6	3.8	4.5
Sum of Ions	meq/L	9.3	7.2	6.0	9.5	7.8	9.3
Imbalance	%	+4.3	+8.4	+1.2	+4.0	+4.2	+3.1

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Union Oil of California Page 3 Request No. 805-109

field filtered, unpreserved

Customer ID		L20-2A, 7-9-81, 15:55	L20-3A, 7-9-81, 23:19	L20-4A, 7-9-81, 20:54	L20-5A, 7-9-81, 18:28	L29-4B, 7-10-81, 16:01	L29-5B, 7-10-81, 13:17
Lab No.		6596	6597	6598	6599	6600	6601
Calcium	mg/L	28.5	14.7	3.40	25.0	16.6	22.4
Magnesium	mg/L	0.800	0.390	0.062	0.780	0.630	0.890
Potassium	mg/L	1.19	1.22	0.524	1.25	1.05	1.68
Sodium	mg/L	77.8	71.7	68.5	85.8	76.6	80.3
Uranium (as U_3O_8)	mg/L	3.86	2.13	0.11	3.80	0.22	2.18

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Union Oil of California Page 4 Request No. 805-109

unfiltered-unpreserved

Customer ID		L20-2A, 7-9-81, 15:55	L20-3A, 7-9-81, 23:19	L20-4A, 7-9-81, 20:54	L20-5A, 7-9-81, 18:28	L29-4B, 7-10-81, 16:01	L29-5B, 7-10-81, 13:17
Lab No.		6596	6597	6598	6599	6600	6601
Calcium	mg/L	28.3	14.9	3.40	25.2	16.6	22.5
Magnesium	mg/L	0.810	0.394	0.065	0.770	0.580	0.940
Potassium	mg/L	1.19	1.22	0.524	1.24	1.05	1.69
Sodium	mg/L	76.9	71.7	67.5	81.4	75.5	82.4
Uranium (U_3O_8)	mg/L	3.99	2.45	0.10	3.93	0.11	2.23

Copy of results to:

CH_2M Hill

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.

Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road, Room 105
Tucson, AZ 85705

Request No. 805-109
Date: 6 November, 1981*

REPORT OF ANALYSIS

Customer ID		L20-8A, 7/9/81, 18:48
Lab No.		6599
Bicarbonate (as $CaCO_3$)	mg/L	162
Carbonate (as $CaCO_3$)	mg/L	0
Conductivity	µmho	276
$NO_2 + NO_3$	mg/L	<0.50
pH		8.1
Chloride	mg/L	9.37
Sulfate	mg/L	50.2
TDS	mg/L	250
SiO_2	mg/L	5.5

*This report is a correction of Request No. 805-109, dated July 1981.

Gene F. Hayes
Laboratory Director

field filtered-preserved

Customer ID		L20-8A, 7/9/81, 18:48
Lab No.		6599
Calcium	mg/L	25.2
Magnesium	mg/L	0.740
Potassium	mg/L	1.25
Sodium	mg/L	82.2
Uranium (as U_3O_8)	mg/L	3.93
Calculated Charge Balance		
Sum of Cations	meq/L	4.9
Sum of Anions	meq/L	4.6
Sum of Ions	meq/L	9.5
Imbalance	%	+4.0

*This report is a correction of Request No. 805-109, dated July 23, 1981.

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
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Customer ID	L20-8A, 7/9/81, 18:48
Lab No.	6599

Calcium	mg/L	25.0
Magnesium	mg/L	0.780
Potassium	mg/L	1.25
Sodium	mg/L	85.8
Uranium (as U_3O_8)	mg/L	3.80

*This report is a correction of Request No. 805-109, dated July 23, 1981.

Gene F. Hayes
Laboratory Director

unfiltered-unpreserved

Customer ID	L20-8A, 7/9/81, 18:48
Lab No.	6599

Calcium	mg/L	25.2
Magnesium	mg/L	0.770
Potassium	mg/L	1.24
Sodium	mg/L	81.4
Uranium (U_3O_8)	mg/L	3.93

*This report is a correction of Request No. 805-109, dated July 23, 1981.

Gene F. Hayes
Laboratory Director

Union Energy Mining Division Request No. 805-109 16 September 1981

	Sample ID L20-2A, 15:55, 7-9-81 Lab No. 6596			Sample No. L20-3A, 23:19, 7-9-81 Lab No. 6597			Sample ID L20-4A, 20:54, 7-9-81 Lab No. 6598		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat			0.2			0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	24	3	0.2	25	3	0.2	1.4	0.6	0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

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WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

	Sample ID Lab No. L20-5A, 18:28, 6599 7-9-81			Sample No. Lab No. L29-4B, 16:01, 6600 7-10-81			Sample ID Lab No. L29-5B, 13:17, 6601 7-10-81		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat			0.2			0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	36	3	0.2	3.7	1.0	0.2	15.8	2.0	0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

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WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

WYOMING ANALYTIC . LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

Bill Volk
Union Oil of California
1846 W. Grant Road, Room 105
Tucson, AZ 85705

Request No. 806-109
Date: 23 July 1981

REPORT OF ANALYSIS

Customer ID		L29-2B, 7-10-81, 20:41	L29-3B, 7-10-81, 18:23
Lab No.		6602	6603
Bicarbonate (as $CaCO_3$)	mg/L	102	146
Carbonate (as $CaCO_3$)	mg/L	4	0
Conductivity	µmho	257	264
$NO_2 + NO_3$	mg/L	<0.50	<0.50
pH	mg/L	8.4	8.0
Chloride	mg/L	11.1	4.31
Sulfate	mg/L	65.0	55.1
TDS	mg/L	216	214
SiO_2	mg/L	3.1	3.0

Gene F. Hayes
Laboratory Director

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WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

field filtered-preserved

Customer ID		L29-2B, 7-10-81, 20:41	L29-3B, 7-10-81, 18:23
Lab No.		6602	6603
Calcium	mg/L	8.50	17.9
Magnesium	mg/L	0.212	0.630
Potassium	mg/L	1.05	1.55
Sodium	mg/L	79.6	77.7
Uranium (as U_3O_8)	mg/L	1.65	3.02
Calculated Charge Balance			
Sum of Cations	meq/L	3.9	4.4
Sum of Anions	meq/L	3.8	4.2
Sum of Ions	meq/L	7.7	8.5
Imbalance	%	+1.9	+2.1

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

field filtered-unpreserved

Customer ID		L29-2B, 7-10-81, 20:41	L29-3B, 7-10-81, 18:23
Lab No.		6602	6603
Calcium	mg/L	8.50	17.9
Magnesium	mg/L	0.211	0.620
Potassium	mg/L	1.05	1.54
Sodium	mg/L	79.3	78.7
Uranium (as U_3O_8)	mg/L	1.62	2.99

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

unfiltered-unpreserved

Customer ID		L29-2B, 7-10-81, 20:41	L29-3B, 7-10-81, 18:23
Lab No.		6602	6603
Calcium	mg/L	8.40	17.8
Magnesium	mg/L	0.209	0.640
Potassium	mg/L	1.05	1.55
Sodium	mg/L	79.1	78.4
Uranium (as U_3O_8)	mg/L	1.59	2.97

Copy of results to:

CH_2M Hill

Gene F. Hayes
Laboratory Director

20648

Union Energy Mining Division Request No. 806-109 16 September 1981

	Sample ID		Lab No.	Sample No.		Lab No.	Sample ID		Lab No.
	L29-2B, 20:41, 7-10-81		6602	L29-3B, 18:23, 7-10-81		6603			
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat			0.2			0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	4.8	1.1	0.2	7.8	1.4	0.2			0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Energy Mining Division
195 Pronghorn Drive
Casper, Wyoming 82601

Request No. 814-109
Date: 11 August 1981

REPORT OF ANALYSIS

Customer ID		L20-4A, 7-12-81, 18:48	~~L29-B1,~~ L29-1B 7-13-81, 12:27
Lab No.		6627	6628
Bicarbonate (as $CaCO_3$)	mg/L	94.1	154
Carbonate (as $CaCO_3$)	mg/L	0	2.12
Conductivity	µmho	218	295
$NO_2 + NO_3$	mg/L	<0.50	<0.50
pH	mg/L	8.3	8.4
Chloride	mg/L	4.79	4.81
Sulfate	mg/L	55.6	53.9
TDS	mg/L	160	218
SiO_2	mg/L	6.88	4.79

Jane V. Thomas
President

8478

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

field filtered-preserved

Customer ID		L20-4A, 7-12-81, 18:48	L29-1B ~~L29-B1,~~ 7-13-81, 12:27
Lab No.		6627	6628
Calcium	mg/L	3.25	30.2
Magnesium	mg/L	0.068	0.891
Potassium	mg/L	0.588	1.11
Sodium	mg/L	100	118
Uranium (as U_3O_8)	mg/L	1.06	5.67
Calculated Charge Balance			
Sum of Cations	meq/L	4.5	6.7
Sum of Anions	meq/L	3.2	4.4
Sum of Ions	meq/L	7.7	11.1
Imbalance	%	+17.7	+21.3

Jane V. Thomas
President

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Union Energy Mining Division Page 3 Request No. ~~806~~ 814-109

field filtered-unpreserved

Customer ID		L20-4A, 7-12-81, 18:48	~~L29-B1~~ L29-1B, 7-13-81, 12:27
Lab No.		6627	6628
Calcium	mg/L	3.36	31.3
Magnesium	mg/L	0.067	0.852
Potassium	mg/L	0.622	1.12
Sodium	mg/L	113	131

Jane V. Thomas
President

WYOMING ANALYTIC. LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

unfiltered-unpreserved

Customer ID		L20-4A, 7-12-81, 18:48	L29-1B ~~L29-81~~, 7-13-81, 12:27
Lab No.		6627	6628
Calcium	mg/L	3.28	31.5
Magnesium	mg/L	0.066	0.861
Potassium	mg/L	0.578	1.10
Sodium	mg/L	109	129

Copy of results to:

CH_2M Hill

Jane V. Thomas
President

20648

WYOMING ANALYTICAL LABORATORIES, INC.

Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Energy Mining Division
195 Pronghorn Drive
Casper, WY 82601

Request No. 814-109
Date: 6 November, 1981*

REPORT OF ANALYSIS

Customer ID	L29-1B, 7/13/81, 12:27
Lab No.	6628

Bicarbonate (as $CaCO_3$)	mg/L	154
Carbonate (as $CaCO_3$)	mg/L	2.12
Conductivity	µmho	295
$NO_2 + NO_3$	mg/L	<0.50
pH		8.4
Chloride	mg/L	4.81
Sulfate	mg/L	53.9
TDS	mg/L	218
SiO_2	mg/L	4.79

*This report is a correction of Request No. 814-109, dated August 11, 1981.

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Gene F. Hayes
Laboratory Director

20648

field filtered-preserved

Customer ID		L29-1B, 7/13/81, 12:27
Lab No.		6628
Calcium	mg/L	30.2
Magnesium	mg/L	0.891
Potassium	mg/L	1.11
Sodium	mg/L	118
Uranium (as U_3O_8)	mg/L	5.67
Calculated Charge Balance		
Sum of Cations	meq/L	6.7
Sum of Anions	meq/L	4.4
Sum of Ions	meq/L	11.1
Imbalance	%	+21.3

*This report is a correction of Request No. 814-109, dated August 11, 1981.

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

20648

unfiltered-unpreserved

Customer ID		L29-1B, 7/13/81, 12:27
Lab No.		6628

Calcium	mg/L	31.5
Magnesium	mg/L	0.861
Potassium	mg/L	1.10
Sodium	mg/L	129
Uranium (U_3O_8)	mg/L	---

*This report is a correction of Request No. 814-109, dated August 11, 1981.

Gene F. Hayes
Laboratory Director

Union Energy Mining Division Request No. 814-109 16 September 1981

	Sample ID L20-4A, 18:48, 7-12-81		Lab No. 6627	Sample No. L29-1B, 12:27, 7-13-81		Lab No. 6628	Sample ID		Lab No.
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat			0.2			0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	0.7	0.4	0.2	27	3.0	0.2			0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

20618

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7935 LARAMIE, WYOMING 82070

REPORT OF ANALYSIS

Customer ID		A-3 L20-6A, 10-20-81, 14:45	A-3 L20-8A, 10-20-81, 18:00
Lab No.		7312	7313
Aluminum	mg/L	--	--
Arsenic	mg/L	--	--
Barium	mg/L	--	--
Cadmium	mg/L	--	--
Calcium	mg/L	25.5	17.2
Chromium	mg/L	--	--
Copper	mg/L	--	--
Iron	mg/L	--	--
Lead	mg/L	--	--
Magnesium	mg/L	0.848	0.226
Manganese	mg/L	--	--
Mercury	µg/L	--	--
Nickel	mg/L	--	--
Potassium	mg/L	1.47	1.26
Selenium	mg/L	--	--
Sodium	mg/L	79.5	82.6
Zinc	mg/L	--	--
Molybdenum	mg/L	--	--
Vanadium	mg/L	--	--
Silica	mg/L	2.13	4.12

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

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Customer ID		A-3 L20-6A, 10-20-81, 14:45	A-3 L20-8A, 10-20-81, 18:00
Lab No.		7312	7313
Alkalinity	mg/L	156	158
Ammonia (as N)	mg/L	--	--
Bicarbonate (as $CaCO_3$)	mg/L	156	158
Carbonate (as $CaCO_3$)	mg/L	0	0
NO_2 + NO_3	mg/L	.032	.030
Chloride	mg/L	14.6	24.8
Fluoride	mg/L	--	--
Sulfate	mg/L	83.1	61.7
TDS	mg/L	397	265
TSS	mg/L	--	--
Boron	mg/L	--	--
Uranium (as U_3O_8)	mg/L	6.20	2.82
Hardness	mg/L	67.2	43.9
Conductivity	µmho	321	292
Phosphorus (as PO_4)	mg/L	--	--
Calculated Charge Balance			
Sum of Cations	meq/L	4.84	4.50
Sum of Anions	meq/L	5.26	5.14
Sum of Ions	meq/L	10.10	9.64
Imbalance	%	-4.17	-6.63
pH		8.1	8.2

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Union Energy Mining Division Request No. 941-109

	Sample ID A-3 L20-6A, 10-20-81, 14:45 Lab No. 7312			Sample No. A-3 L20-8A, 10-20-81 18:00 Lab No. 7313			Sample ID Lab No.		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat	3388	±32	0.2	1153	±19	0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	24	±3	0.2	6.0	±1.3	0.2			0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

WYOMING ANALYTICAL LABORATORIES, INC.

Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Energy Mining Division
195 Pronghorn Drive
Casper, WY 82601

Request No. 943-109
Date: 4 December 1981

REPORT OF ANALYSIS

Customer ID		A-3 L20-2A, 10-21-81, 11:50	A-3 L20-5A, 10-21-81, 14:15
Lab No.		7327	7328
Aluminum	mg/L	--	--
Arsenic	mg/L	--	--
Barium	mg/L	--	--
Cadmium	mg/L	--	--
Calcium	mg/L	8.09	7.06
Chromium	mg/L	--	--
Copper	mg/L	--	--
Iron	mg/L	--	--
Lead	mg/L	--	--
Magnesium	mg/L	0.774	0.726
Manganese	mg/L	--	--
Mercury	µg/L	--	--
Nickel	mg/L	--	--
Potassium	mg/L	1.30	1.34
Selenium	mg/L	--	--
Sodium	mg/L	77.7	80.6
Zinc	mg/L	--	--
Molybdenum	mg/L	--	--
Vanadium	mg/L	--	--
Silica	mg/L	1.62	3.61

Gene F. Hayes
Laboratory Director

20648

Customer ID		A-3 L20-2A, 10-21-81, 11:50	A-3 L20-5A, 10-21-81, 14:15
Lab No.		7327	7328
Alkalinity	mg/L	190	179
Ammonia (as N)	mg/L	--	--
Bicarbonate (as $CaCO_3$)	mg/L	190	179
Carbonate (as $CaCO_3$)	mg/L	0	0
$NO_2 + NO_3$	mg/L	0.023	0.028
Chloride	mg/L	18.1	17.0
Fluoride	mg/L	--	--
Sulfate	mg/L	52.3	57.2
TDS	mg/L	255	263
TSS	mg/L	--	--
Boron	mg/L	--	--
Uranium (as U_3O_8)	mg/L	4.44	4.21
Hardness	mg/L	23.39	20.62
Conductivity	µmho	271	298
Phosphorus (as PO_4)	mg/L	--	--
Calculated Charge Balance			
Sum of Cations	meq/L	3.88	3.95
Sum of Anions	meq/L	5.40	5.25
Sum of Ions	meq/L	9.28	9.20
Imbalance	%	-16.3	-14.1
pH		8.0	7.9

Gene F. Hayes
Laboratory Director

Union Energy Mining Division Request No. 943-109

	Sample ID A-3 L20-2A, 10-21-81, 11:50		Lab No. 7327	Sample No. A-3 L20-5A, 10-21-81, 14:50		Lab No. 7328	Sample ID		Lab No.
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat	2451	±27	0.2	2127	±25	0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	28	±3	0.2	34	±3	0.2			0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Union Energy Mining Division Request No. 943-109 *

	Sample ID A-3, L20-5A, 10-21-81, 14:15		Lab No. 7328	Sample No.		Lab No.	Sample ID		Lab No.
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
		10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL	
Uranium-Nat	2127	±25	0.2			0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	34	±3	0.2			0.2			0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

* Corrected Report.

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

WYOMING ANALYTICAL LABORATORIES, INC.

Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Energy Mining Division
195 Pronghorn Drive
Casper, WY 82601

Request No. 944-109
Date: 15 December 1981

REPORT OF ANALYSIS

Customer ID		~~A-3~~ L20-1A, 10-21-81,17:35	~~A-3~~ L20-7A, 10-21-81,20:30	L20-1A 10-21-81,17:35 A-3 ~~IXL USD DS-UD-TD~~ DAPI	L20-7A 10-21-81 20:30 ~~A-3 2XL USA DS-UD-TD~~ USPS
Lab No.		7333	7334	7335	7336
Calcium	mg/l	2.42	20.6	2.48	20.2
Magnesium	mg/l	0.060	0.588	0.055	0.590
Potassium	mg/l	0.523	1.61	0.528	1.64
Sodium	mg/l	64.9	89.0	66.7	86.6
Silica	mg/l	7.40	4.08	7.26	4.06

Gene F. Hayes
Laboratory Director

20648

REPORT OF ANALYSIS

L20-1A 10-21-81 17:35 L20-7A 10-21-81 20:30

Customer ID		A-3 L20-1A, 10-21-81, 17:35	A-3 L20-7A, 10-21-81, 20:30	~~A-3 IXL USD DS-UD-TD DAPI~~	~~A-3 2XL USA DS-UD-TD USPS~~
Lab No.		7333	7334	7335	7336
Alkalinity (as $CaCO_3$)	mg/l	102	177	101	179
Bicarbonate (as $CaCO_3$)	mg/l	88.2	177	82.5	174
Carbonate (as $CaCO_3$)	mg/l	13.7	0	18.3	4.58
Conductivity	µmho	281	425	279	422
$NO_2 + NO_3$	mg/l	0.029	0.034	0.028	0.032
pH		9.1	8.3	9.0	8.4
Chloride	mg/l	8.29	8.62	5.82	8.51
Sulfate	mg/l	49.0	79.4	136	72.8
TDS	mg/l	181	299	187	262
Uranium (as U_3O_8)	mg/l	0.10	7.77	0.06	7.82
Calculated Charge Balance					
Sum of Cations	meq/l	2.96	4.99	3.04	4.87
Sum of Anions	meq/l	3.29	5.43	3.49	5.32
Sum of Ions	meq/l	6.25	10.4	6.53	10.2
Imbalance	%	-5.25	-4.26	-6.87	-4.50

Gene F. Hayes
Laboratory Director

Union Energy Mining Division Request No. 944-109

L20-1A 10-21-81 17:35

	Sample ID A-3 L20-1A, 10-21-81, 17:35 Lab No. 7333			Sample No. A-3 L20-7A, 10-21-81, 20:30 Lab No. 7334			Sample ID ~~A-3 1XL DAPI~~ USD-DS-UD-TD Lab No. 7335		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat	58	±4	0.2	3929	±34	0.2	43	±4	0.2
Thorium-230			0.2			0.2			0.2
Radium-226	2.2	±0.8	0.2	39	±2	0.2	3.1	±1.0	0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Union Energy Mining Division Request No. 944-109

L20-7A 10-21-81 20:30

Sample ID	Lab No.	Sample No.	Lab No.	Sample ID	Lab No.
A-3 2XL USA DS-UD-TD USPS	7336				

	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat	4253	±36	0.2			0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	35	±3	0.2			0.2			0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

WYOMING ANALYTICAL LABORATORIES, INC.

Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Energy Mining Division
195 Pronghorn Drive
Casper, WY 82601

Request No. 945-109
Date: 15 December 1981

REPORT OF ANALYSIS

Customer ID		A-3 L20-3A, 10-22-81, 13:00	A-3 L20-4A, 10-22-81, 15:30
Lab No.		7339	7340
Calcium	mg/l	12.6	2.84
Magnesium	mg/l	0.547	0.179
Potassium	mg/l	1.30	0.575
Sodium	mg/l	67.8	64.2
Silica	mg/l	3.99	5.92

Gene F. Hayes
Laboratory Director

20648

Customer ID		A-3 L20-3A, 10-22-81, 13:00	A-3 L20-4A, 10-22-81, 15:30
Lab No.		7339	7340
Alkalinity (as $CaCO_3$)	mg/l	141	106
Bicarbonate (as $CaCO_3$)	mg/l	141	92.0
Carbonate (as $CaCO_3$)	mg/l	0	14.0
Conductivity	µmho	329	287
$NO_2 + NO_3$	mg/l	0.029	0.125
pH		7.0	8.8
Chloride	mg/l	6.57	12.5
Sulfate	mg/l	52.3	49.0
TDS	mg/l	216	182
Uranium (as U_3O_8)	mg/l	2.40	0.80
Calculated Charge Balance			
Sum of Cations	meq/l	3.66	2.96
Sum of Anions	meq/l	4.09	3.49
Sum of Ions	meq/l	7.75	6.46
Imbalance	%	-5.62	-8.19

Gene F. Hayes
Laboratory Director

Union Energy Mining Division Request No. 945-109

	Sample ID A-3 L20-3A, 10-22-81, 13:00 Lab No. 7339			Sample No. A-3 L20-4A, 10-22-81, 15:30 Lab No. 7340			Sample ID Lab No.		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat	1262	±19	0.2	325	±10	0.2			0.2
Thorium-230			0.2			0.2			0.2
Radium-226	32	±3	0.2	2.3	±0.8	0.2			0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 695 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

WYOMING ANALYTICAL LABORATORIES, INC.

Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Energy Mining Division
195 Pronghorn Drive
Casper, WY 82601

Request No. 946-109
Date: 16 December 1981

REPORT OF ANALYSIS

Customer ID		A-3 L29-1B, 10-22-81, 18:30	A-3 L29-4B, 10-22-81, 21:00	L29-1B 10-22-81 18:30 ~~A-3 3XL UED DS-UU-TD DTPS~~
Lab No.		7341	7342	7343
Calcium	mg/l	26.3	15.4	25.5
Magnesium	mg/l	1.04	0.725	0.958
Potassium	mg/l	1.18	1.08	1.17
Sodium	mg/l	75.9	70.6	69.0
SiO_2	mg/l	3.59	3.37	3.47

Gene F. Hayes
Laboratory Director

20648

L29-1B
10-22-81 18:30

Customer ID		A-3 L29-1B, 10-22-81,18:30	A-3 L29-4B, 10-22-81,21:00	~~A-3 3XL UED DS-UU-TD DTPS~~
Lab No.		7341	7342	7343
Alkalinity (as $CaCO_3$)	mg/l	176	158	184
Bicarbonate (as $CaCO_3$)	mg/l	176	158	184
Carbonate (as $CaCO_3$)	mg/l	0	0	0
Conductivity	µmho	290	252	306
$NO_2 + NO_3$	mg/l	0.304	0.300	0.344
pH		7.9	8.2	8.1
Chloride	mg/l	15.5	12.9	21.5
Sulfate	mg/l	69.1	43.2	63.8
TDS	mg/l	268	219	268
Uranium (as U_3O_8)	mg/l	4.88	0.74	4.88
Calculated Charge Balance				
Sum of Cations	meq/l	4.73	3.93	4.38
Sum of Anions	meq/l	5.40	4.42	5.62
Sum of Ions	meq/l	10.1	8.35	10.0
Imbalance	%	-6.59	-5.96	-12.3

Gene F. Hayes
Laboratory Director

20648

Union Energy Mining Division Request No. 946-109

	Sample ID A-3 L29-1B, 10-22-81, 18:30 Lab No. 7341			Sample No. A-3 L29-4B, 10-22-81, 21:00 Lab No. 7342			L29-1B 10-22-81 18:30 Sample ID A-3 3XL-UED DS-UU-TD DTPS Lab No. 7343		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat	2703	±28	0.2	343	±10	0.2	2595	±28	0.2
Thorium-230			0.2			0.2			0.2
Radium-226	29	±3	0.2	8.6	±1.6	0.2	27	±1	0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

20648

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Bill Volk
Union Energy Mining Division
195 Pronghorn Drive
Casper, WY 82601

Request No. 948-109
Date: 16 December 1981

REPORT OF ANALYSIS

Customer ID		A-3 L29-2B, 10-23-81, 15:30	A-3 L29-3B 10-23-81, 17:55	A-3 L29-5B, 10-23-81, 13:30
Lab No.		7351	7352	7353
Calcium	mg/l	6.31	14.4	17.7
Magnesium	mg/l	0.319	0.696	0.926
Potassium	mg/l	1.08	1.55	1.73
Sodium	mg/l	73.9	76.1	77.2
SiO_2	mg/l	2.89	2.81	2.98

Gene F. Hayes
Laboratory Director

Customer ID		A-3 L29-2B, 10-23-81,15:30	A-3 L29-3B, 10-23-81,17:55	A-3 L29-5B, 10-23-81, 13:30
Lab No.		7351	7352	7353
Alkalinity (as $CaCO_3$)	mg/l	123	166	164
Bicarbonate (as $CaCO_3$)	mg/l	114	166	164
Carbonate (as $CaCO_3$)	mg/l	9.16	0	0
Conductivity	µmho	248	271	331
$NO_2 + NO_3$	mg/l	0.270	0.270	0.265
pH		8.95	8.3	8.2
Chloride	mg/l	17.3	7.65	15.1
Sulfate	mg/l	60.9	57.6	59.7
TDS	mg/l	214	235	354
Uranium (as U_3O_8)	mg/l	2.39	3.61	2.55
Calculated Charge Balance				
Sum of Cations	meq/l	3.58	4.13	4.36
Sum of Anions	meq/l	4.22	4.74	4.95
Sum of Ions	meq/l	7.80	8.86	9.31
Imbalance	%	-8.17	-6.88	-6.31

Gene F. Hayes
Laboratory Director

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

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Union Energy Mining Division Request No. 948-109

	Sample ID A-3 L29-2B, 10-23-81, 15:30 Lab No. 7351			Sample No. A-3 L29-3B, 10-23-81, 17:55 Lab No. 7352			Sample ID A-3 L29-5B, 10-23-81 13:30 Lab No. 7353		
	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD	Conc.	Err.Est.	LLD
	10^{-9} µCi/mL			10^{-9} µCi/mL			10^{-9} µCi/mL		
Uranium-Nat	1297	±20	0.2	1910	±24	0.2	1153	±19	0.2
Thorium-230			0.2			0.2			0.2
Radium-226	7.4	±1.6	0.2	9.8	±1.8	0.2	33	±33	0.2
Lead-210			1.0			1.0			1.0
Polonium-210			1.0			1.0			1.0

Gene F. Hayes
Laboratory Director

2048

WYOMING ANALYTICAL LABORATORIES, INC.
Box 638 • 605 South Adams (307) 742 7995 LARAMIE, WYOMING 82070

CDM

environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

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

July 24, 1981

William G. Volk
Union Energy and Mining
1846 W. Grant Road
Tucson, AZ 85705

RE: 875-12781-2
Date Samples Recd 7-10-81

REPORT OF ANALYSIS

Lab Designation	875-12781-2-1	875-12781-2-2
Sponsor Designation	L20-1A	L20-6A
	7-8-81	7-8-81
	18:21	15:34
Determination (mg/L)		
Sodium, total	68	79
Sodium, dissolved	68	77
Potassium, total	0.6	0.9
Potassium, dissolved	0.4	0.9
Calcium, total	1.9	21
Calcium, dissolved	1.9	21
Magnesium, total	0.08	0.7
Magnesium, dissolved	0.05	0.7
Carbonate (as CO_3)	0	0
Bicarbonate (as HCO_3)	89	147
Sulfate (as SO_4)	58	72
Chloride	4	5
Nitrate (as N)	<0.05	<0.05
Silica	6	3
pH	8.2	7.2
T.D.S. (180°C)	188	281
Eh	+216	+204

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/rjf

xc: C. Feast

20648

CDM

environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

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

October 2, 1981

William G. Volk
Union Oil Co. of CA
Union Energy Mining Div.
1846 W. Grant Rd., Suite 105
Tucson, AZ 85705

RE: 875-12781-2
Date Samples Recd 7-10-81

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	875-12781-2-1 L20-1A 7-8-81 18:21	875-12781-2-2 L20-6A 7-8-81 15:34
Determination (pCi/L)		
Uranium (as U), total (mg/L)	0.023	5.3
Uranium (as U), dissolved (mg/L)	0.021	4.7
Radium-226, dissolved ± Counting Error*	0.7 ± 1.9	30 ± 8
Uranium-238, dissolved ± Counting Error*	9 ± 2	940 ± 30 2.83 ± 0.09
Uranium-235, dissolved ± Counting Error*	1 ± 1	67 ± 7 0.03 ± 0.003
Uranium-234, dissolved ± Counting Error*	6 ± 1	800 ± 20 0.0001 ±
Uranium-238, total ± Counting Error*	7 ± 1	1,400 ± 100
Uranium-235, total ± Counting Error*	0 ± 1	120 ± 30
Uranium-234, total ± Counting Error*	8 ± 1	1,500 ± 100

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

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

BY Bud Summers
Bud Summers
Radiochemistry
Supervisor

BS/rjf

xc: Chuck Feast

20648

CDM

environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

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

Date July 30, 1981

William G. Volk
Union Energy and Mining
1846 W. Grant Road
Suite 105
Tucson, AZ 85705

RE: 875-12842-1
Date Samples Recd 7-20-81

ANALYITCAL REPORT

CDM Designation	875-12842-1-1
Sponsor Designation	~~A-3~~ L 29-1B 7-13-81
Determination mg/L	
Sodium, dissolved	75
Potassium, dissolved	0.7
Calcium, dissolved	21
Magnesium, dissolved	0.8
Sodium, total	75
Potassium, total	0.8
Calcium, total	21
Magnesium, total	0.8
Carbonate (as CO_3)	0
Bicarbonate (as HCO_3)	170
Sulfate (as SO_4)	55
Chloride	3
Nitrate (as N)	<0.05
Silica	4
pH	7.5
TDS (108°C)	228
eh (Redox Potential)	+410

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

By David LeMaster
David LeMaster
Water Laboratory
Supervisor

xc: Chuck Feast
DL/tew

20648

CDM

environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

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

October 2, 1981

William G. Volk
Union Oil Co. of CA
Union Energy Mining Div.
1846 W. Grant Rd., Suite 105
Tucson, AZ 85705

RE: 875-12842-1
Date Sample Recd 7-20-81

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	875-12842-1-1 ~~A3~~ L29-1B 7-13-81
Determination (pCi/L)	
Uranium-238, dissolved ± Counting Error*	1,400 ± 100
Uranium-235, dissolved ± Counting Error*	25 ± 8
Uranium-234, dissolved ± Counting Error*	900 ± 50
Uranium (as U), Flurometric, dissolved (mg/L)	4.6
Uranium-238, total ± Counting Error*	1,200 ± 100
Uranium-235, total ± Counting Error*	48 ± 11
Uranium-234, total ± Counting Error*	800 ± 40
Uranium (as U), Flurometric, total (mg/L)	6.3
Radium-226, dissolved ± Counting Error*	31 ± 6

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

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

BY Bud Summers

Bud Summers
Radiochemistry
Supervisor

BS/rjf

xc: Chuck Feast

20648

CDM

environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

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

November 12, 1981

Mr. Bill Volk
Union Energy Mining
195 Pronghorn Drive
Casper, WY 82601

RE: 863-13403-4
Date Samples Rec'd 10-23-81

REPORT OF ANALYSIS

Lab Designation	863-13403-4-3	863-13403-4-4
Sponsor Designation	A3-L-20-1 A	A3-L-20-7 A
	10-21-81	10-21-81
Determination (mg/L)		
Aluminum, dissolved	-	-
Arsenic, dissolved	-	-
Barium, dissolved	-	-
Cadmium, dissolved	-	-
Copper, dissolved	-	-
Chromium, dissolved	-	-
Calcium, dissolved	2.0	17
Iron, dissolved	-	-
Lead, dissolved	-	-
Magnesium, dissolved	<0.05	0.58
Manganese, dissolved	-	-
Mercury, dissolved	-	-
Nickel, dissolved	-	-
Potassium, dissolved	0.2	0.8

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

20648

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environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

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

RE: 863-13403-4
Date Samples Rec'd 10-23-81

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	863-13403-4-3 A3-L-20-1-A 10-21-81	863-13403-4-4 A3-L-20-7-A 10-21-81
Determination (mg/L)		
Selenium, dissolved	-	-
Sodium, dissolved	69	91
Zinc, dissolved	-	-
Silica, dissolved	9	5
Molybdenum, dissolved	-	-
Vanadium, dissolved	-	-
Boron	-	-
Fluoride	-	-
Sulfate (as SO_4)	47	66
T.D.S. (at 180°C)	186	312
Total Phosphorus (as P)	-	-
Chloride	4	7
Total Alkalinity	-	-
Bicarbonate (as HCO_3)	59	167
Carbonate (as CO_3)	9	0
TSS (at 105°C)	-	-
Conductivity, µmhos/cm	-	-
Nitrate/Nitrite (as N)	-	-

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RE: 863-13403-4
Date Samples Rec'd 10-23-81

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	863-13403-4-3 A3-L-20-1 A 10-21-81	863-13403-4-4 A3-L-20-7 A 10-21-81
Determination (mg/L)		
Ammonia	-	-
pH	8.7	7.5
Nitrate (as N)	<0.05	<0.05
Eh, mV	+124	+149
Sodium, total	80	105
Potassium, total	0.9	1.0
Calcium, total	2.3	20
Magnesium, total	<0.05	0.69

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

7968

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environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

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

December 31, 1981

Mr. Bill Volk
Union Energy Mining
195 Pronghorn Drive
Casper, WY 82601

RE: 863-13403-4
Date Samples Rec'd 10-23-81

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	863-13403-4-3 A3-L-20-1 A 10-21-81	863-13403-4-4 A3-L-20-7 A 10-21-81
Determination		
Uranium (as U) total, mg/L	0.025	8.0
Gross Alpha, total, pCi/L		
± counting error	-	-
Gross Beta, total, pCi/L		
± counting error	-	-
Thorium-230, total, pCi/L		
± counting error	-	-
Radium-226, total, pCi/L		
± counting error	-	-
Lead-210, total, pCi/L		
± counting error	-	-
Polonium-210, total, pCi/L		
± counting error	-	-
Uranium (as U) dissolved, mg/L	0.069	7.0
Radium-226, dissolved, pCi/L		
± counting error	1.8 ± 0.2	38 ± 1

*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.
NOTE: The results for the total and dissolved Uranium on Sample A3-L-20-1-A were confirmed by re-analysis.

20648

BY Bud Summers
Bud Summers
Radiochemistry
Supervisor

BS/srf

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CAMP DRESSER & McKEE INC.

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

November 9, 1981

Mr. Bill Volk
Union Energy Mining
195 Pronghorn Drive
Casper, WY 82601

RE: 863-13407-3
Date Samples Rec'd 10-24-81

REPORT OF ANALYSIS

Lab Designation Sponsor Designation	863-13407-3-3 ~~A-3-L-29-B~~ 1 10-22-81
Determination (mg/L)	
Aluminum, dissolved	-
Arsenic, dissolved	-
Barium, dissolved	-
Cadmium, dissolved	-
Chromium, dissolved	-
Copper, dissolved	-
Calcium, dissolved	24
Iron, dissolved	-
Lead, dissolved	-
Magnesium	0.90
Manganese	-
Mercury	-
Nickel	--
Potassium	0.7
Selenium	-
Sodium	89
Zinc	-
Silica (as SIO_2)	4
Molybdenum	-
Vanadium	-
Fluoride	-
Sulfate (as SO_4)	68
T.D.S. (at 180°C)	296
Total Phosphorus (as P)	-
Chloride	4
Total Alkalinity	-
Bicarbonate (as HCO_3)	185
Carbonate (as CO_3)	0

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

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CAMP DRESSER & McKEE INC.

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

RE: 863-13407-3
Date Samples Rec'd 10-24-81

REPORT OF ANALYSIS

Lab Designation	863-13407-3-3
Sponsor Designation	L-29-~~B-1~~
	10-22-81 IB

Determination (mg/L)

T.S.S. (at 105°C)	-
Conductivity, µmhos/cm	-
Nitrate/Nitrite	-
Ammonia (as N)	-
Boron	-
Nitrate (as N)	<0.05
eH, mV	+94
pH	7.5
Sodium, total	90
Potassium, total	0.8
Calcium, total	26
Magnesium, total	1.03

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

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environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

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

December 31, 1981

Mr. Bill Volk
Union Energy Mining
195 Pronghorn Drive
Casper, WY 82601

RE: 863-13407-3
Date Samples Rec'd 10-24-81

REPORT OF ANALYSIS

Lab Designation	863-13407-3-3
Sponsor Designation	L-29-~~B~~ 11B
	10-22-81

Determination

Uranium (as U) total, mg/L	4.6
Gross Alpha, total, pCi/L	
± counting error	-
Gross Beta, total, pCi/L	
± counting error	-
Thorium-230, total, pCi/L	
± counting error	-
Radium-226, total, pCi/L	
± counting error	-
Lead-210, total, pCi/L	
± counting error	-
Polonium-210, total, pCi/L	
± counting error	-
Uranium (as U) dissolved, mg/L	5.7
Radium-226, dissolved, pCi/L	
± counting error	36 ± 1

*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 Bud Summers
Bud Summers
Radiochemistry
Supervisor

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