

Submitted: 8/25/2014

NUCLEAR DYNAMICS

ALBERT F. STOICK

VICE PRESIDENT, URANIUM EXPLORATION
MANAGER, NUBETH JOINT VENTURE

September 25, 1980

8010230376

Mr. R. A. Scarano, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Source Material License No. SUA-1331, Sundance Project,
Crook County, Wyoming, Docket No. 40-8663

Attention: J. Rothfleisch

Gentlemen:

For information only, and in accordance with Conditions 14 and 19 of the Source Material License, we are enclosing a copy of Nuclear Dynamics' 1980 Activity and Restoration Report on the In Situ Mining Test Site, Sundance Project, Crook County, Wyoming as prepared by Mr. Albert Stoick, Manager, Sundance Project. As you are aware, on October 31, 1979, Nuclear Dynamics received written approval from the Wyoming Department of Environmental Quality authorizing the September 19th shut down of the restoration phase of the research and development program. Activities were suspended for a period of six months to evaluate the stability and completeness of restoration achieved as of September 19th. The pilot plant and well field have been secured during that period with restoration check sampling commencing on April 23, 1980. A Restoration Summary Report covering activities to the September shut down was submitted to all concerned on October 19, 1979.

We are sending a copy of this report to the Department of Environmental Quality, Mr. Glenn Mooney, District IV Geologist, Sheridan office; Mr. Walt Ackerman, Administrator, Department of Environmental Quality office in Cheyenne, Wyoming; and the U.S. Nuclear Regulatory Commission office in Arlington, Texas.

Sincerely,

The plant modifications and test results summary report prepared by and for NUBETH and is prepared by the NUBETH design and major design change requests. He is also Albert F. Stoick, Manager, Nubeth Joint Venture support contractor.

AFS:ldr
Enclosure

NUCLEAR DYNAMICS, INC. 200 SOUTH LOWELL • CASPER, WYOMING 82601 • (307) 265-5854

8010230376

1980 ACTIVITY AND RESTORATION REPORT

ON

IN SITU SOLUTION MINING TEST SITE, SUNDANCE PROJECT,

CROOK COUNTY, WYOMING

SOURCE MATERIAL LICENSE NO. SUA-1331

DOCKET NO. 40-8663

BY

ALBERT F. STOICK, MANAGER

NUBETH JOINT VENTURE

NUCLEAR REGULATORY

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...of certain parameters, such as Uranium, Iron, Radium 226, Gross Alpha, Gross Beta, and to a lesser degree, Arsenic, Selenium and Molybdenum, mobilized in the water. The quantities of these parameters drop off substantially and rapidly once water is pumped out of the aquifer from a relatively short distance from the well.

Vanadium, at less than one part per million, appears to be mostly unaffected by this condition and remains about six tenths of a part per million above the established restoration limit.

In Situ Solution Mining Test Site, Sundance Project,

Crook County, Wyoming

Source Material License No. SUA-1331

Docket No. 40-8663

...three parameters assayed for are below the upper limit of restoration or according to the accuracy of chemical assaying are considered to be at or below that limit.

by
Albert F. Stoick, Manager

Introduction

For information purposes, this report covers the check on and evaluation of the stability of the established restoration of the solution mining test site well field at the Sundance Project in Crook County, Wyoming.

Early in September, 1979, the Nuclear Regulatory Commission (NRC) and the Wyoming Department of Environmental Quality (DEQ) were advised by telephone and by personal communication respectively, of the degree of restoration already attained for the majority of the parameters of the well field water. At that time, Nuclear Dynamics requested, and received on behalf of the Nubeth Joint Venture, permission to secure the well field for a period of six months.

The well field was shut down on September 19, 1979 and with the pilot plant remained secured until April 23, 1980. During this six month period the evaporation ponds continued to be monitored according to related permits and no fluid from inside the liners was found in the detection systems. Also, the "outside" or private wells have been sampled as required.

It is the opinion of Nuclear Dynamics that restoration is as complete as can be obtained within practical limitations and is stabilized with the possible exception of the immediate area of the wells themselves. In that area, it appears from the latest pumping data, that a certain amount of oxidation is taking place and will continue to do so until the wells are plugged and sealed. That oxidizing condition apparently affects the amount of certain parameters, such as Uranium, Iron, Radium 226, Gross Alpha, Gross Beta, and to a lesser degree, Arsenic, Selenium and Molybdenum, mobilized in the water. The quantities of these parameters drop off substantially and rapidly once water is pumped out of the aquifer from a relatively short distance from the well.

Vanadium, at less than one part per million, appears to be mostly unaffected by this condition and remains about six tenths of a part per million above the established restoration limit.

As can be observed from the accompanying plots of restoration check sampling data, the great majority (27) of the thirty-three parameters assayed for are below the upper limit of restoration or according to the accuracy of chemical assaying are considered to be at or below that limit.

All five well field monitor wells were sampled on April 24, 1980 and the chemical data indicates that no excursions, either horizontally or vertically have occurred. For your reference, data pertaining to these wells is attached to this report.

Nuclear Dynamics, as managers for the Nubeth Joint Venture, will be requesting permission from the Wyoming Department of Environmental Quality to plug and seal off all of the wells in the Phase I well field and then reclaim the well sites. The remainder of the well field has already been reclaimed and re-seeded. The pilot plant and evaporation ponds will remain intact, and in a standby condition, until final decisions on future pilot tests are made by the Nubeth Joint Venture Partners.

Sufficient and proper bonding is, and has been, kept in effect to cover our activities and obligations on the Sundance Project.

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Party's representatives in the National Congress in 1980 and the 1981-82 Legislative Session. The Government has also taken measures to ensure that the Party's representatives in the National Congress and the Legislative Assembly are able to discharge their duties effectively. The Government has also taken measures to ensure that the Party's representatives in the National Congress and the Legislative Assembly are able to discharge their duties effectively.

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In April, 1980. The analytical data from these wells, including data previously submitted and now updated, is attached as part of this report (Tables III, IV, V, VI and VII).

- 6) The monitor well (OSA-1) in the "A" aquifer (immediately above the mining zone) was also sampled in September, 1979 and again in April 1980. That analytical data, including data previously submitted and now updated, is attached as part of this report.

Summary of Activities - Sundance Project
September 19, 1979 to September 19, 1980

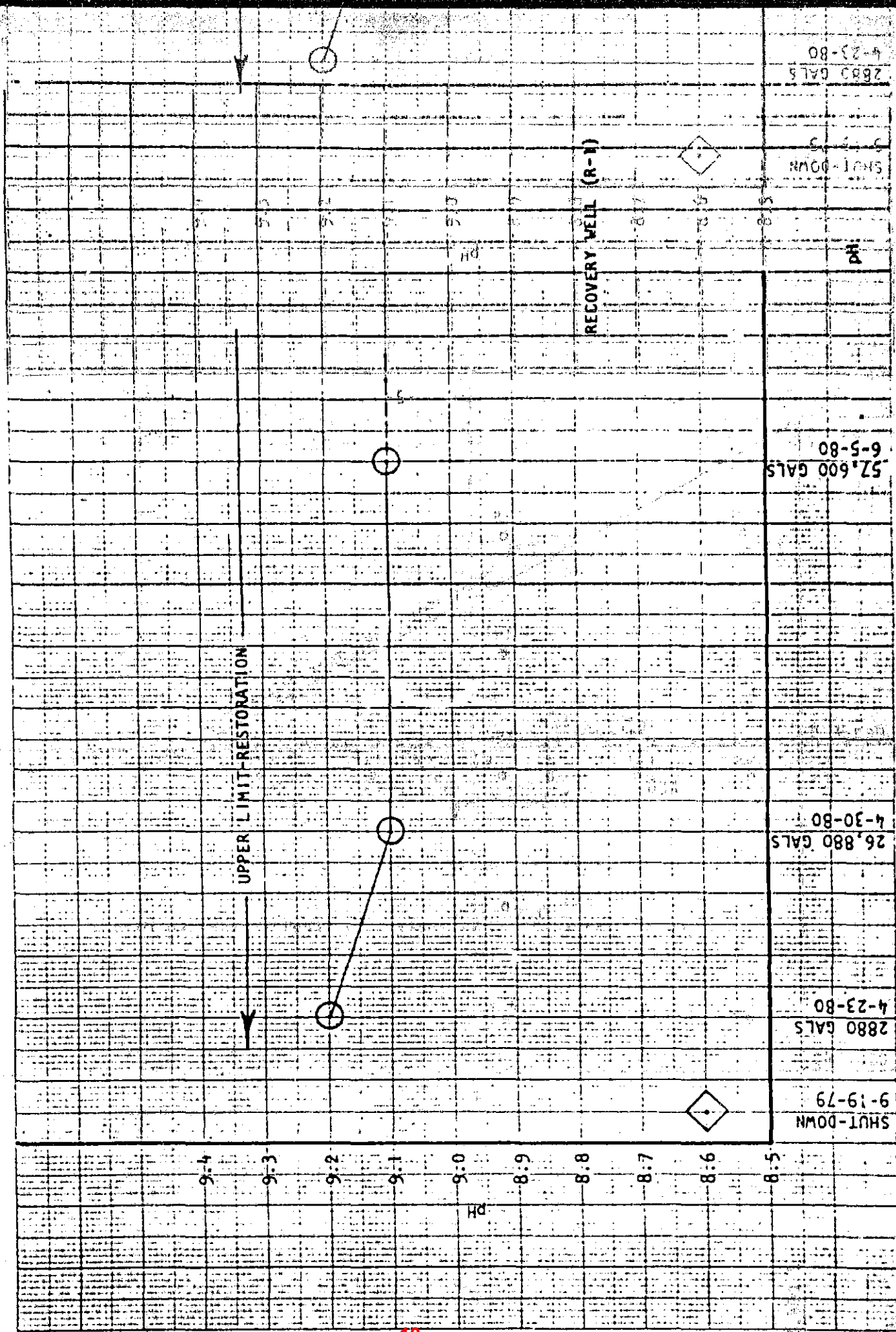
- 1) An updated Table IX, containing data on the water chemistry of Water Well 789V, is attached for reference and information only.
- 1) A final set of samples was taken on September 19, 1979 from the Recovery Well (R-1, 19XX Figure 1) and sent to CDM Labs for analyses. This "shut-down" data is plotted on the accompanying thirty-three graphs of the various parameters analyzed. Restoration stability can be checked by comparing this data with that obtained on check samples taken in April and June of 1980 and by comparing with the upper limit for restoration as shown on each graph.
- 2) Three sets of check samples were taken; one on April 23, 1980, after 2880 gallons had been removed from the Recovery Well (R-1), one on April 30, 1980, after 26,880 gallons were pumped, and a third sample, somewhat later, on June 5, 1980, after another 57,600 gallons had been pumped. It is estimated that the first sample removed water from as close as two to five feet around the well, that the second sample drew some water from ten to sixteen feet away, and that the third sample could contain some water coming from twenty to twenty-five feet away.
- 3) Table I is an updated Restoration Summary of the Water Chemistry of the recovery well and buffer water supply as some additional data has been received since the Restoration Summary Report was submitted on October 19, 1979. Table I-A illustrates the upper limit restoration data, the restoration data as of shut-down on September 19, 1979, and the check sampling data obtained during sampling activities on April 23, 1980, April 30, 1980 and June 5, 1980.
- 4) All of the water removed from the recovery well during the above sampling procedure was sent to the evaporation ponds. The attached Table II illustrates the Well Field Flow Volume as was required for restoration plus that pumped for sampling in April and June, 1980.
- 5) The five monitor wells (M-1, M-2, M-3, M-4, and M-5) in the "B" (mining zone) aquifer were also sampled in September, 1979 and again in April, 1980. The analytical data from these wells, including data previously submitted and now updated, is attached as part of this report (Tables III, IV, V, VI and VII).
- 6) The monitor well (OSA-1) in the "A" aquifer (immediately above the mining zone) was also sampled in September, 1979 and again in April, 1980. That analytical data, including data previously submitted and now updated, is attached as Table VIII.
- 7) An updated Table IX, containing data on the water chemistry of Water Well 789V, is attached for reference and information only.

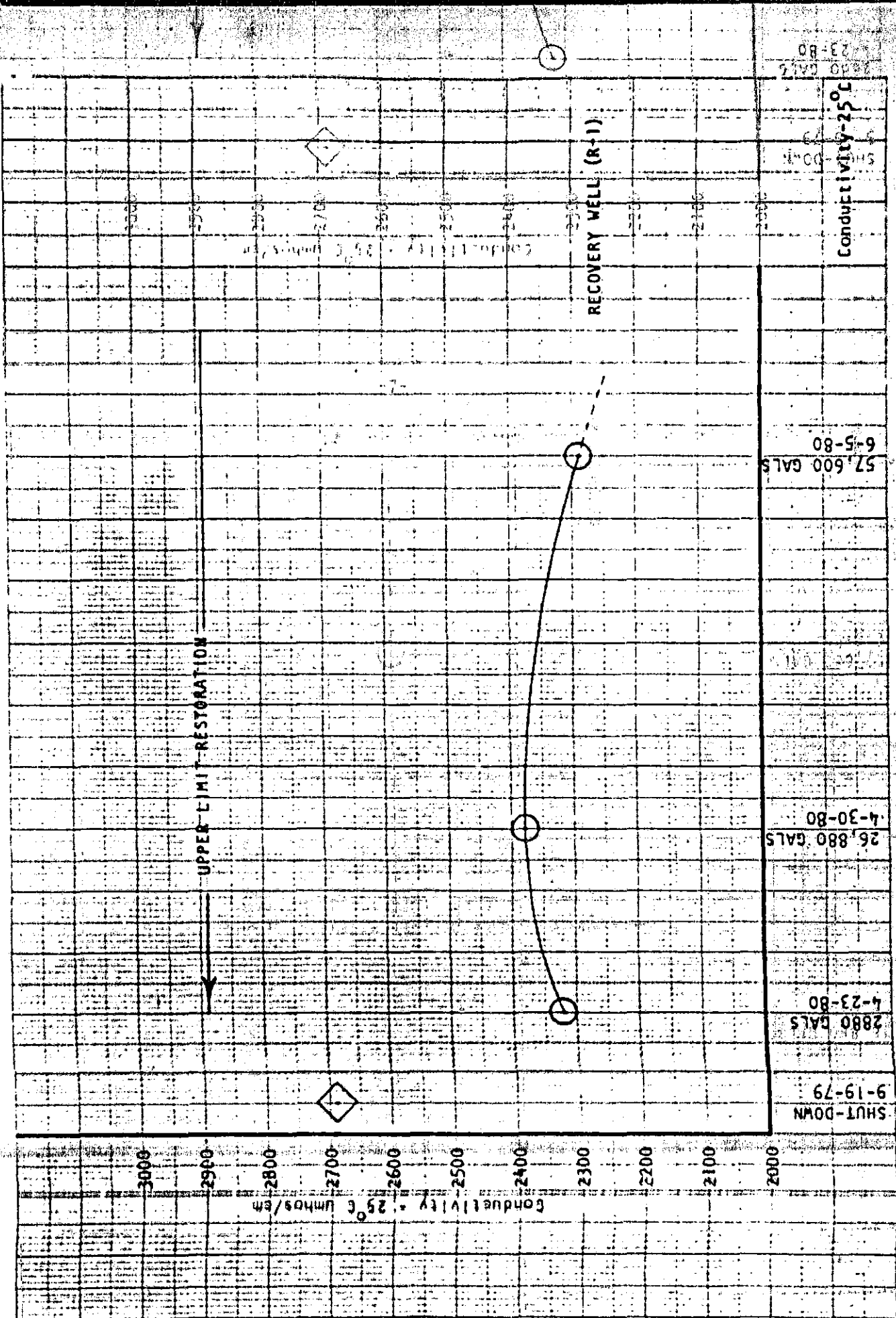
search and development program, has been achieved while using a sodium bicarbonate-carbonate leachant system and a combination ground water sweep - fresh (buffer) water injection system for restoration.

- 7) No excursions occurred during the test or during restoration.
- 8) It is recommended that the Phase I well field be secured by plugging and sealing all wells as soon as possible. The procedure for sealing wells that have no further value has been established with the Wyoming Department of Environmental Quality.
- 9) The pilot plant and well field remained secured all winter and now stand in that condition.
- 10) Well 1-2 (north injection) was repaired on October 31, 1979 with 235 feet of 4" liner and three very tight fitting packers. This well has not been used for any activity since prior to the well field shut down.
- 11) Reclamation of all drill sites on the Sundance Project is 99% completed with only a few small recently built drill hole sites to be re-seeded this fall. Also, the entire well field, except for the wells themselves, has been reclaimed and re-seeded.
- 12) Baseline vegetation studies for the Sundance Project have been completed by International Environmental Consultants. These studies are intended to suffice both for a possible Phase II research test as well as for anticipated commercial mining activities.
- 13) Five wells, located about four thousand feet northwest of the present well field, have been completed and are intended to be used to obtain baseline information for a proposed Phase II test.
- 14) The "outside" or private wells have been sampled as required by the permits granted to Nuclear Dynamics. Table 2, 3, 4, 5, and 6 illustrate the data obtained from these wells since July, 1979.
- 15) Proper and sufficient bonding for all drilling and research activities conducted on the Sundance Project have been kept in effect and are properly filed with the Wyoming Department of Environmental Quality.

Conclusions

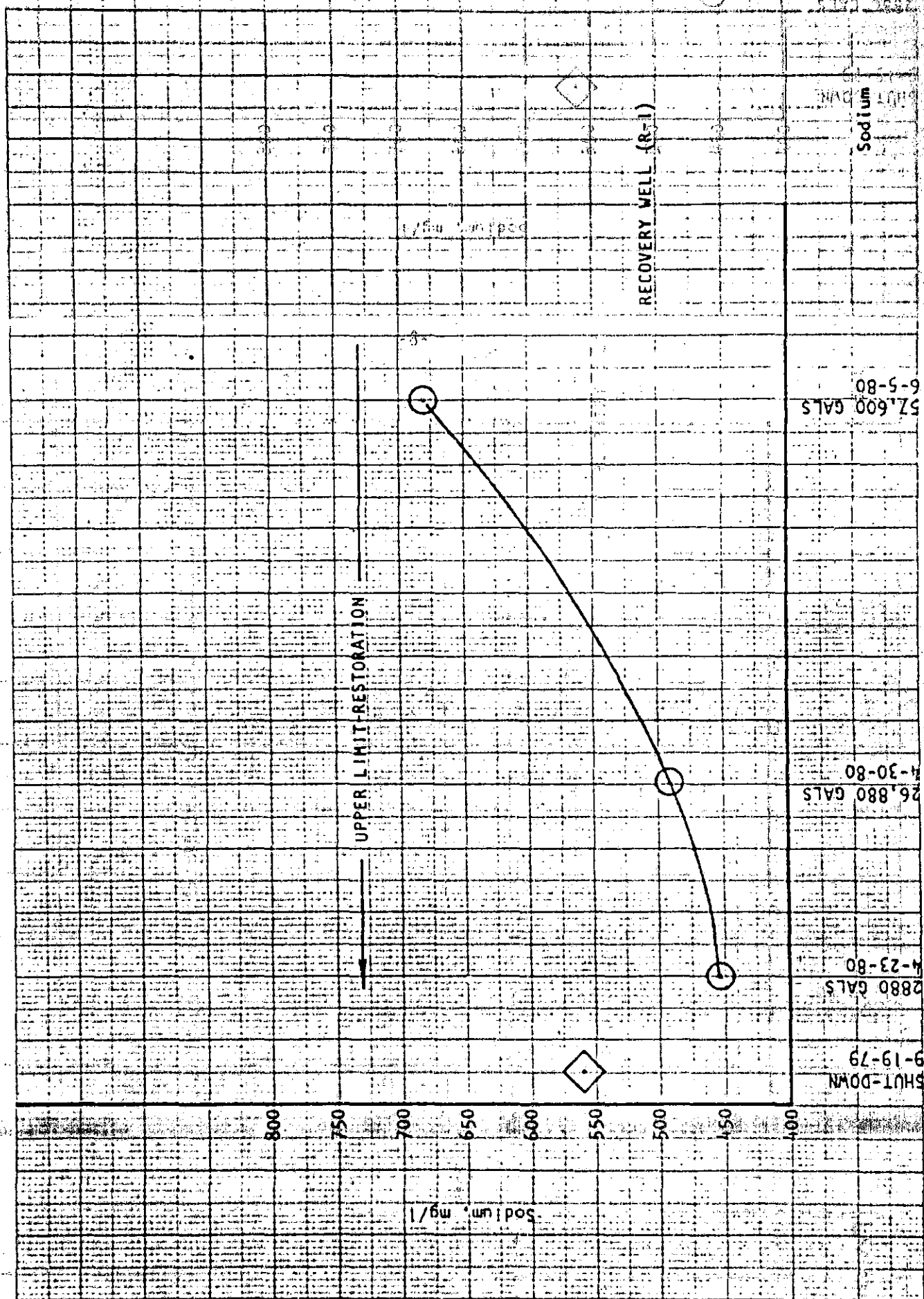
- 1) Satisfactory restoration, under the intent and limitations of a research and development program, has been achieved while using a sodium bicarbonate-carbonate leachant system and a combination ground water sweep - fresh (buffer) water injection system for restoration.
- 2) No excursions occurred during the test or during restoration.
- 3) It is recommended that the Phase I well field be secured by plugging and sealing all wells as soon as possible. The procedure for sealing wells that have no further value has been established with the Wyoming Department of Environmental Quality.



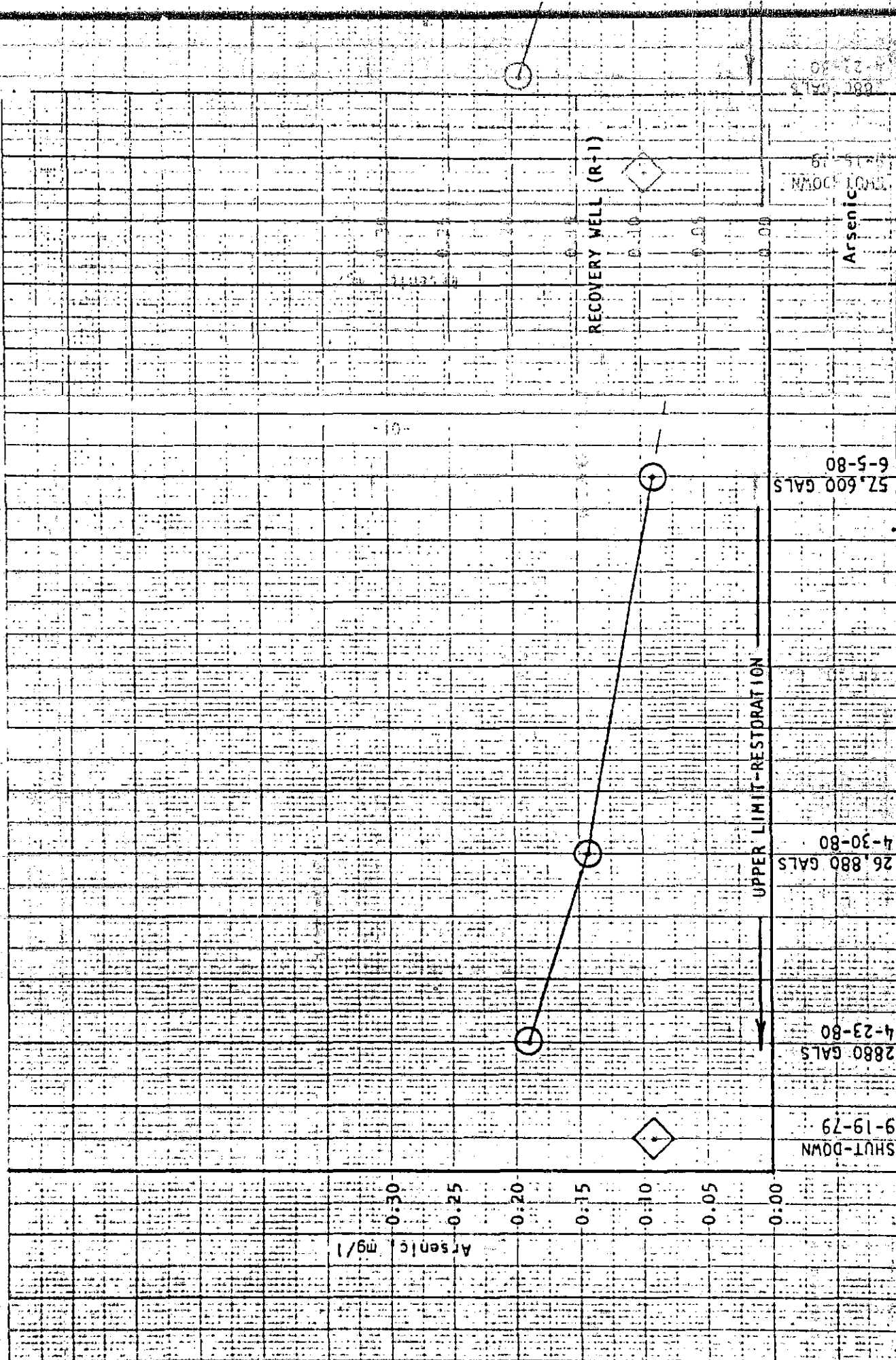


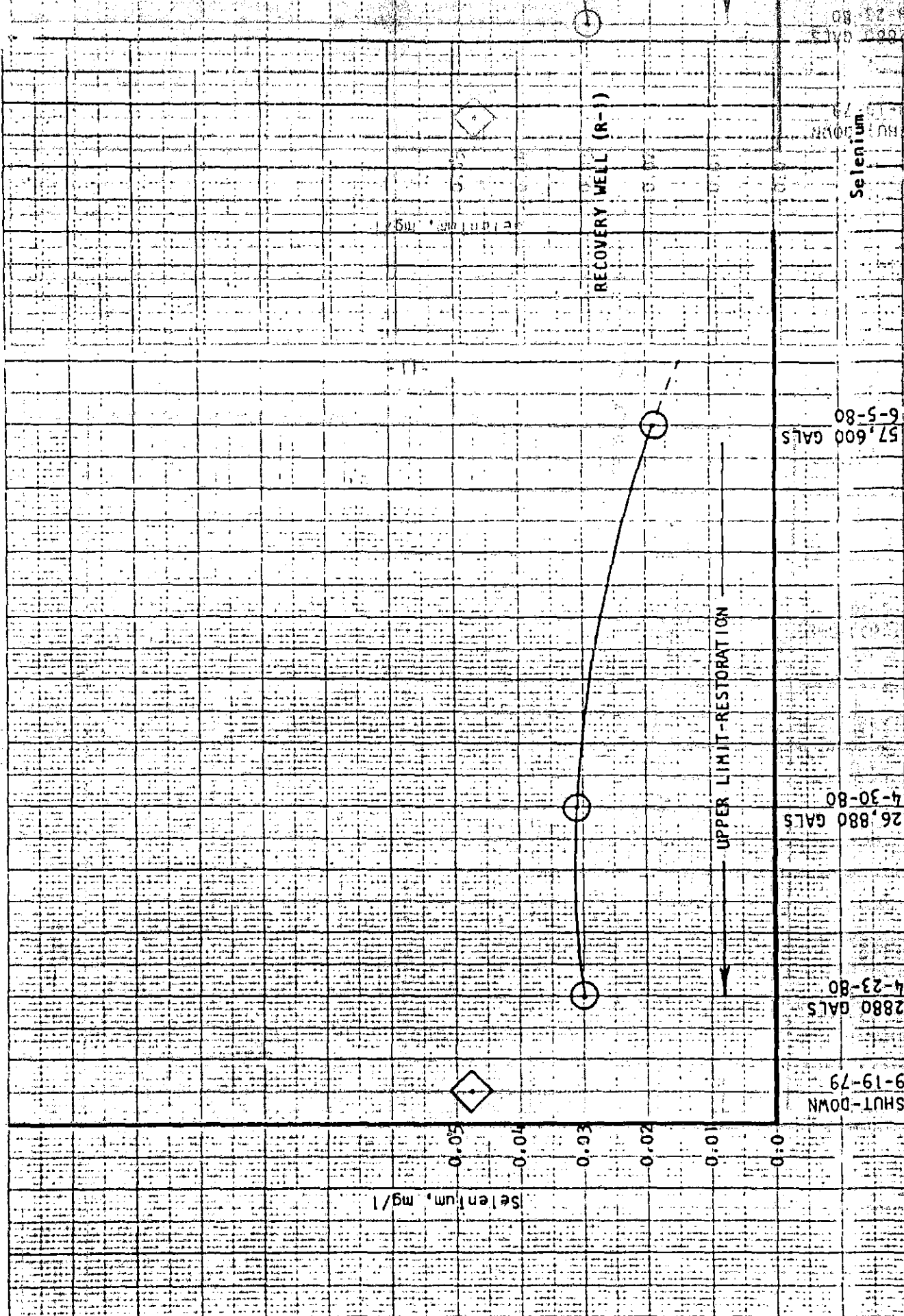
Cross Section 20' to 30' 11.45 in U.S.A.

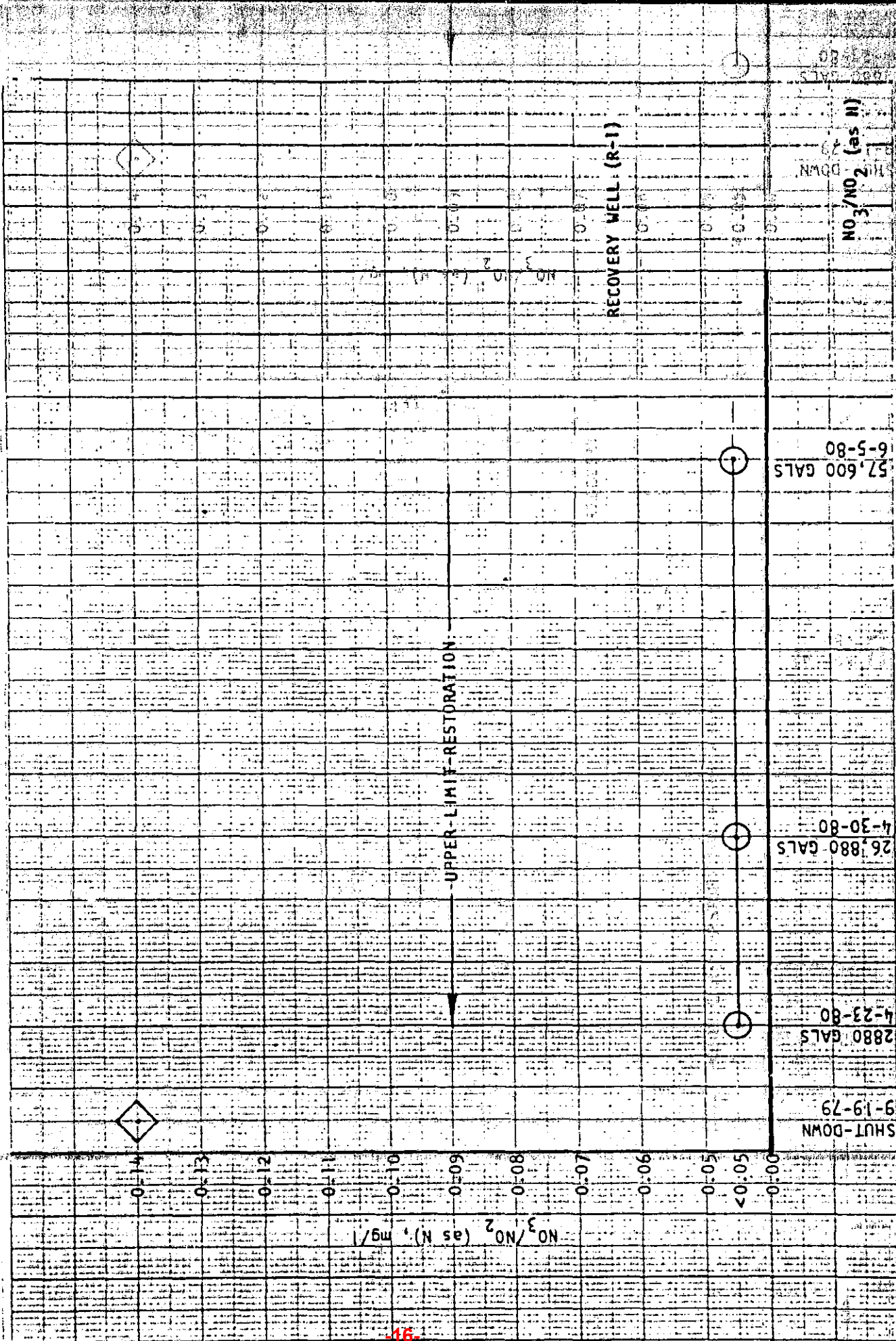
10-20-1980, 10-20-1980, 10-20-1980





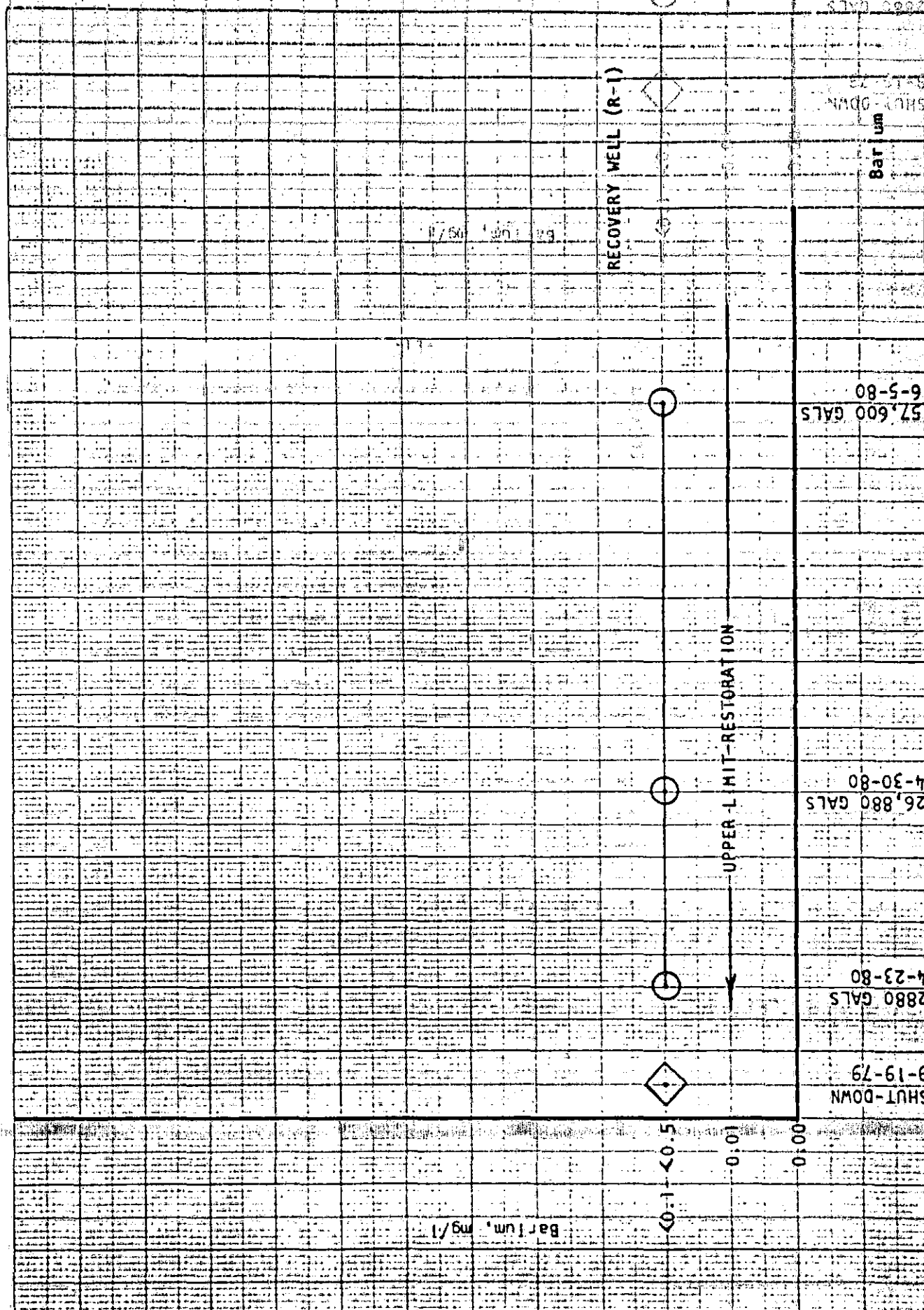


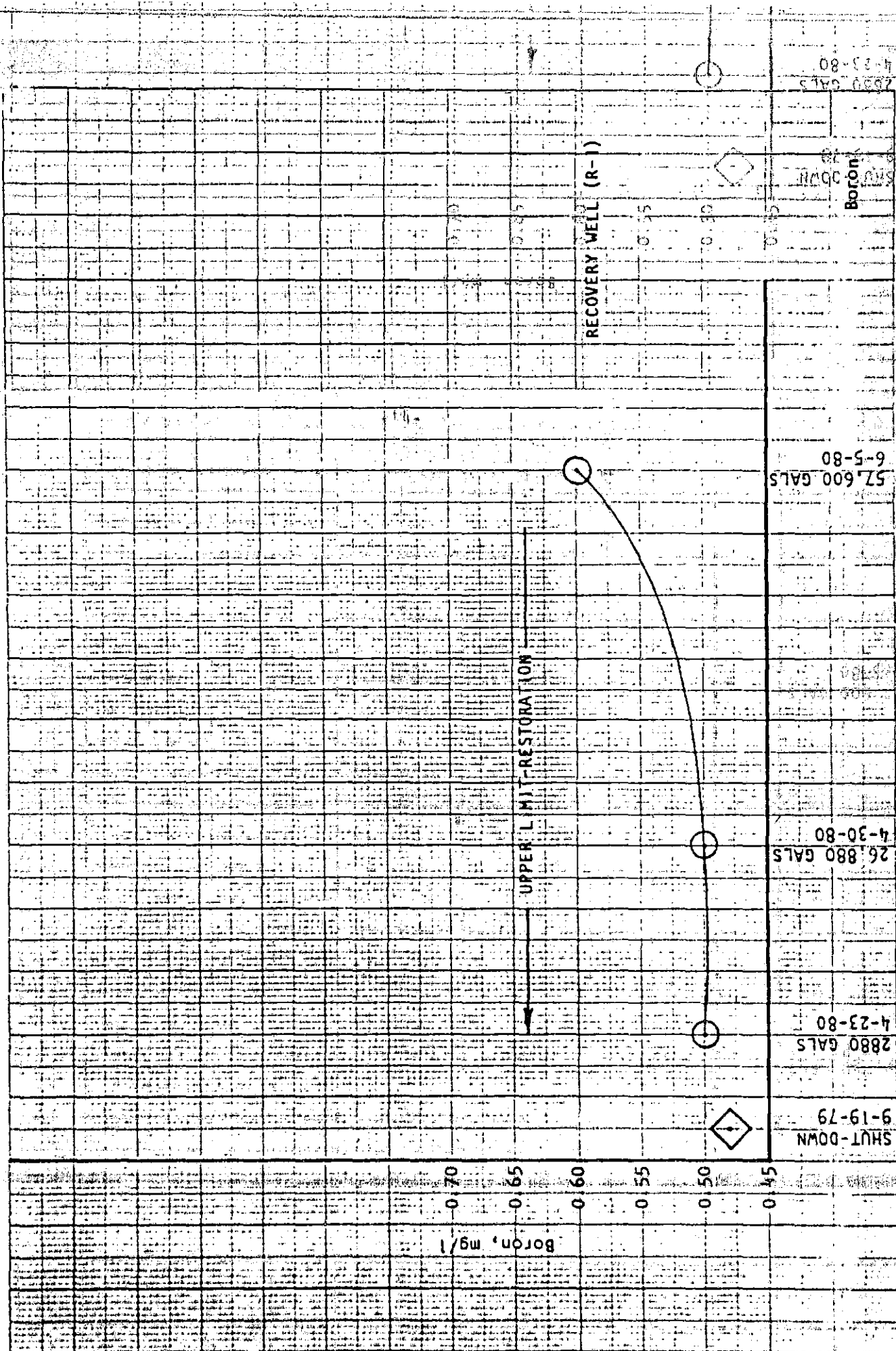


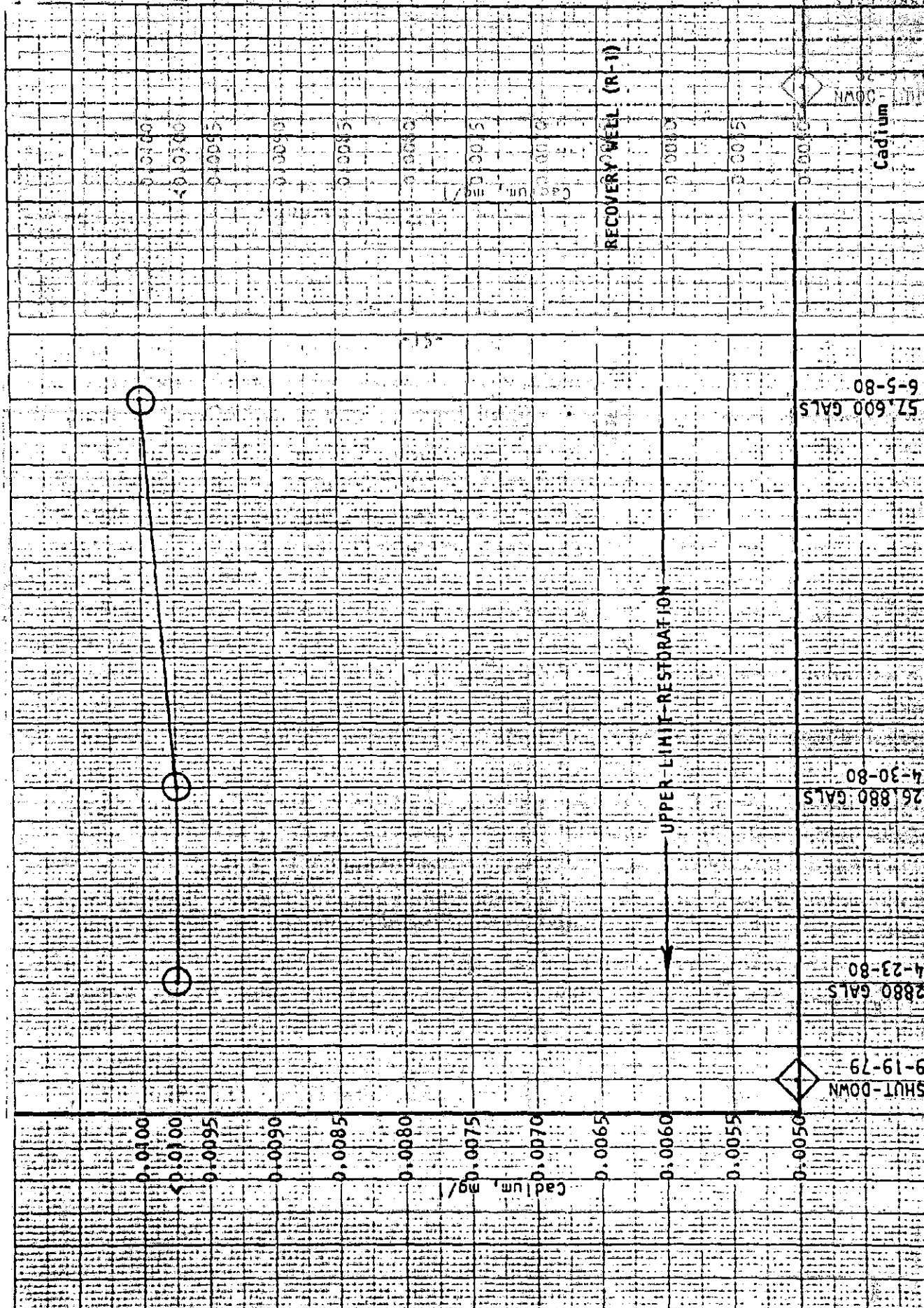


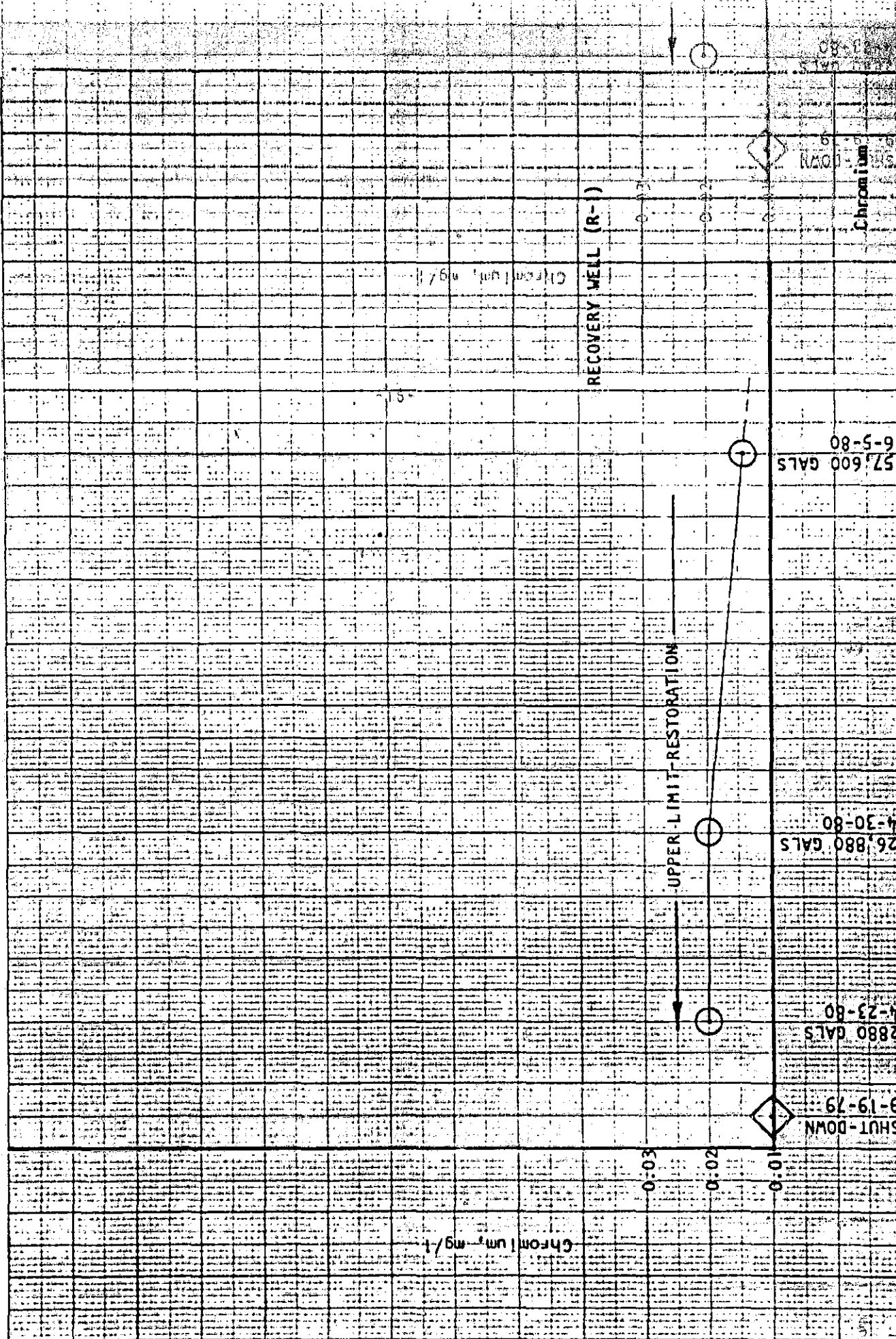
Cross Section 20 was to a depth Made in U.S.A.

HEAD PRODUCT BAYON, ON 0 4114



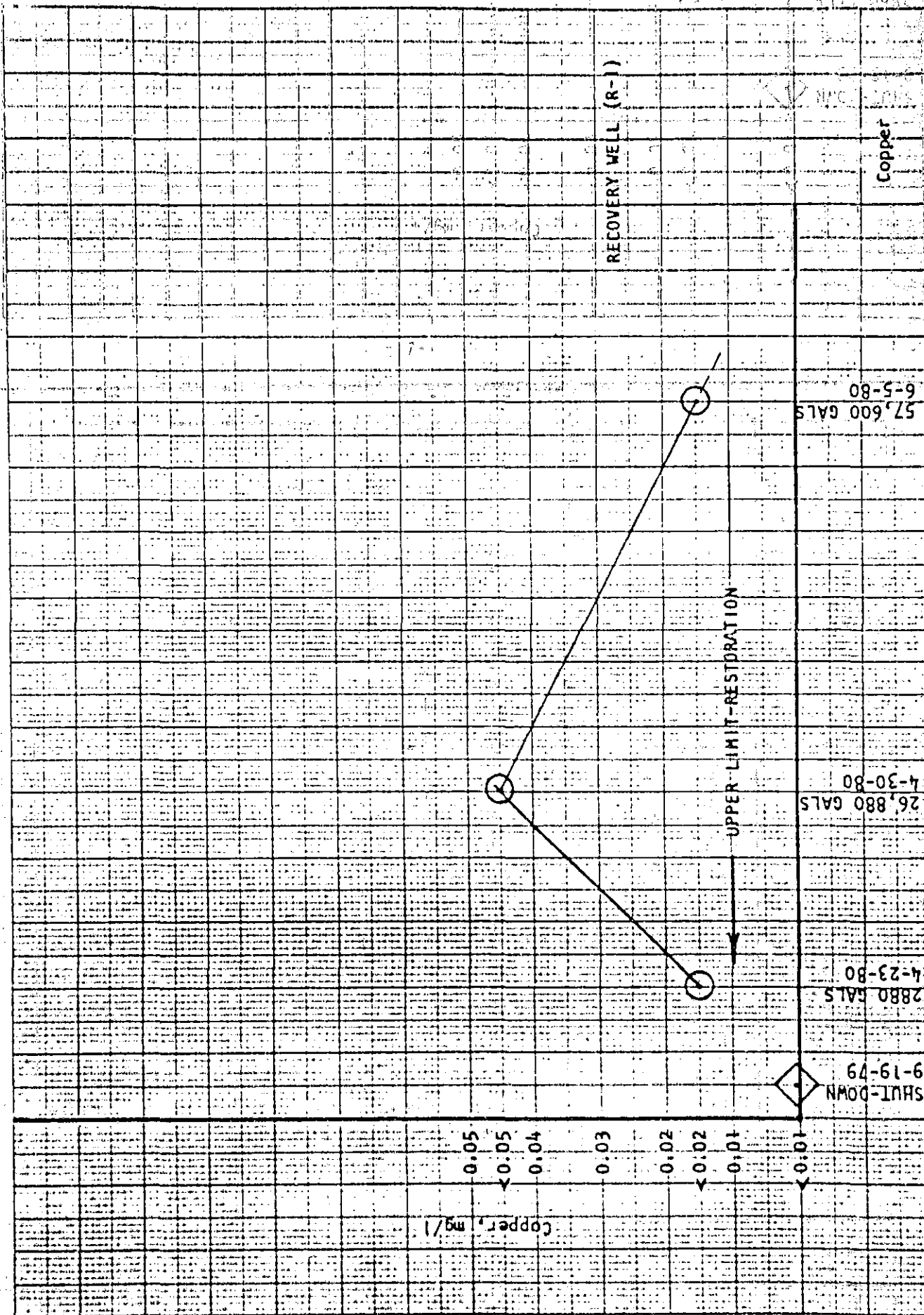






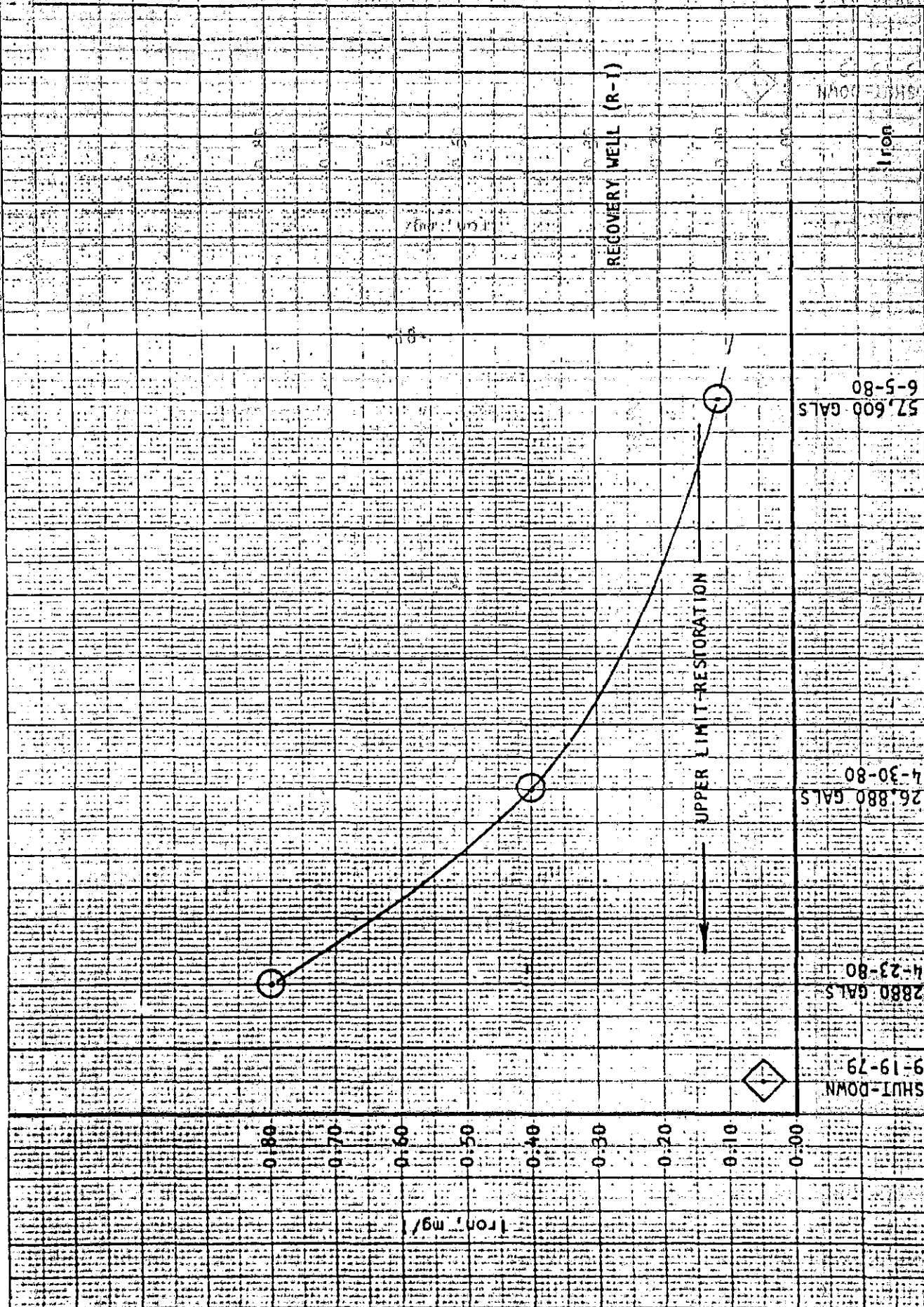
Cross Section 20-425 to 426, 1/2 mile in U.S.A.

U.S.A. PRODUCT'S DESIGN OF 0-1-18.



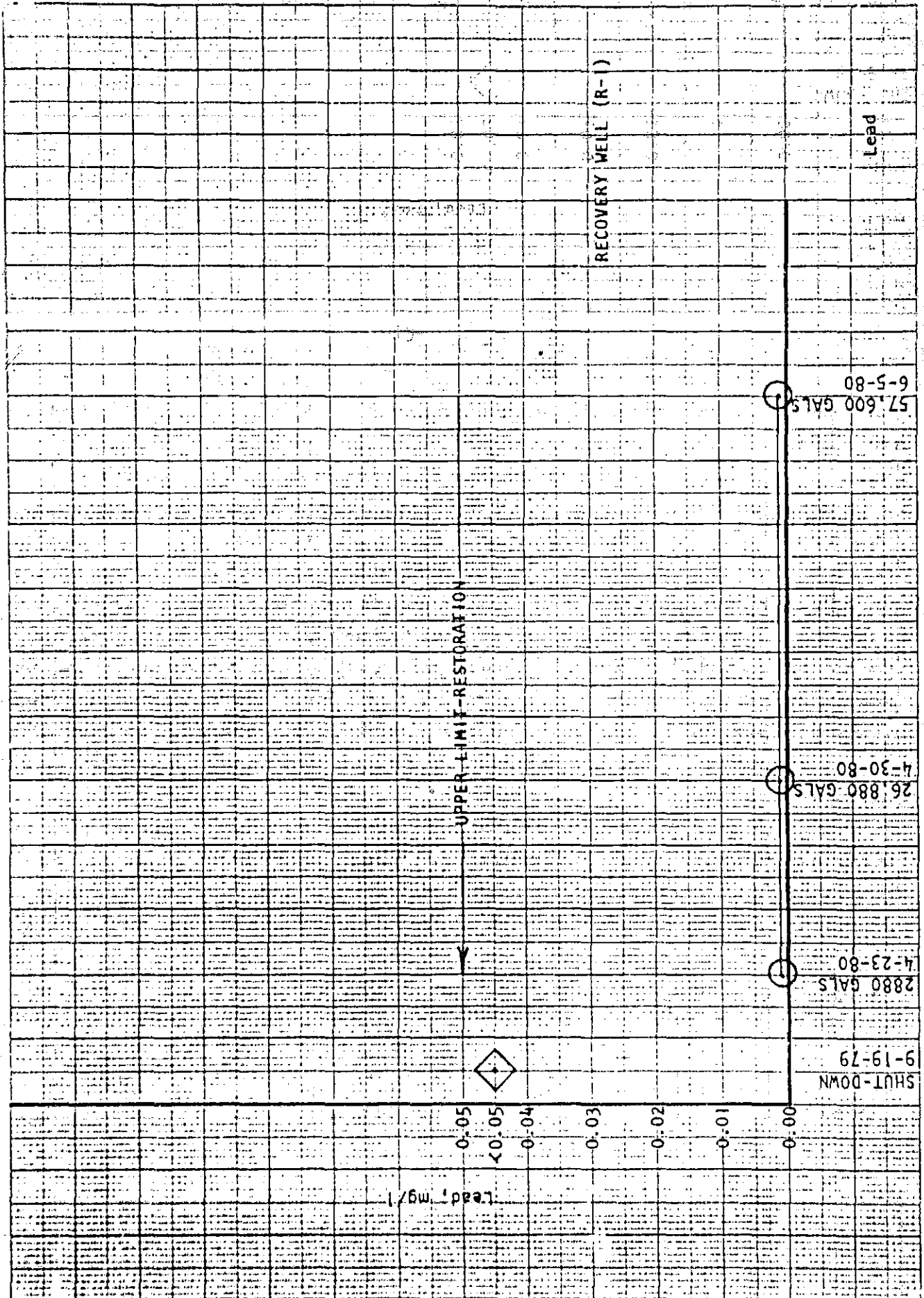
Cross Section 20 mts in a m² state in U.S.A.

RECOVERY WELL (R-1)



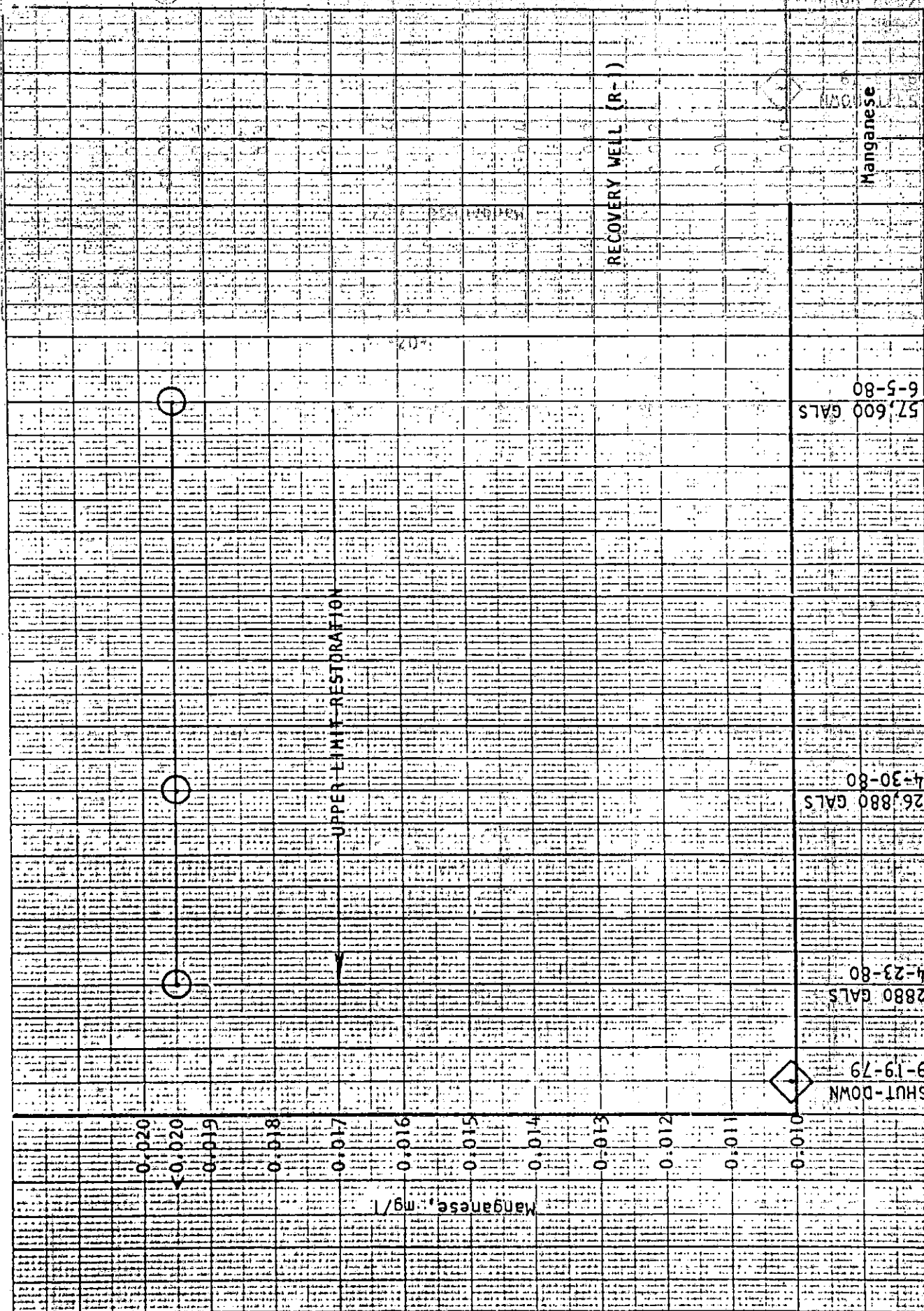
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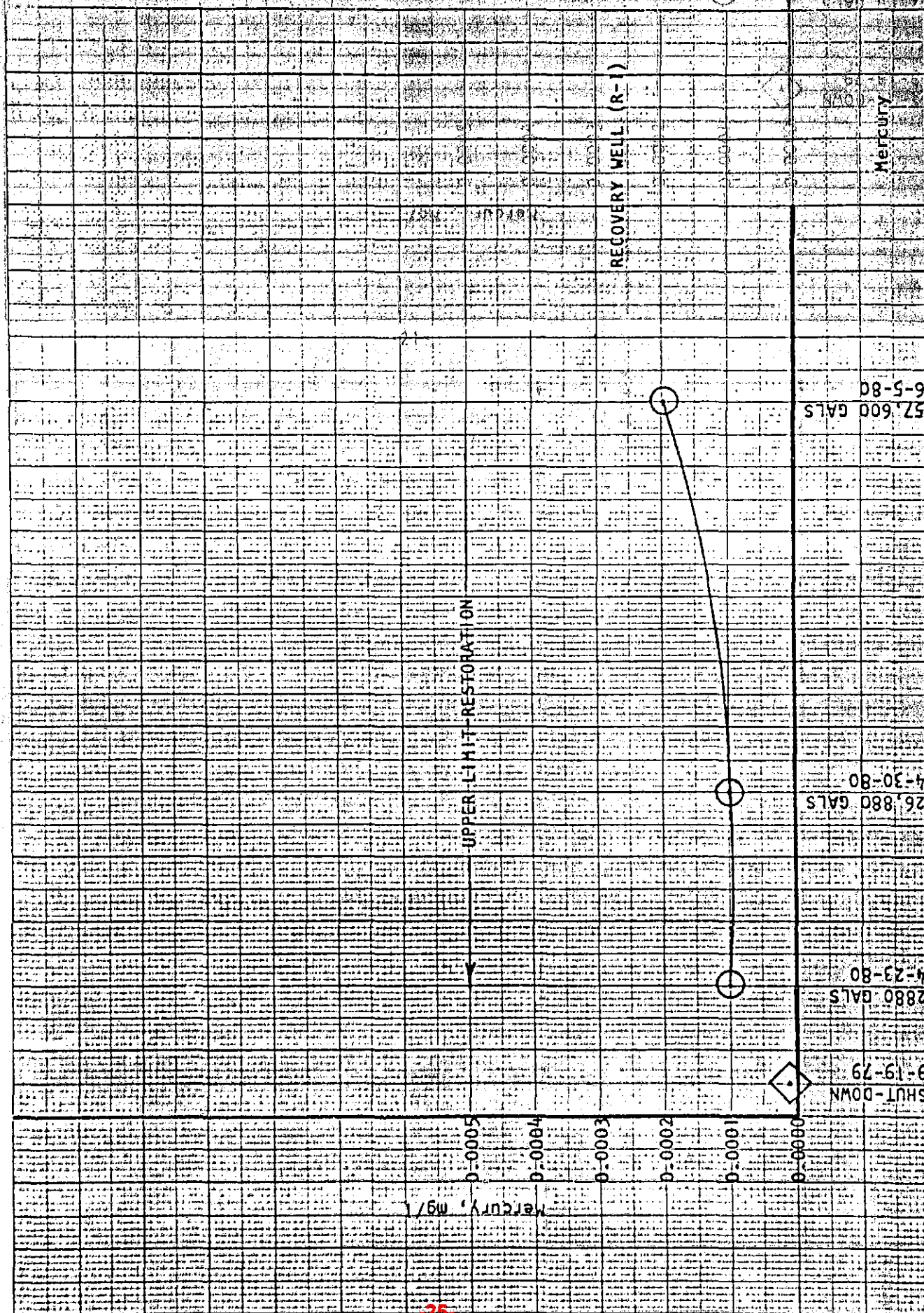
LEAD PRODUCTS WATER O. D. 1.6



Cross Section 20 ft. to a mi. N. in U.S.A.

NEAD PROGRESS DAYTON, O. 0-316

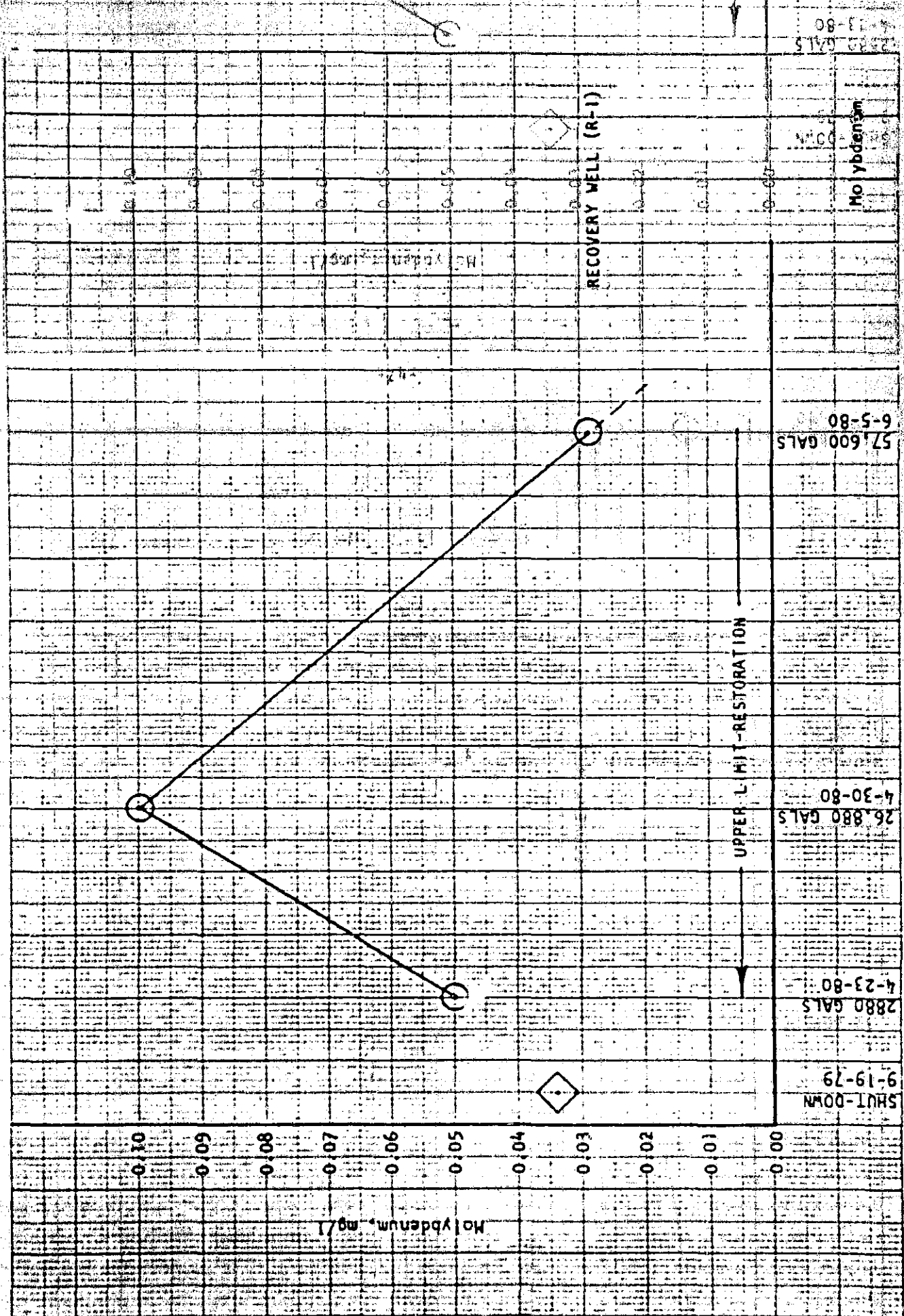




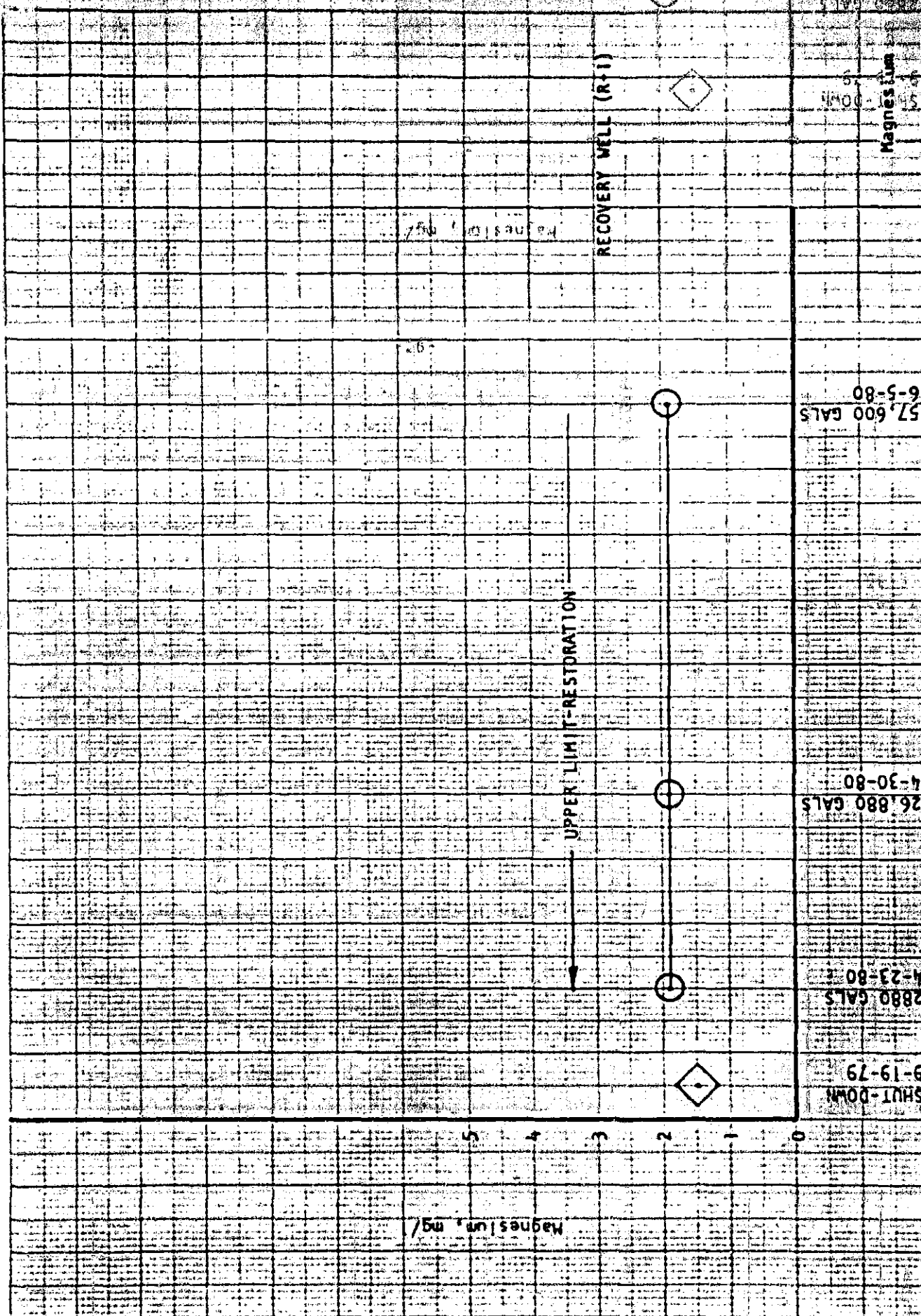
-22- -26-

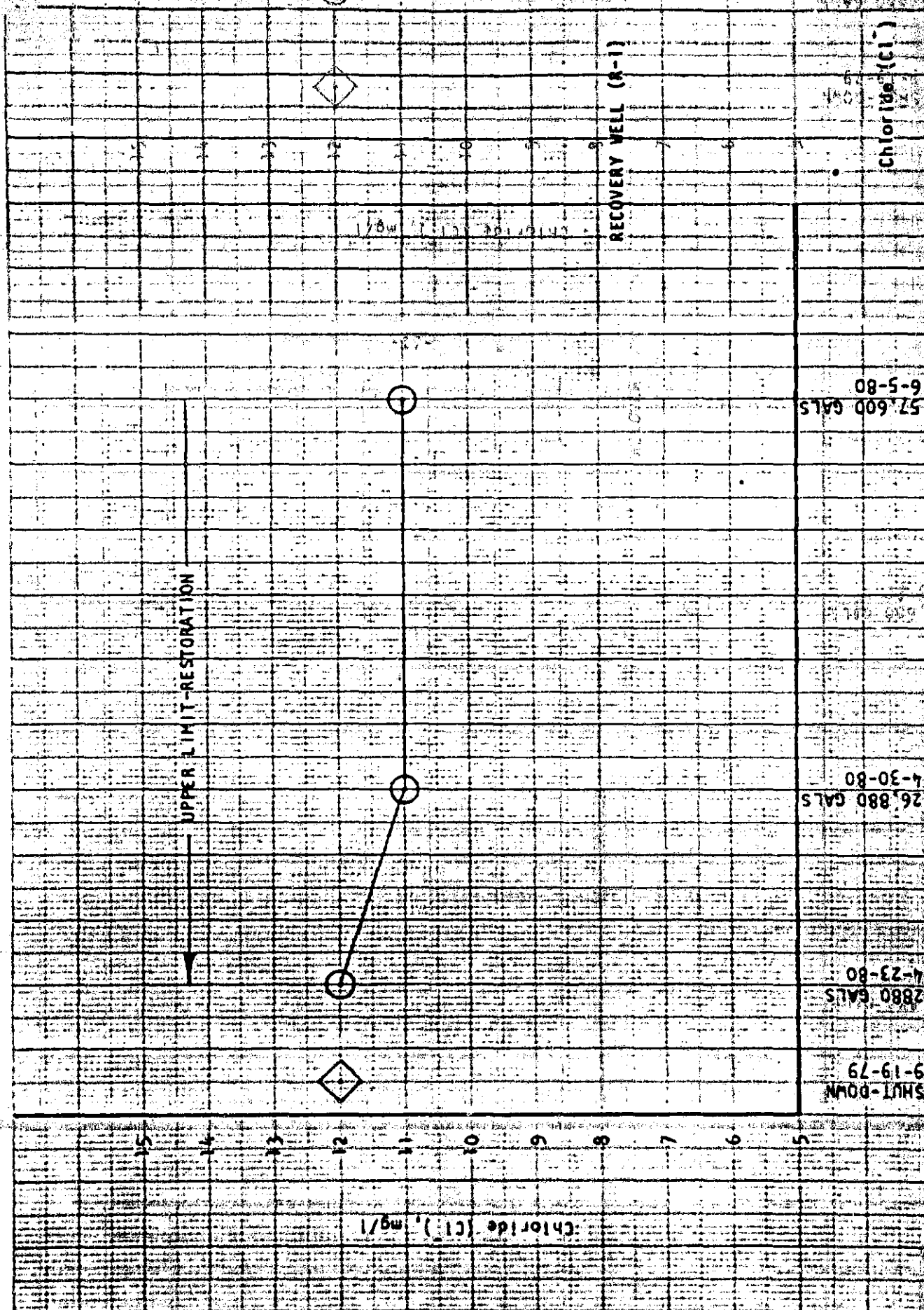
Case Section 28, 100 ft. x 100 ft. 100 ft. x 100 ft.

100 ft. x 100 ft. 100 ft. x 100 ft.

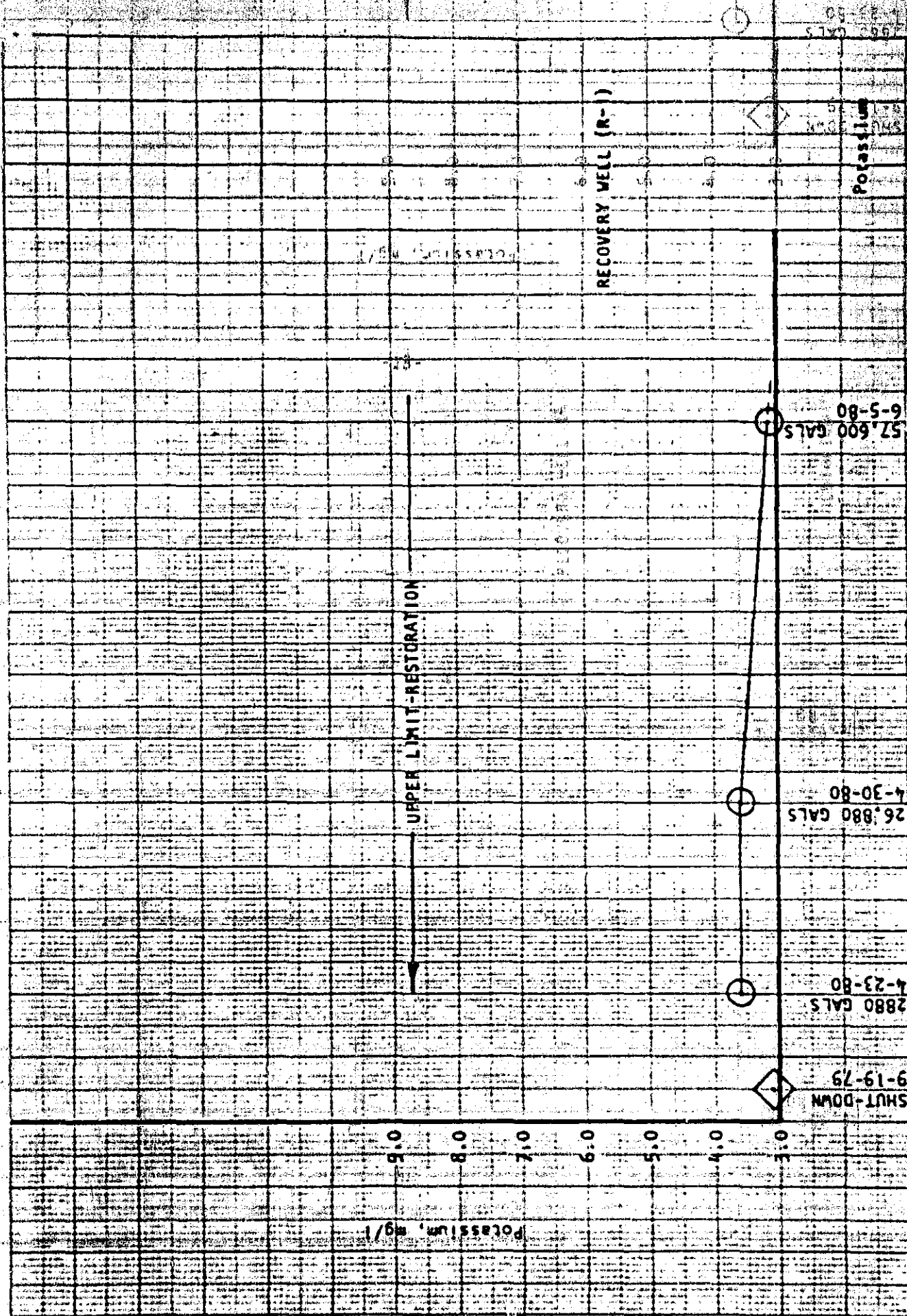


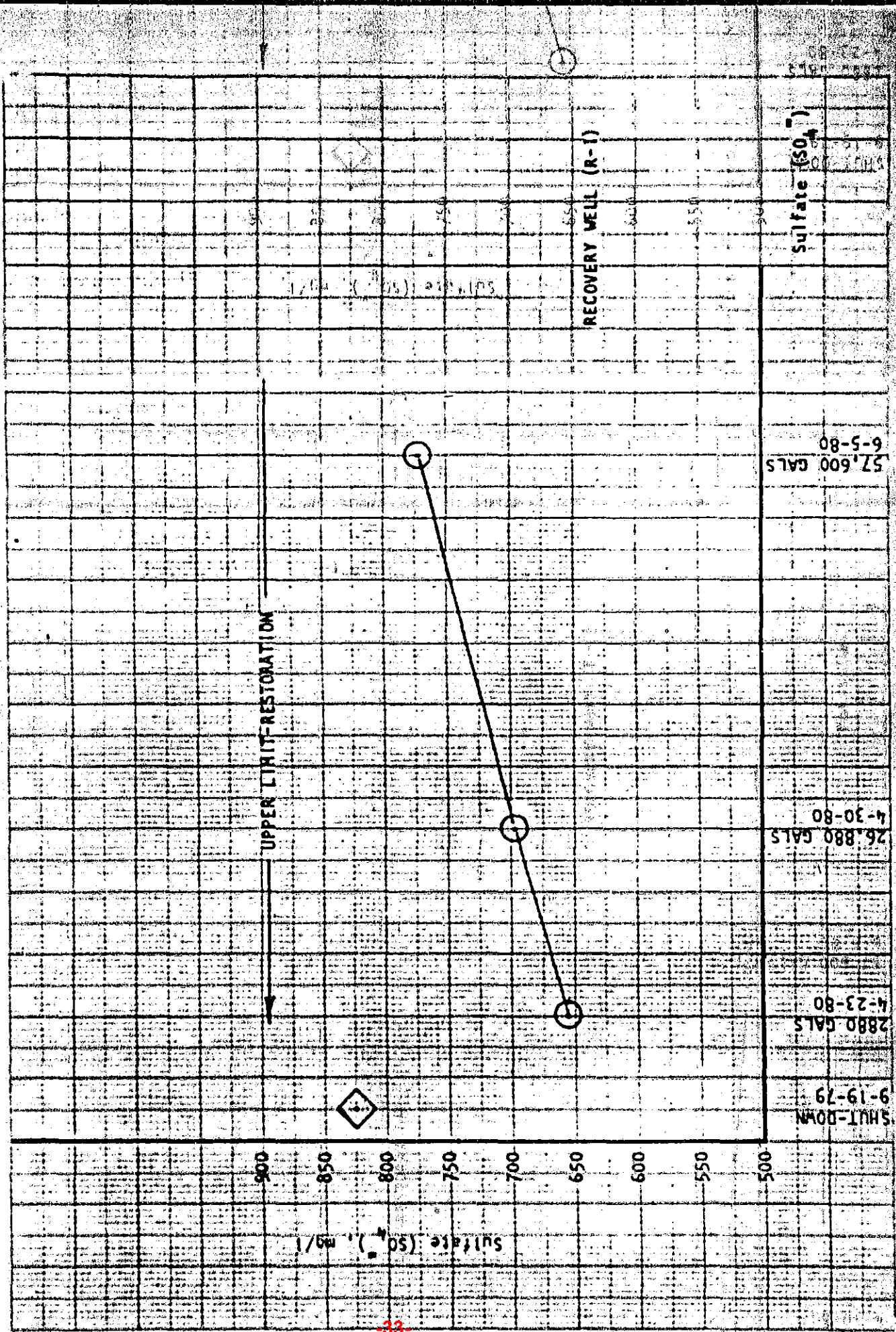


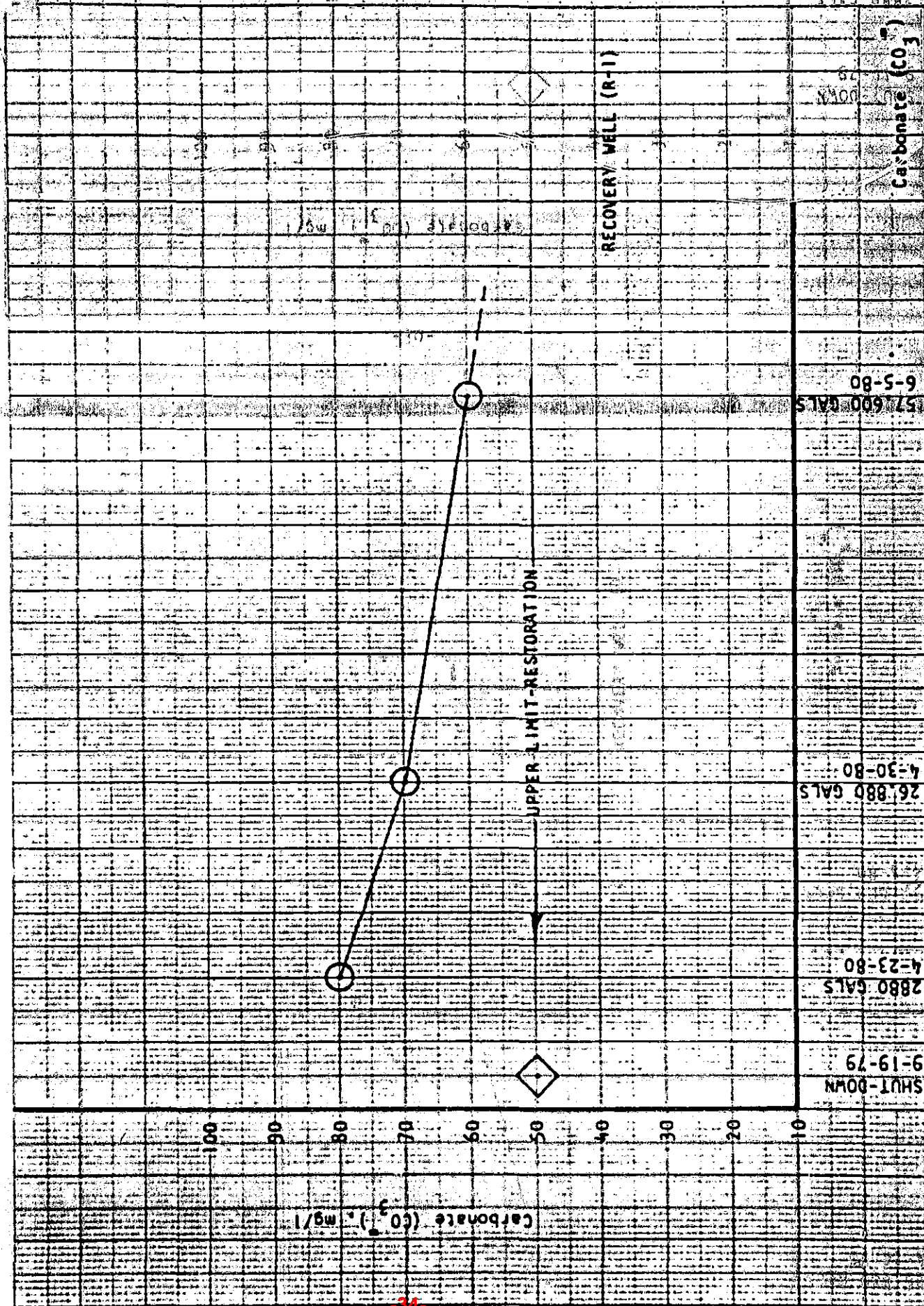




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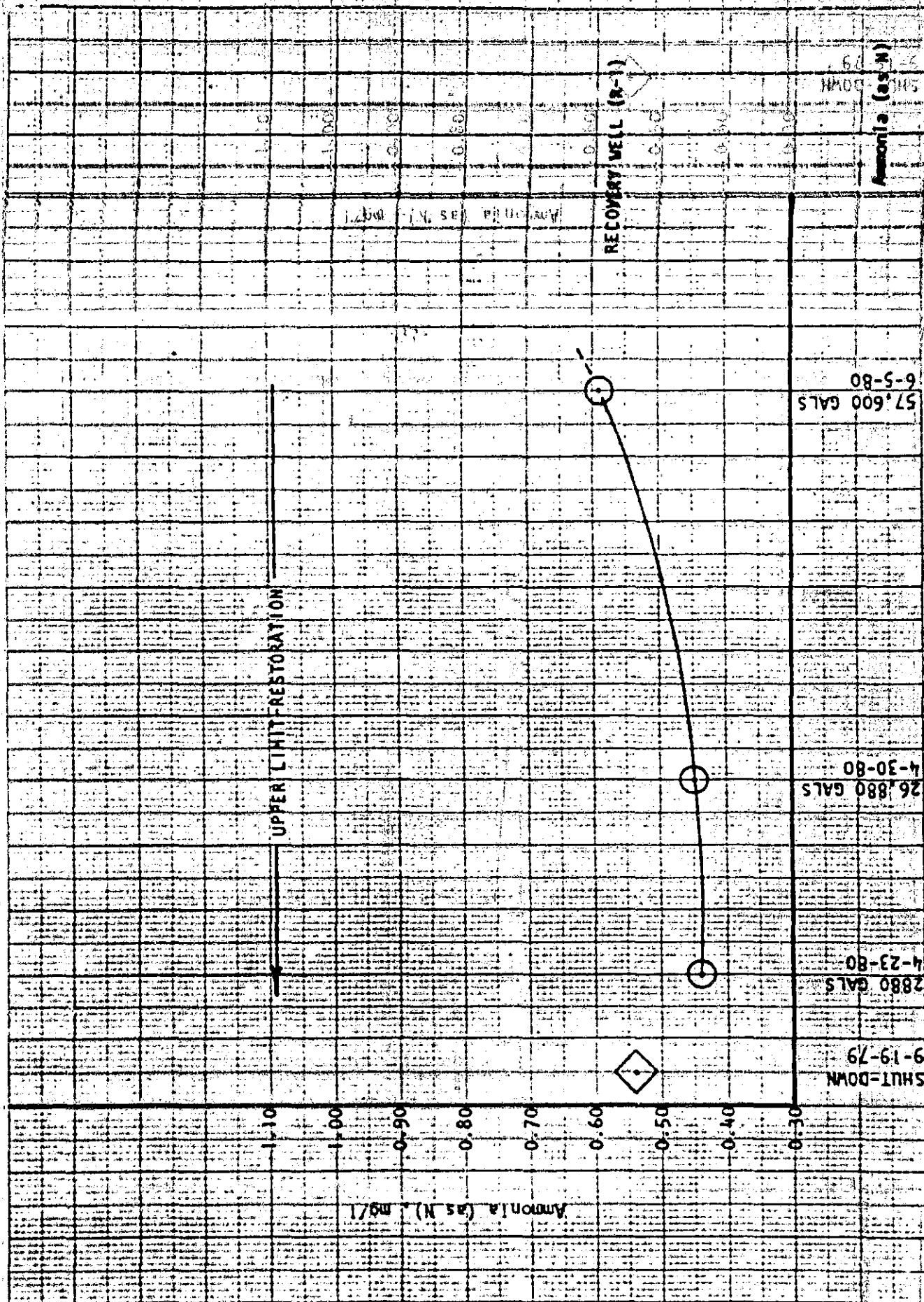






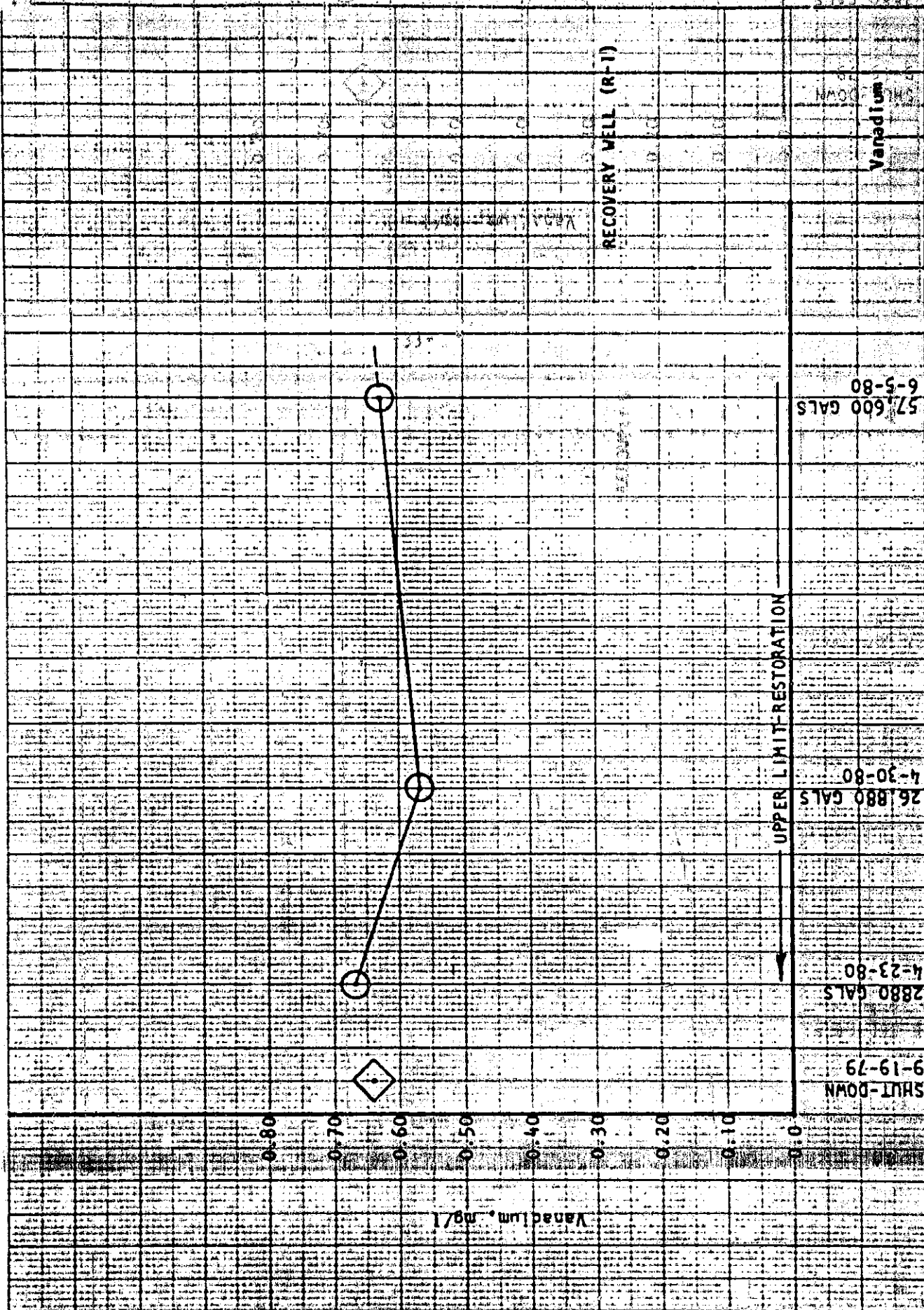
U.S. DEPARTMENT OF JUSTICE
FEDERAL BUREAU OF INVESTIGATION
WASHINGTON, D. C. 20535



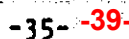


Cross Section 20' to 20' in 10' blocks at 10' S

Vanadium, mg/l

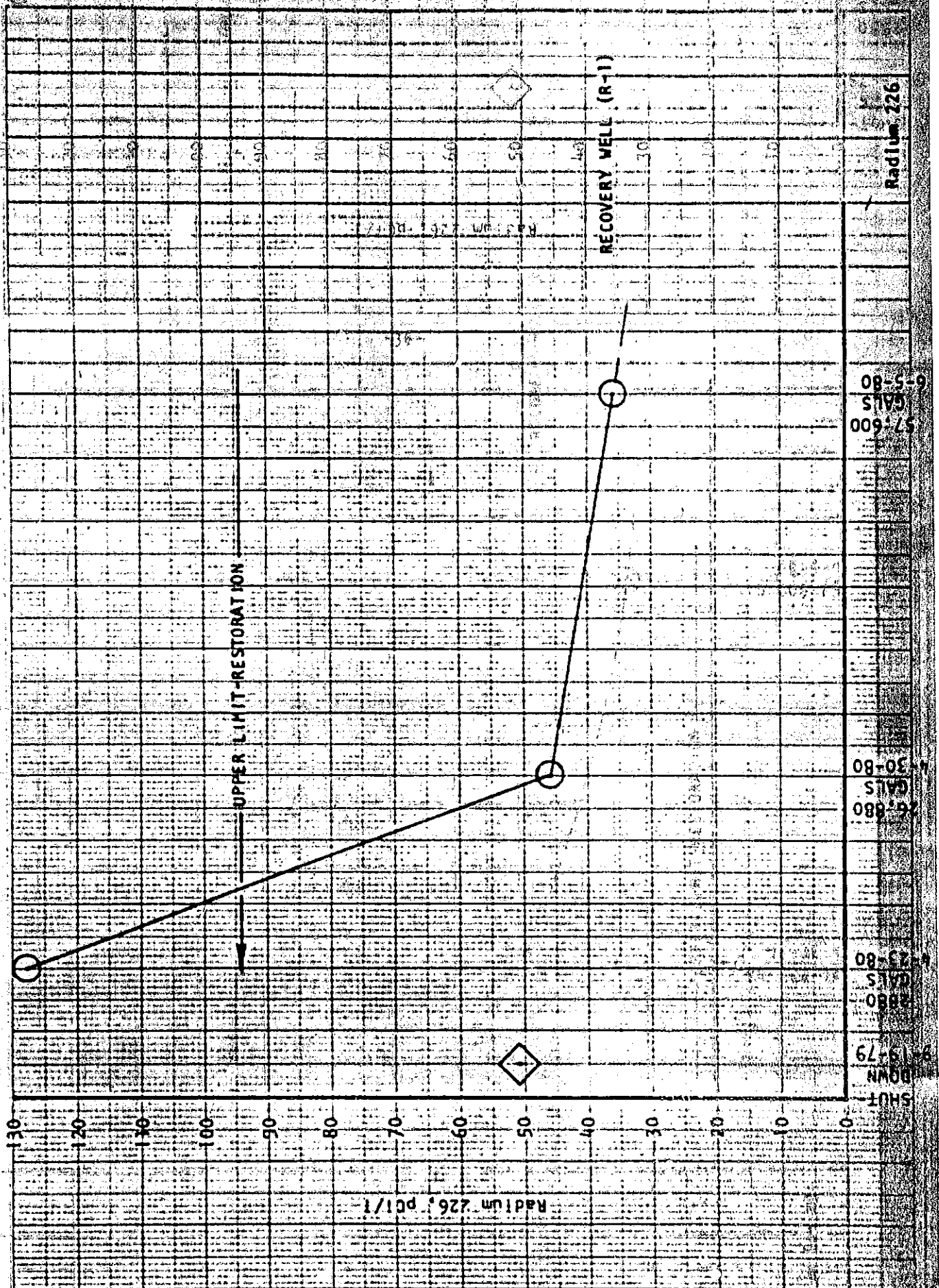






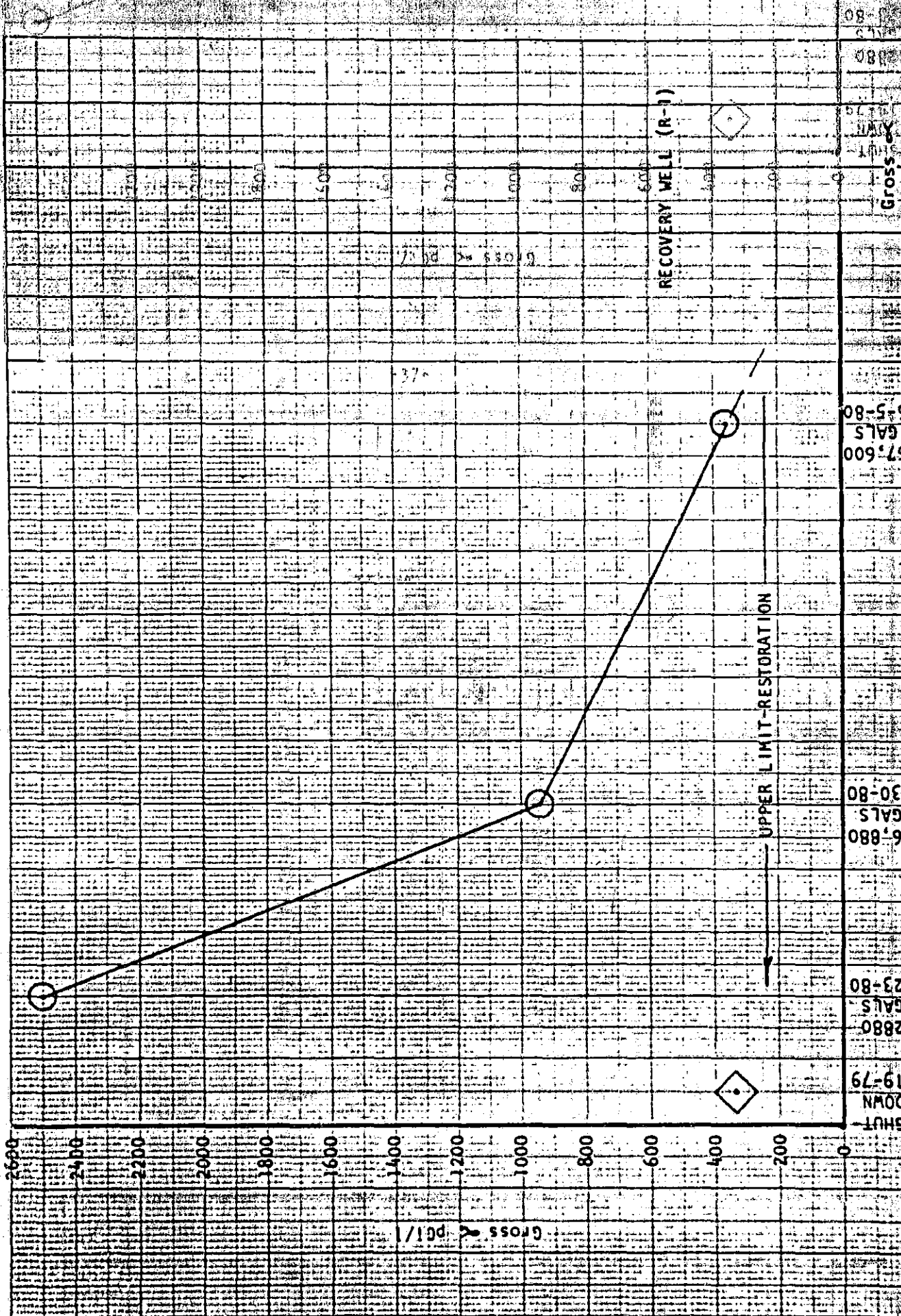
Cross Section 30 cut to a well Made in 1954

Map Projection: Mercator, Q1 D 43-26



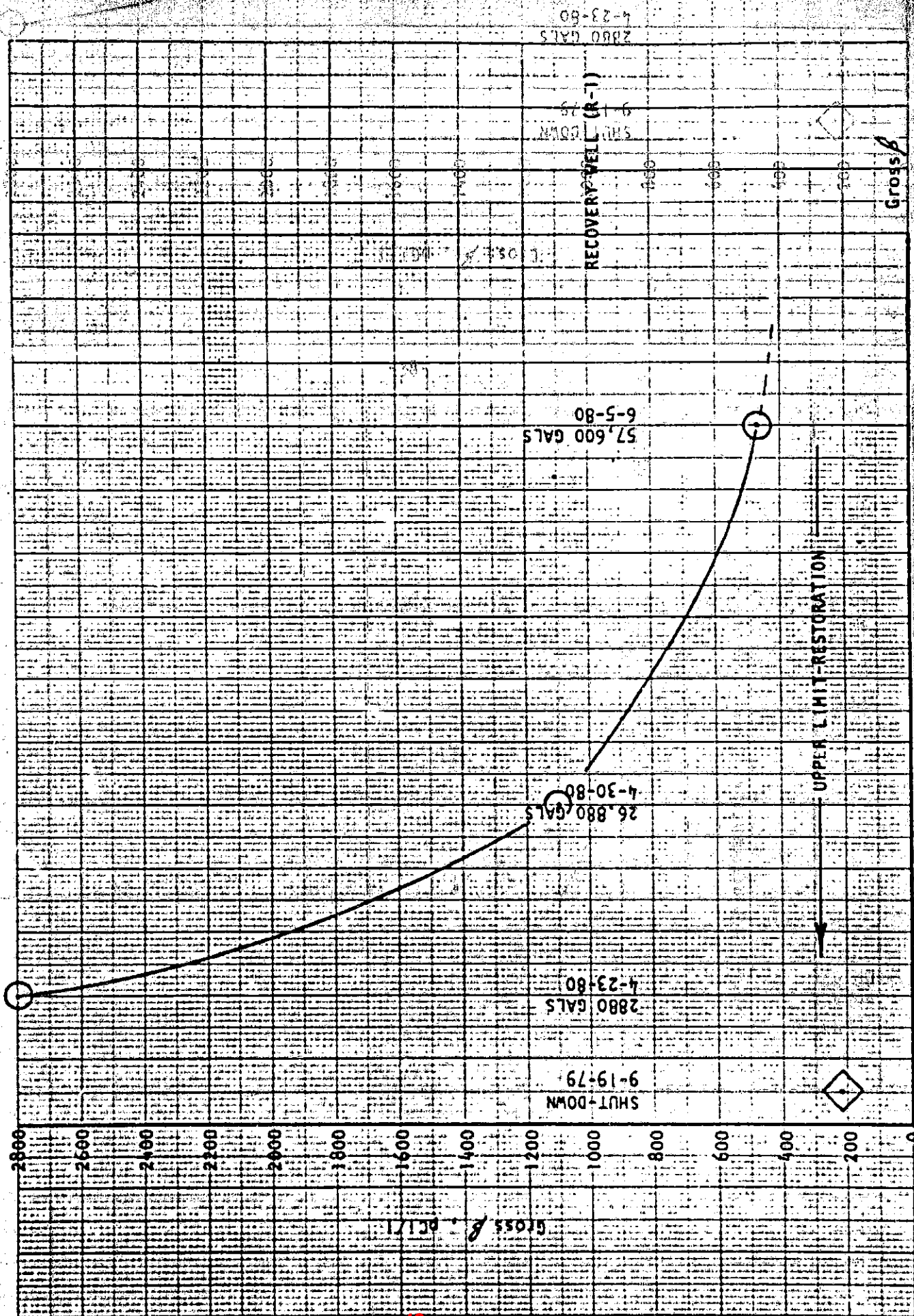
Cross Section 20 psi to a inch. Made in U.S.A.

20-20 24-20 28-20 32-20 36-20 40-20 44-20 48-20 52-20 56-20 60-20 64-20 68-20 72-20 76-20 80-20 84-20 88-20 92-20 96-20 100-20



Cross Section 20 mil. to 1 in. Made in U.S.A.

HEAD PRODUCTIVE BOTTOM ON 45°



POOR ORIGINAL

TABLE I

RESTORATION SUMMARY

Water Chemistry

Analyses on Full Suite of parameters listed on page 14 of Application for Source Material License
Well R (Recovery Well), Water Supply Well (789V), and Upper Restoration Limit*
(in mg/l, except for pH, and where noted)

	R Recovery Well					Upper Rest. Limit*	789V		5/25/79
	5/25/79	6/25/79	7/06/79	8/06/79	9/07/79		7/02-18/79	9/7/79	
Calcium	9.8	4.5 ⁽⁴⁾	5.0	7.8	6.3	9.0	9.0	8.5	9.8
Sodium	950.0 ⁽¹⁾	770.0 ⁽⁴⁾	760.0	690.0		730.0	600.0	530.0	940.0 ⁽¹⁾
Potassium	5.5	3.6 ⁽⁴⁾	3.7	3.6	3.0	8.7	3.2	2.7	5.3
Magnesium	3.2	2.8 ⁽⁴⁾	2.2	2.2	1.9	3.4	2.7	2.8	3.2
Chloride (Cl ⁻)	16.0 ⁽¹⁾	16.0 ⁽⁴⁾	12.0	12.5	13.0	14.3	12.5	12.5	16.0 ⁽¹⁾
Carbonate (CO ₃ ²⁻)	300.0	178.0	158.0	97.0	85.0	50.0	6.0	9.0	300.0
Bicarbonate (HCO ₃ ⁻)	719.0 ⁽¹⁾	650.0 ⁽⁴⁾	654.0	623.0	608.0	660.0	581.0	581.0	719.0 ⁽¹⁾
Sulfate (SO ₄ ²⁻)	809.0 ⁽¹⁾	841.0 ⁽⁴⁾	788.0	761.0		891.0	767.0	747.0	809.0 ⁽¹⁾
Ammonia (as N)	0.7 ⁽³⁾	0.7 ⁽⁴⁾	0.05	0.52	0.16	1.09	<0.05	0.19	0.7 ⁽³⁾
Total Dissolved Solids	2738.0	2282.0	2016.0	1816.0	1832.0	1940.0	1616.0	1552.0	2738.0
Conductivity	3559.0	3384.0	2993.0	2829.0	2786.0	2898.0	2478.0	2477.0	3559.0
	umhos/cm	umhos/cm	umhos/cm	umhos/cm	umhos/cm	umhos/cm	umhos/cm	umhos/cm	umhos/cm
Uranium (U ₃ O ₈)	4.6	3.3 ⁽⁴⁾	2.4	2.2	1.18	0.26	0.066	0.060	4.6
Boron	1.08 ⁽¹⁾	0.98 ⁽⁴⁾	0.88	0.66	0.56	0.64	0.40	0.42	1.08
Copper			0.02	0.015	0.005	0.01	0.008	0.005	
Zinc			0.06	0.070	0.015	0.024	0.067	0.048	
Lead			0.03	0.02	0.02	0.053	<0.02	<0.02	
Nickel			0.03	0.01	0.01	0.024	0.01	0.01	
Molybdenum		0.4	0.13	0.09	0.04	0.005	<0.04	0.04	0.4
Vanadium (V ₂ O ₅)	10.7	7.1	2.7	3.1	1.75	0.02	<0.2	<0.2	10.7
Selenium	0.17 ⁽²⁾		0.018	0.007	0.004	0.008	<0.001	<0.001	0.17 ⁽²⁾
Silver			0.004	0.004	0.004	0.005	<0.004	<0.004	
Cadmium			0.006	0.004	0.002	0.006	0.002	0.002	
Manganese			0.005	0.003	0.003	0.017	0.015	0.015	
Barium			<0.05	<0.05		0.01	<0.05		
Mercury	0.00002 ⁽¹⁾		0.00014	0.00002	0.00014	0.00005	0.00005	<0.00004	0.00002
Iron	0.7	0.50	0.24	0.31	0.21	0.14	0.17	0.09	0.7
Arsenic	0.29 ⁽²⁾		0.066	0.024		0.015	<0.003	<0.003	0.29 ⁽²⁾
Chromium			0.005	0.008	0.01	0.01	0.005	<0.01	
Nitrate (as N)	3.7	3.7	0.39	0.03	0.14	0.09	0.44	<0.06	3.7
pH	9.8	9.65	9.6	9.4	9.35	9.33	8.5	8.5	9.8
Radium 226 pCi/l	135 ± 15	77 ± 9	58 ± 8	46 ± 6	39 ± 6	94.0	28 ± 5	29 ± 5	135 ± 15
Gross Alpha pCi/l	3200 ± 100	1220 ± 50	1050 ± 50	620 ± 40	660 ± 40	230.0	66 ± 13	101 ± 14	3200 ± 100
Gross Beta pCi/l	2500 ± 100	1160 ± 50	540 ± 50	590 ± 50	0 ± 43	267.0	0 ± 40	0 ± 21	2500 ± 100

* From Table 15, page 63, 1st Quarterly Report, August 31, 1978

- (1) 5/12-18
- (2) 5/19-6/1, As 1.1, Se 0.91 (4/21-5/4)
- (3) 4/7-5/4
- (4) 5/12-18

* From Table 15, page 63, 1st Quarterly Report, August 31, 1978

- (1) 5/12-18
- (2) 5/19-6/1, As 1.1, Se 0.91 (4/21-5/4)
- (3) 4/7-5/4
- (4) 5/12-18

TABLE I-A
RESTORATION DATA - RECOVERY WELL (R-1)*
WATER C HISTRY

Determination	Units	UPPER LIMIT- RESTORATION**	SHUT-DOWN 9/19/79	RESTORATION - CHECK SAMPLING		
				4/23/80	4/30/80	6/5/80
				2880 GALLONS	26,880 GALLONS	57,600 GALLONS
pH		9.33	8.6	9.2	pH 9.1	9.1
Conductivity	umhos/cm	2898.0	2690.0	2320.0	Conductivity 2380.0	2290.0
Sodium	mg/l	730.0	560.0	451.0	Sodium 485.0	680.0
TDS (180°C)	mg/l	1940.0	1780.0	1760.0	TDS 1750.0	1790.0
Arsenic	mg/l	0.015	0.084	0.19	Arsenic 0.145	0.090
Selenium	mg/l	0.008	0.048	0.03	Selenium 0.031	0.019
NO ₃ /NO ₂ (as N)	mg/l	0.09	0.14	<0.05	NO ₃ /NO ₂ (as N) <0.05	<0.05
Barium	mg/l	0.01	<0.1	<0.5	Barium <0.5	<0.1
Boron	mg/l	0.64	0.48	0.5	Boron 0.5	0.6
Cadmium	mg/l	0.006	<0.005	<0.01	Cadmium <0.01	0.01
Chromium	mg/l	0.01	<0.01	0.02	Chromium 0.02	<0.02
Copper	mg/l	0.01	<0.01	<0.02	Copper <0.05	<0.02
Iron	mg/l	0.14	<0.05	0.80	Iron 0.40	0.12
Lead	mg/l	0.053	<0.05	<0.005	Lead <0.005	0.002
Manganese	mg/l	0.017	<0.01	<0.02	Manganese <0.02	<0.02
Mercury	mg/l	0.00005	<0.00004	0.0001	Mercury 0.0001	0.0002
Nickel	mg/l	0.024	---	---	Nickel ---	<0.04
Zinc	mg/l	0.024	<0.01	0.01	Zinc 0.01	0.02
Molybdenum	mg/l	0.005	0.034	0.05	Molybdenum 0.10	0.029
Calcium	mg/l	9.0	3.2	3.2	Calcium 2.8	1.48
Magnesium	mg/l	3.4	1.5	1.9	Magnesium 1.9	1.9
Chloride	mg/l	14.3	12.0	12.0	Chloride 11.0	11.0
Potassium	mg/l	8.7	3.1	3.6	Potassium 3.6	3.17
Sulfate (as SO ₄ ²⁻)	mg/l	891.0	825.0	658.0	Sulfate (as SO ₄ ²⁻) 699.0	772.0
Carbonate (as CO ₃ ²⁻)	mg/l	50.0	50.0	80.0	Carbonate (as CO ₃ ²⁻) 70.0	60.0
Bicarbonate (as HCO ₃ ⁻)	mg/l	660.0	640.0	670.0	Bicarbonate (as HCO ₃ ⁻) 630.0	620.0
Ammonia (as N)	mg/l	1.09	0.54	0.44	Ammonia (as N) 0.45	0.59
Vanadium	mg/l	0.02	0.64	0.67	Vanadium 0.57	0.63
Silver	mg/l	0.005	<0.01	<0.01	Silver <0.01	<0.02
Uranium (as U)	mg/l	0.22	0.78	5.6	Uranium (as U) 3.0	1.3
Ra 226	pCi/l	94.0	51 ± 8	128 ± 12	Ra 226 46 ± 7	36 ± 6
Gross α	pCi/l	230.0	350 ± 30	2500 ± 100	Gross α 950 ± 40	370 ± 30
Gross β	pCi/l	267.0	210 ± 40	2800 ± 100	Gross β 1100 ± 100	470 ± 40

* Analysis by CDM Labs

** From Table 15, Page 63, 1st Quarterly Report, August 31, 1978-44-

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* Analysis by CDM Labs

** From Table 15, Page 63, 1st Quarterly

TABLE II

RESTORATION

Well Field Flow Volume in Gallons
(Lower figure is flow rate average in GPM)

1979	P U M P E D							I N J E C T E D				C O N T A I N E R				
Month	R	OSB-2	I-1	I-2	I-3	I-4	Total	I-1	I-2	I-3	I-4	B-1	B-2	B-3	Total	
April 26-30	21,744 (5.0)						21,744					3,456 (0.8)	3,456 (0.8)	3,456 (0.8)	10,368	
May	326,736 (12.0)	94,464 (10.3)					421,200	9,360 (1.3)	2,448 (0.2)	17,568 (1.5)	15,408 (1.3)	38,448 (1.3)	38,448 (1.3)	38,448 (1.3)	160,128	
June	168,336 (7.0)	166,320 (6.9)					334,656	12,672 (1.2)	1,728 (0.2)	15,264 (0.8)	7,344 (0.5)	30,960 (1.5)	28,080 (1.2)	14,544 (0.7)	110,592	
July	233,424 (7.8)	102,816 (6.9)			52,992 (5.1)		389,232					64,368 (2.3)	87,552 (2.9)	23,616 (0.8)	175,536	
August	211,392 (8.0)		101,088 (4.9)			103,824 (5.5)	416,304			52,704 (4.4)	5,904 (2.0)	47,808 (1.9)	72,432 (2.8)	20,880 (0.8)	199,728	
Sept. 1-19	134,352 (8.0)		103,968 (6.2)	16,416 (3.1)			254,736			32,976 (3.1)	23,472 (1.5)	22,608 (1.4)	41,184 (2.4)	8,784 (0.5)	129,024	
Totals	1,095,984	363,600	205,056	16,416	52,992	103,824	1,837,872	22,032	4,176	118,512	52,128	207,648	271,152	109,728	785,376	
								(Tot. I-1,I-2,I-3,I-4 196,848)				(Tot. B-1,B-2,B-3,B-4 588,528)				
1980								NOTE: Pumped volumes given above are from permanent installed submersible pumps only. It does not include flows produced during air lift and well washing operations, which are reflected in the total volume actually stored in the evaporation ponds.								
April	29,760 (8.0)						1,867,632									
June	57,600 (8.0)						TOTAL GALLONS PUMPED = 1,925,232									
Totals	1,183,344															

Monitor Well Program

Wells sampled in September, 1979 and again in April, 1980 are as follows:

Quarterly Report No. 1, August 31, 1978. Source Material License No. SUA-1331, Docket No. Monitor Wells, 40-8663, pages 59-61.

Well	"In House" Designation	
12X	M-1	Northeast Monitor Well - "B" Zone Aquifer
5X	M-2	Northwest Monitor Well - "B" Zone Aquifer
121X	M-3	West Monitor Well - "B" Zone Aquifer
6X	M-4	Southwest Monitor Well - "B" Zone Aquifer
11X	M-5	Southeast Monitor Well - "B" Zone Aquifer
789V	789V	Buffer Injection Water Source
7X	OSA-1	Monitor Well - "A" Zone Aquifer

Sample methods and preservation of collected samples were identical to those employed in the premining baseline program.⁽¹⁾ Samples were field filtered through 0.45 u membranes and all analytical values represent dissolved concentrations only.

Although the excursion control parameters for monitor wells are pH, uranium, bicarbonate, carbonate, sodium, chloride, conductivity, and total dissolved solids; each monitor well sample was assayed for thirty-three (including the above) parameters both in September, 1979 and April, 1980. This analytical data is illustrated in Tables III, IV, V, VI, VII, and VIII.

No excursion condition was detected for any control parameter in either the "A" or "B" zone aquifer.

(1) Quarterly Report No. 1, August 31, 1978. Source Material License No. SUA-1331, Docket No. 40-8663; pages 59-61.

POOR ORIGINAL

TABLE III

RESTORATION PERIOD

Monitor Well M-1

Water Chemistry

Analyses on Full Suite of parameters listed on page 14 of Application for Source Material License
(Values in mg/l except Conductivity in umhos/cm, pH, and where noted)

	Sample Period - 1979					Premining Mean "B Zone"	Upper Restor. Limit "B Zone"	Restoration Check Sample 4/24/80
	May	June	July	August	September			
Calcium	6.0	7.0	--	6.8	6.5	6.2	9.0	6.6
Sodium	530.0	540.0	585.0	--	460.0	622.0	730.0	430.0
Potassium	6.1	4.0	--	3.3	3.5	5.2	8.7	4.5
Magnesium	2.3	2.3	--	2.8	2.1	2.7	3.4	2.6
Chloride (Cl ⁻)	10.0	8.0	8.0	--	9.0	10.0	14.3	9.0
Carbonate (CO ₃ ⁻)	15.0	15.0	6.0	18.0	30.0	22.0	50.0	10.0
BiCarbonate (HCO ₃ ⁻)	613.0	605.0	633.0	615.0	596.0	592.0	660.0	610.0
Sulfate (SO ₄)	672.0	642.0	--	675.0	646.0	716.0	891.0	557.0
Ammonia (as N)	0.64	--	--	0.46	0.19	0.73	1.09	0.50
Total Dissolved Solids	1590.0	1624.0	1586.0	--	1492.0	1629.0	1940.0	1520.0
Conductivity	2373.0	2331.0	2284.0	2345.0	2312.0	2456.0	2898.0	2150.0
Uranium (U ₃₀₈)	0.09	0.09	0.09	0.09	0.11	0.09	0.26	0.076
Boron	0.46	0.47	--	0.48	0.43	0.52	0.64	0.5
Copper	0.010	0.005	--	0.005	--	0.01	0.01	<0.05
Zinc	0.067	0.036	--	0.052	0.030	0.011	0.024	0.01
Lead	<0.02	<0.02	--	<0.02	<0.02	0.040	0.053	<0.005
Nickel	0.01	0.01	--	0.01	0.015	0.017	0.024	<0.05
Molybdenum	<0.04	<0.04	--	<0.04	<0.04	<0.005	0.005	0.020
Vanadium (V ₂₀₅)	<0.1	<0.1	--	<0.1	<0.1	<0.005	0.02	<0.005
Selenium	0.002	0.001	<0.001	--	0.001	0.003	0.008	<0.005
Silver	<0.004	<0.004	--	<0.004	<0.004	<0.005	0.005	<0.01
Cadmium	0.004	0.002	--	0.002	0.002	0.005	0.006	<0.01
Manganese	0.009	0.008	--	0.011	0.006	0.012	0.017	0.02
Barium	<0.05	<0.05	--	--	<0.02	<0.01	0.01	<0.5
Mercury	0.00003	--	0.00002	0.00002	<0.00004	0.00004	0.00005	<0.0001
Iron	0.17	0.11	--	0.06	0.14	0.090	0.14	0.28
Arsenic	<0.003	<0.003	0.003	--	0.003	0.011	0.015	0.007
Chromium	<0.01	<0.01	--	<0.01	--	<0.01	0.01	<0.01
Nitrate (as N)	<0.01	--	--	<0.02	<0.06	0.06	0.09	0.50
pH	8.60	8.65	8.55	8.75	8.95	8.77	9.33	8.5
Radium 226 pCi/l	5.8 ± 2.0	1.8 ± 0.8	2.1 ± 1.5	1.6 ± 1.5	1.9 ± 0.6	22 ± 3	94.0 ± 25	1.6 ± 1.2
Gross Alpha pCi/l	130 ± 18	170 ± 20	114 ± 17	53 ± 12	96 ± 14	98 ± 12	230.0 ± 111	111 ± 14
Gross Beta pCi/l	81 ± 41	88 ± 24	0 ± 40	30 ± 40	0 ± 22	97 ± 22	267.0 ± 111	54 ± 25

*From Table 15, page 63, 1st Quarterly Report, August 31, 1978

**Analysis by CDM Labs

TABLE IV

RESTORATION PERIOD

Monitor Well M-2 (across hydrologic barrier)

Water Chemistry

Analyses on Full Suite of parameters listed on page 14 of Application for Source Material License

(Values in mg/l except Conductivity in umhos/cm, pH, and where noted)

	Sample Period - 1979					Premining	Upper Restor.	Restoration
	May	June	July	August	September	Mean "B Zone"	Limit "B Zone"	Check Sample 4/24/80**
Calcium	7.5	5.5	--	4.3	6.0	6.2	9.0	3.0
Sodium	510.0	560.0	600.0	--	500.0	622.0	730.0	440.0
Potassium	5.3	4.7	--	5.1	4.1	5.2	8.7	5.7
Magnesium	2.4	2.5	--	2.8	2.3	2.7	3.4	2.4
Chloride (Cl ⁻)	7.0	7.0	7.0	--	7.0	10.0	14.3	5.0
Carbonate (CO ₃ ⁻)	27.0	30.0	29.0	--	27.0	22.0	50.0	40.0
Bicarbonate (HCO ₃ ⁻)	601.0	615.0	641.0	--	648.0	592.0	660.0	640.0
Sulfate (SO ₄)	706.0	606.0	--	668.0	677.0	716.0	897.0	600.0
Ammonia (as N)	0.55	--	--	0.49	0.21	0.73	1.09	0.53
Total Dissolved Solids	1598.0	1592.0	1652.0	--	1490.0	1629.0	1940.0	1550.0
Conductivity	2467.0	2472.0	2369.0	--	2364.0	2456.0	2898.0	2150.0
Uranium (U ₃ O ₈)	0.10	0.09	0.09	--	0.08	0.09	0.26	0.035
Boron	0.50	0.45	--	0.48	0.52	0.52	0.64	0.5
Copper	0.005	0.005	--	<0.005	--	<0.01	0.01	<0.05
Zinc	0.031	0.040	--	0.084	0.066	0.011	0.024	0.04
Lead	<0.02	<0.02	--	<0.02	<0.02	0.040	0.053	<0.005
Nickel	0.01	0.01	--	0.01	0.013	0.017	0.024	<0.05
Molybdenum	<0.04	<0.04	--	<0.04	<0.04	<0.005	0.005	<0.010
Vanadium (V ₂ O ₅)	<0.1	<0.1	--	0.1	<0.1	<0.005	0.02	<0.005
Selenium	<0.001	<0.001	0.001	--	0.004	0.003	0.008	<0.005
Silver	<0.004	<0.004	--	<0.004	<0.004	<0.005	0.005	<0.01
Cadmium	0.002	0.002	--	0.004	0.002	0.005	0.006	<0.01
Manganese	0.006	0.008	--	0.003	0.005	0.012	0.017	0.02
Barium	0.05	<0.05	--	0.48	<0.02	<0.01	0.01	<0.5
Mercury	0.00006	--	0.00002	0.00004	<0.00004	<0.00004	0.00005	<0.0001
Iron	0.14	0.09	--	0.04	0.06	0.090	0.14	0.08
Arsenic	<0.003	<0.003	<0.003	--	0.003	0.011	0.015	0.004
Chromium	<0.01	<0.01	--	<0.01	--	<0.01	0.01	<0.007
Nitrate (as N)	0.03	--	--	<0.02	<0.06	0.06	0.09	<0.05
pH	8.85	8.90	8.90	--	8.90	8.77	9.33	9.0
Radium 226 pCi/l	0.6 ± 0.4	0.5 ± 0.5	0.7 ± 0.5	0.7 ± 0.5	0.5 ± 0.3	22 ± 3	94.0	5 ± 0.4
Gross Alpha pCi/l	145 ± 20	106 ± 14	19 ± 8	62 ± 13	56 ± 11	98 ± 12	230.0	37 ± 8
Gross Beta pCi/l	68 ± 42	74 ± 23	0 ± 40	36 ± 40	0 ± 23	97 ± 22	267.0	10 ± 24

*From Table 15, page 63, 1st Quarterly Report, August 31, 1978

** Analysis by CDM Labs

TABLE V

RESTORATION PERIOD

Monitor Well M-3 (across hydrologic barrier)

Water Chemistry

Analyses on Full Suite of parameters listed on page 14 of Application for Source Material License

(Values in mg/l except Conductivity in umhos/cm, pH, and where noted)

	Sample Period - 1979					Premining	Upper Restor.	Restoration
	May	June	July	August	September	Mean "B Zone"	Limit "B Zone"	Check Sample 4/24/80**
Calcium	6.5	5.5	--	11.0	7.0	6.2	9.0	3.3
Sodium	540.0	610.0	620.0	--	520.0	622.0	730.0	450.0
Potassium	4.6	5.2	--	4.5	3.8	5.2	8.2	6.2
Magnesium	2.6	2.3	--	3.8	2.3	2.7	3.4	2.0
Chloride (Cl ⁻)	13.0	13.0	11.0	--	11.0	10.0	14.3	9.0
Carbonate (CO ₃ ⁻)	18.0	18.0	12.0	--	15.0	22.0	50.0	20.0
Bicarbonate (HCO ₃ ⁻)	604.0	572.0	608.0	--	605.0	592.0	660.0	590.0
Sulfate (SO ₄ ⁻)	718.0	779.0	--	787.0	777.0	716.0	891.0	712.0
Ammonia (as N)	0.66	--	--	0.54	0.26	0.73	1.09	0.59
Total Dissolved Solids	1772.0	1760.0	1770.0	--	1582.0	1629.0	1940.0	1650.0
Conductivity	2660.0	2628.0	2568.0	--	2732.0	2456.0	2898.0	2220.0
Uranium (U ₃ O ₈)	0.11	0.09	0.09	--	0.10	0.09	0.26	0.10
Boron	0.42	0.45	--	0.51	0.48	0.52	0.54	0.5
Copper	<0.005	0.005	--	0.010	--	<0.01	0.01	<0.05
Zinc	0.035	0.080	--	0.051	0.052	0.011	0.024	<0.01
Lead	<0.02	<0.02	--	<0.02	<0.02	0.040	0.053	<0.005
Nickel	0.02	0.01	--	0.01	0.018	0.017	0.024	<0.05
Molybdenum	<0.04	<0.04	--	<0.04	<0.04	<0.005	0.005	0.009
Vanadium (V ₂ O ₅)	<0.1	<0.1	--	<0.1	<0.1	<0.005	0.02	<0.005
Selenium	0.001	<0.001	<0.001	--	0.002	0.003	0.008	<0.005
Silver	0.004	<0.004	--	<0.004	<0.004	0.005	0.005	<0.01
Cadmium	0.004	0.009	--	0.002	0.002	0.005	0.006	<0.01
Manganese	0.009	0.008	--	0.008	0.009	0.012	0.017	0.02
Barium	<0.05	<0.05	--	--	<0.02	<0.01	0.01	<0.5
Mercury	<0.00002	--	0.00002	0.0012	<0.00004	<0.00004	0.00005	<0.0001
Iron	0.16	0.14	--	0.39	0.08	0.090	0.14	0.20
Arsenic	<0.003	<0.003	<0.003	--	<0.003	0.011	0.015	0.002
Chromium	<0.01	0.01	--	<0.01	--	<0.01	0.01	<0.02
Nitrate (as N)	<0.01	--	--	<0.02	<0.06	0.06	0.09	<0.05
pH	8.75	8.70	8.65	--	8.7	8.77	9.33	8.7
Radium 226 pCi/l	1.0 ± 0.6	0.6 ± 0.4	0.9 ± 0.5	0.7 ± 0.5	0.8 ± 0.4	22 ± 3	94.0	0.9 ± 0.5
Gross Alpha pCi/l	109 ± 17	140 ± 15	36 ± 11	73 ± 14	75 ± 13	98 ± 12	230.0	115 ± 14
Gross Beta pCi/l	26 ± 41	73 ± 24	0 ± 40	114 ± 42	0 ± 25	97 ± 22	267.0	50 ± 25

*From Table 15, page 63, 1st Quarterly Report, August 31, 1978

**Analysis by CDM Labs

TABLE VI

RESTORATION PERIOD

Monitor Well M-4

Water Chemistry

Analyses on Full Suite of parameters listed on page 14 of Application for Source Material License

(Values in mg/l except Conductivity in umhos/cm, pH, and where noted)

	Sample Period - 1979					Premining Mean "B Zone"	Upper Restor. Limit "B Zone"	Restoration Check Sample 4/24/80
	May	June	July	August	September			
Calcium	12.5	9.0	--	9.3	9.5	6.2	9.0	4.4
Sodium	540.0	590.0	620.0	--	530.0	622.0	730.0	460.0
Potassium	3.4	3.5	--	3.7	2.9	5.2	8.7	6.2
Magnesium	2.9	3.0	--	3.3	2.7	2.7	3.4	2.1
Chloride (Cl ⁻)	11.0	11.0	11.0	--	12.0	10.0	14.3	10.0
Carbonate (CO ₃ ⁻)	13.0	10.0	12.0	8.0	9.0	22.0	50.0	30.0
Bicarbonate (HCO ₃ ⁻)	590.0	598.0	615.0	619.0	618.0	592.0	660.0	530.0
Sulfate (SO ₄)	816.0	795.0	--	792.0	817.0	716.0	891.0	746.0
Ammonia (as N)	0.09	--	--	0.82	0.19	0.73	1.09	0.55
Total Dissolved Solids	1726.0	1810.0	1684.0	--	1512.0	1629.0	1940.0	1650.0
Conductivity	2635.0	2630.0	2691.0	2616.0	2588.0	2456.0	2898.0	2320.0
Uranium (U ₃ O ₈)	0.09	0.10	0.10	0.10	0.10	0.09	0.26	0.095
Boron	0.44	0.32	--	0.46	0.49	0.52	0.64	0.6
Copper	<0.005	<0.005	--	0.005	--	<0.01	0.01	<0.05
Zinc	0.047	0.028	--	0.030	0.052	0.011	0.024	0.03
Lead	<0.02	<0.02	--	0.02	<0.02	0.040	0.053	<0.005
Nickel	0.01	0.015	--	0.02	0.020	0.017	0.024	<0.05
Molybdenum	<0.04	<0.04	--	<0.04	<0.04	<0.005	0.005	<0.005
Vanadium (V ₂ O ₅)	<0.1	<0.1	--	<0.1	<0.1	<0.005	0.02	0.005
Selenium	0.003	0.001	0.002	--	0.001	0.003	0.008	<0.005
Silver	<0.004	<0.004	--	<0.004	<0.004	<0.005	0.005	<0.01
Cadmium	0.002	0.004	--	0.002	0.004	0.005	0.006	<0.01
Manganese	0.015	0.018	--	0.012	0.012	0.012	0.017	0.02
Barium	<0.05	<0.05	--	--	<0.02	<0.01	0.01	<0.5
Mercury	0.00002	--	0.00002	0.00005	<0.00004	<0.00004	0.00005	<0.0001
Iron	0.29	0.30	--	0.05	0.38	0.090	0.14	0.11
Arsenic	<0.003	0.003	<0.003	--	<0.003	0.011	0.015	0.003
Chromium	<0.01	<0.01	--	<0.01	--	<0.01	0.01	<0.02
Nitrate (as N)	0.59	--	--	<0.02	<0.06	0.06	0.09	0.10
pH	8.65	8.60	8.65	8.55	8.65	8.77	9.33	9.0
Radium 226 pCi/l	2.2 ± 1.4	0.9 ± 0.5	0.9 ± 0.6	1.5 ± 0.7	0.7 ± 0.4	22 ± 3	94.0 ± 30.0	0.1 ± 1.2
Gross Alpha pCi/l	135 ± 20	115 ± 15	35 ± 10	32 ± 10	57 ± 11	98 ± 12	230.0 ± 100.0	66 ± 11
Gross Beta pCi/l	52 ± 42	81 ± 24	0 ± 40	120 ± 42	0 ± 26	97 ± 22	267.0 ± 100.0	136 ± 26

*From Table 15 page 63, 1st Quarterly Report, August 31, 1978

**Analysis by CDM Labs

TABLE VII
RESTORATION PERIOD

Monitor Well M-5
Water Chemistry

Analyses on Full Suite of parameters listed on page 14 of Application for Source Material License
(Values in mg/l except Conductivity in umhos/cm, pH, and where noted)

Analyses on Full Suite

	Sample Period - 1979					Premining Mean "B Zone"	Upper Restor. Limit "B Zone"	Restoration Check Sample 4/24/80**
	May	June	July	August	September			
Calcium	10.5	9.0	--	9.3	10.5	6.2	9.0	7.1
Sodium	550.0	590.0	640.0	--	520	622.0	730.0	480.0
Potassium	4.4	3.7	--	3.7	3.2	5.2	8.7	4.7
Magnesium	3.1	3.2	--	3.4	2.8	2.7	3.4	3.3
Chloride (Cl ⁻)	7.0	11.0	7.0	--	6.0	10.0	14.3	7.0
Carbonate (CO ₃ ⁻)	15.0	10.0	18.0	8.0	3.0	22.0	50.0	10.0
Bicarbonate (HCO ₃ ⁻)	680.0	598.0	683.0	619.0	673.0	592.0	660.0	680.0
Sulfate (SO ₄)	793.0	759.0	--	759.0	773.0	716.0	891.0	718.0
Ammonia (as N)	0.24	--	--	0.45	0.22	0.73	1.09	<0.1
Total Dissolved Solids	1792.0	1810.0	1782.0	--	1612.0	1629.0	1940.0	1730.0
Conductivity	2622.0	2630.0	2610.0	2616.0	2557.0	2456.0	2898.0	2390.0
Uranium (U ₃₀₈)	0.10	0.10	0.10	0.10	0.08	0.09	0.26	0.082
Boron	0.46	0.47	--	0.49	0.51	0.52	0.64	0.2
Copper	0.010	0.005	--	0.010	--	<0.01	0.01	<0.05
Zinc	0.061	0.030	--	0.063	0.034	0.011	0.024	0.01
Lead	<0.02	<0.02	--	<0.02	<0.02	0.040	0.053	<0.005
Nickel	0.01	0.015	--	0.02	0.010	0.017	0.024	<0.05
Molybdenum	<0.04	<0.04	--	<0.04	<0.04	<0.005	0.005	<0.005
Vanadium (V ₂₀₅)	<0.1	<0.1	--	<0.1	<0.1	<0.005	0.02	<0.005
Selenium	0.003	0.001	<0.001	--	0.002	0.003	0.008	<0.005
Silver	<0.004	<0.004	--	<0.004	<0.004	<0.005	0.005	<0.01
Cadmium	0.004	0.004	--	0.004	0.002	0.005	0.006	<0.01
Manganese	0.009	0.012	--	0.008	0.009	0.012	0.017	0.03
Barium	<0.05	<0.05	--	0.49	<0.02	<0.01	0.01	<0.5
Mercury	<0.00002	--	0.00002	0.00007	<0.00004	<0.00004	0.00005	<0.0001
Iron	0.17	0.24	--	0.12	0.007	0.090	0.14	0.08
Arsenic	<0.003	<0.003	<0.003	--	<0.003	0.011	0.015	0.002
Chromium	<0.01	<0.01	--	<0.01	--	<0.01	0.01	<0.02
Nitrate (as N)	0.36	--	--	0.03	<0.06	0.06	0.09	0.52
pH	8.65	8.60	8.60	8.55	8.50	8.77	9.33	8.5
Radium 226 pCi/l	1.1 ± 0.4	6.2 ± 2.9	2.0 ± 0.7	1.1 ± 0.5	1.2 ± 0.5	22 ± 3	94.0	1.0 ± 0.5
Gross Alpha pCi/l	135 ± 20	175 ± 20	39 ± 11	73 ± 14	81 ± 13	98 ± 12	230.0	116 ± 15
Gross Beta pCi/l	104 ± 42	78 ± 24	0 ± 40	73 ± 42	0 ± 23	97 ± 22	267.0	39 ± 25

*From Table 15, page 63, 1st Quarterly Report August 31, 1978
**Analysis by CDM Labs

POOR ORIGINAL

TABLE VIII

RESTORATION PERIOD

Monitor Well OSA-1

Water Chemistry

Analyses on Full Suite of parameters listed on page 14 of Application for Source Material License
(Values in mg/l except Conductivity in umhos/cm, pH, and where noted)

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	Sample Period - 1979					Premining	Restoration
	May	June	July	August	September	Mean "A Zone"	Check Sample 4/24/80**
Calcium	8.5	7.0	6.0	8.5	7.0	6.0	Calcium 2.6
Sodium	490.0	560.0	560.0	580.0	450.0	592.0	Sodium 410.0
Potassium	4.1	4.2	4.1	3.8	2.8	3.9	Potassium 5.1
Magnesium	2.5	2.6	2.4	2.8	2.2	2.7	Magnesium 2.1
Chloride (Cl ⁻)	5.0	5.0	5.0	4.0	7.0	6.0	Chloride 4.0
Carbonate (CO ₃ ⁻)	24.0	39.0	27.0	18.0	9.0	17.0	Carbonate 40.0
BiCarbonate (HCO ₃ ⁻)	674.0	630.0	660.0	694.0	697.0	653.0	BiCarbonate 620.0
Sulfate (SO ₄)	590.0	589.0	565.0	575.0	600.0	567.0	Sulfate 541.0
Ammonia (as N)	0.29	0.55	0.05	0.38	0.22	0.53	Ammonia 0.2
Total Dissolved Solids	1534.0	1574.0	1578.0	1370.0	1388.0	1530.0	Total 1400.0
Conductivity	2276.0	2294.0	2330.0	2325.0	1984.0	2300.0	Conductivity 2030.0
Uranium (U ₃ O ₈)	0.007	0.001	0.003	0.007	0.006	0.005	Uranium <0.001
Boron	0.53	0.53	0.57	0.58	0.58	0.6	Boron 0.6
Copper	<0.005	0.005	0.010	0.005	--	0.010	Copper 0.11
Zinc	0.012	0.044	0.042	0.016	0.030	0.016	Zinc 0.02
Lead	<0.02	<0.02	<0.02	<0.02	<0.02	0.037	Lead <0.005
Nickel	0.01	0.01	0.01	0.01	0.015	0.016	Nickel <0.05
Molybdenum	<0.04	<0.04	<0.04	<0.04	<0.04	<0.005	Molybdenum <0.005
Vanadium (V ₂ O ₅)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.005	Vanadium <0.012
Selenium	0.003	0.001	0.001	0.001	0.001	0.005	Selenium <0.005
Silver	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005	Silver <0.01
Cadmium	0.002	0.004	<0.002	0.002	0.002	0.004	Cadmium <0.01
Manganese	0.015	0.009	0.009	0.005	0.011	0.014	Manganese 0.02
Barium	<0.05	<0.05	<0.05	0.58	<0.02	<0.10	Barium <0.5
Mercury	0.00006	<0.00002	<0.00002	0.00006	<0.00004	0.00003	Mercury 0.0001
Iron	0.14	0.20	0.36	0.09	0.20	0.074	Iron 0.36
Arsenic	0.003	0.003	0.003	0.003	0.003	0.011	Arsenic 0.005
Chromium	<0.01	<0.01	<0.01	<0.01	--	<0.01	Chromium 0.02
Nitrate (as N)	0.18	0.02	--	<0.02	<0.06	0.03	Nitrate 0.30
pH	8.80	8.90	8.85	8.7	8.5	8.6	pH 8.9
Radium 226 pCi/l	1.4 ± 0.9	1.4 ± 1.2	0.8 ± 0.5	0.8 ± 0.5	0.9 ± 0.8	0.26 ± 0.3	Radium 0.6 ± 0.4
Gross Alpha pCi/l	5.6 ± 5.5		2.8 ± 5.4	2.3 ± 5.1	4.7 ± 4.6	1.4 ± 3.4	Gross 180 ± 20
Gross Beta pCi/l	0 ± 40		0 ± 40	33 ± 40	0 ± 26	3.2 ± 19	Gross 108 ± 25

*From Table 9, page 21, 1st Quarterly Report, August 31, 1978

**Analysis by CDM Labs

*From Table 9, page 21, 1st Quarterly Report, August 31, 1978

**Analysis by CDM Labs

TABLE IX

RESTORATION PERIOD

Water Well 789V

Water Chemistry

Analyses on Full Suite of parameters listed on page 14 of Application for Source Material License

(Values in mg/l except Conductivity in umhos/cm, pH, and where noted)

	Sample Period - 1979					Premining Mean "B Zone"	Upper Restor. Limit "B Zone"
	May	June	July	August	September		
Calcium	9.0		9.0	8.5	8.5	6.2	9.0
Sodium	550.0	560.0	600.0		530.0	622.0	730.0
Potassium	2.9		3.2	3.2	2.7	5.2	8.7
Magnesium	2.8		2.7	2.8	2.8	2.7	3.4
Chloride (Cl ⁻)	11.0	12.0	12.5		12.5	10.0	14.3
Carbonate (CO ₃ ²⁻)	12.0	9.0	6.0		9.0	22.0	50.0
BiCarbonate (HCO ₃ ⁻)	578	569.0	581.0		581.0	592.0	660.0
Sulfate (SO ₄ ²⁻)	765.0		767.0	714.0	747.0	716.0	891.0
Ammonia (as N)	0.11	--	<0.05	0.71	0.19	0.73	1.09
Total Dissolved Solids	1580.0	1692.0	1616.0		1652.0	1629.0	1940.0
Conductivity	2437.0	2445.0	2478.0		2477.0	2456.0	2898.0
Uranium (U ₃ O ₈)	0.06	0.06	0.066		0.060	0.09	0.26
Boron	0.42		0.40	0.42	0.42	0.52	0.64
Copper	0.010		0.008	0.005	<0.005	<0.01	0.01
Zinc	0.045		0.067	0.092	0.048	0.011	0.024
Lead	<0.02		<0.02	<0.02	<0.02	0.040	0.053
Nickel	0.015		0.01	0.01	0.01	0.017	0.024
Molybdenum	<0.04		<0.04	<0.04	<0.04	<0.005	0.005
Vanadium (V ₂ O ₅)	<0.1		<0.2	<0.1	<0.2	<0.005	0.02
Selenium	0.003	0.003	<0.001		<0.001	0.003	0.008
Silver	<0.004		<0.004	<0.004	<0.004	<0.005	0.005
Cadmium	0.004		0.002	0.002	0.002	0.005	0.006
Manganese	0.009		0.015	0.015	0.015	0.012	0.017
Barium	<0.05		<0.05	0.42	<0.02	<0.01	0.01
Mercury	<0.00002	--	0.00005	<0.00002	<0.00004	0.00004	0.00005
Iron	0.11		0.17	0.19	0.09	0.090	0.14
Arsenic	0.003	0.001	<0.003		<0.003	0.011	0.015
Chromium	<0.01		0.005	<0.01	<0.01	<0.01	0.01
Nitrate (as N)	0.53	--	0.44	0.02	<0.06	0.06	0.09
pH	8.65	8.55	8.5		8.5	8.77	9.33
Radium 226 pCi/l	31 ± 6	26 ± 5	28 ± 5	23 ± 5	29 ± 5	22 ± 3	94.0 ± 20
Gross Alpha pCi/l	94 ± 22	43 ± 6	66 ± 13	72 ± 14	101 ± 14	98 ± 12	230.0 ± 50
Gross Beta pCi/l	290 ± 100	47 ± 11	0 ± 40	54 ± 41	0 ± 21	97 ± 22	267.0 ± 50

*From Table 15, page 63, 1st Quarterly Report, August 31, 1978

PRIVATE WELL ANALYSIS

The program to sample surface waters and private well sources within a three mile radius of the test site was continued during the reporting period.

Wells in this program are shown in Table 1.

TABLE 1

Private Wells

<u>Well</u>	<u>Description</u>
101	Oshoto Reservoir - Dip Sample
102	Harry Berger Pasture - Windmill (Hand Pump)
104	Grace Reynolds House Well - Windmill
109	Harry Berger Pasture - Electric Pump
110	Oshoto Reservoir - Dip Sample
119	Burch Ranch Pasture - Electric Pump
125	Allan's Pasture - Windmill
3V	Well 700 feet west of test site - "A" Aquifer
788V	Well 800 feet west of test site - "B" Aquifer

Analytical data is presented in Table 2, 3, 4, 5, and 6 on samples collected from the above wells in July, August, and September, 1979 and January and April, 1980.

No problems or concerns are present with this program except that Well 109 was not available (due to pump problems) during January and April, 1980.

TABLE OF ASSAYS

Determination	Units	101	102	104	109	110	119	125	3V	788V
pH		10.4	8.0	8.6	7.6	9.5	7.5	7.7	8.6	8.6
Conductivity	umhos/cm	1285	3688	1347	1700	1036	827	791	1753	1784
Sodium	mg/l	245	420	310	210	198	355	10	398	1405
TDS (180°C)	mg/l	840	724	832	1216	634	749	426	1186	1226
Arsenic	mg/l	0.006	<0.003	<0.003	<0.003	0.006	0.003	<0.003	<0.003	<0.003
Selenium	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
NO ₃ /NO ₂	mg/l						NO ₃ /NO ₂			
Barium	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	mg/l	0.16	0.66	0.32	0.19	0.25	0.09	0.07	0.39	0.37
Cadmium	mg/l	0.001	0.003	0.002	0.001	0.002	0.002	0.004	0.001	0.002
Chromium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	mg/l	0.005	0.005	0.015	0.005	0.005	<0.005	0.005	0.005	0.005
Iron	mg/l	0.05	0.36	0.15	0.20	0.18	0.30	0.19	0.10	0.10
Lead	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese	mg/l	0.009	0.033	0.008	0.008	0.003	0.096	<0.003	0.009	0.017
Mercury	mg/l						Mercury			
Nickel	mg/l	0.12	0.03	0.12	0.13	0.02	0.06	0.02	0.07	0.11
Zinc	mg/l	0.068	0.020	0.046	0.024	0.054	0.028	0.032	0.088	0.044
Molybdenum	mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Calcium	mg/l	9.5	22.5	3.0	61.0	11.5	49.0	31.0	4.0	11.0
Magnesium	mg/l	9.8	8.2	1.3	15.0	9.7	9.9	34.0	1.6	1.5
Chloride	mg/l	8.5	7.0	5.0	5.0	7.5	2.0	10.0	2.5	4.5
Potassium	mg/l	5.8	9.8	3.0	9.9	6.6	5.9	4.7	3.7	2.6
Sulfate (as SO ₄ ²⁻)	mg/l	127	1142	186	460	90	553	296	296	1380
Carbonate (as CO ₃ ²⁻)	mg/l	231	<1.5	12	<1.5	81	<1.5	12	12	15
Bicarbonate (as HCO ₃ ⁻)	mg/l	154	1029	596	566	422	556	525	706	1654
Ammonia (as N)	mg/l						Ammonia (as N)			
Vanadium	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Silver	mg/l	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Uranium	mg/l	0.005	0.005	0.001	0.007	0.006	<0.001	0.019	0.004	0.003
Ra 226	pCi/l	0.2±0.3	0.3±0.3	0.0±0.3	0.2±0.3	0.3±0.3	0.2±0.3	0.0±0.3	0.2±0.4	0.4±0.4
Gross α	pCi/l	180±15	0.0±4.8	22±6	35±7	51±7	17±3	14±3	46±8	140±14
Gross β	pCi/l	41±22	0.0±4.2	0.0±2.0	9±21	10±14	0.0±0.3	15±10	18±21	37±22

TABLE 2 ASSAY RESULTS - Private Wells 101, 102, 104, 109, 110, 119, 125, 3V, 788V

TABLE JULY 1979* RESULTS - Private Wells

POOR ORIGINAL

TABLE OF ASSAYS

Sampled 8/27/79

Determination	Units	101	102	104	109	110	119	125	3V	788V
pH		8.75	8.25	8.95	7.7	9.0	7.4	7.8	8.7	8.7
Conductivity	umhos/cm	884	3638	1160	1450	929	790	780	1756	1784
Sodium	mg/l	175	820	270	200	195	40	110	400	395
TDS (180°C)	mg/l	528	2658	660	1044	624	454	434	1082	1260
Arsenic	mg/l	0.023	<0.003	0.003	<0.003	0.003	<0.003	<0.003	0.003	<0.003
Selenium	mg/l	<0.001	0.003	0.026	0.002	0.001	<0.001	<0.001	0.001	<0.001
NO ₃ /NO ₂	mg/l									
Barium	mg/l									
Boron	mg/l									
Cadmium	mg/l									
Chromium	mg/l									
Copper	mg/l									
Iron	mg/l									
Lead	mg/l									
Manganese	mg/l									
Mercury	mg/l									
Nickel	mg/l									
Zinc	mg/l									
Molybdenum	mg/l									
Calcium	mg/l									
Magnesium	mg/l									
Chloride	mg/l	6.5	7.5	6.0	6.0	7.5	3.0	4.0	3.0	5.5
Potassium	mg/l									
Sulfate (as SO ₄)	mg/l									
Carbonate (as CO ₃)	mg/l	16.5	<1.5	21	<1.5	28.5	<1.5	<1.5	19.5	19.5
Bicarbonate (as HCO ₃)	mg/l	427	979	511	526	430	456	438	686	650
Ammonia (as N)	mg/l									
Vanadium	mg/l									
Silver	mg/l									
Uranium	mg/l	0.001	0.008	0.005	0.008	0.007	<0.001	0.003	0.001	0.002
Ra 226	pCi/l									
Gross α	pCi/l									
Gross β	pCi/l									

Sampled 8/27/79

TABLE 3 ASSAY RESULTS -- Private Wells 101, 102, 104, 109, 110, 119, 125, 3V, 788V AUGUST 1979

TABLE OF ASSAYS

Determination	Units	101	102	104	109	110	119	125	3V	788V
pH										
Conductivity	umhos/cm									
Sodium	mg/l									
TDS (180°C)	mg/l									
Arsenic	mg/l	0.013	<0.005	0.013		0.015	<0.005	<0.005	<0.005	0.006
Selenium	mg/l	<0.005	0.015	0.018		<0.005	<0.005	<0.005	<0.005	<0.005
NO ₃ /NO ₂	mg/l									
Barium	mg/l									
Boron	mg/l									
Cadmium	mg/l									
Chromium	mg/l									
Copper	mg/l									
Iron	mg/l									
Lead	mg/l									
Manganese	mg/l									
Mercury	mg/l									
Nickel	mg/l									
Zinc	mg/l									
Molybdenum	mg/l									
Calcium	mg/l									
Magnesium	mg/l									
Chloride	mg/l									
Potassium	mg/l									
Sulfate (as SO ₄ ⁼)	mg/l									
Carbonate (as CO ₃ ⁼)	mg/l									
Bicarbonate (as HCO ₃ ⁻)	mg/l									
Ammonia (as N)	mg/l									
Vanadium	mg/l									
Silver	mg/l									
Uranium	mg/l									
Ra 226	pCi/l	0.2±0.5	0.2±0.5	0.0±0.3	0.4±0.3	0.2±0.6	0.0±0.8	0.2±0.5	0.0±0.4	0.2±0.5
Gross α	pCi/l									
Gross β	pCi/l									

TABLE 4 ASSAY RESULTS - Private Wells 101, 102, 104, 109, 110, 119, 125, 3V, 788V

SEPTEMBER, 1979

TABLE OF ASSAYS

Determination	Units	101	102	104	109	110	119	125	3V	788V
pH		7.6	8.4	8.7	OUT OF	7.9	7.8	8.0	8.5	9.2
Conductivity	umhos/cm	1350.0	3630.0	1230.0	ORDER	1260.0	782.0	776.0	1680.0	1780.0
Sodium	mg/l	193.0	720.0	246.0		193.0	309.0	72.0	309.0	341.0
TDS (180°C)	mg/l	876.0	2560.0	785.0		815.0	483.0	500.0	1130.0	1170.0
Arsenic	mg/l	0.014	0.006	0.010		0.010	0.002	0.004	<0.002	0.008
Selenium	mg/l	<0.005	0.005	0.014		<0.005	0.005	<0.005	<0.005	<0.005
NO ₃ /NO ₂	mg/l	1.3	0.4	0.1		1.3	0.2	0.3	0.2	0.4
Barium	mg/l	<0.2	<0.2	<0.2		<0.2	0.2	<0.2	<0.2	<0.2
Boron	mg/l	0.1	0.1	0.3		<0.1	0.1	<0.1	0.5	0.5
Cadmium	mg/l	0.06	0.06	0.02		0.01	0.01	0.01	0.01	<0.01
Chromium	mg/l	0.009	0.010	0.006		0.006	0.005	0.006	0.007	0.006
Copper	mg/l	0.02	0.02	0.06		<0.02	0.02	<0.02	0.03	0.03
Iron	mg/l	0.70	3.5	0.40		0.30	0.65	0.25	0.70	0.30
Lead	mg/l	0.009	0.054	0.004		0.003	0.003	0.007	0.005	0.004
Manganese	mg/l	0.05	0.04	0.02		0.03	0.01	<0.01	<0.01	<0.01
Mercury	mg/l	<0.00003	<0.00003	0.00003		<0.00003	<0.00003	<0.00003	<0.00003	<0.00003
Nickel	mg/l	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	mg/l	0.02	6.95	0.04		<0.01	0.08	0.11	0.02	0.01
Molybdenum	mg/l	<0.005	<0.005	0.005		0.007	<0.005	<0.005	<0.005	<0.005
Calcium	mg/l	21.0	20.0	2.8		21.0	59.0	46.0	4.3	2.3
Magnesium	mg/l	25.0	13.0	1.2		25.0	43.0	23.0	2.0	1.3
Chloride	mg/l	10.0	8.0	<5.0		9.0	<5.0	<5.0	<5.0	<5.0
Potassium	mg/l	8.0	8.0	4.3		9.6	16.0	6.4	4.6	10.8
Sulfate (as SO ₄ ²⁻)	mg/l	112.0	1100.0	137.0		105.0	53.0	57.0	290.0	318.0
Carbonate (as CO ₃ ²⁻)	mg/l	0.0	10.0	20.0		0.0	0.0	0.0	0.0	60.0
Bicarbonate (as HCO ₃ ⁻)	mg/l	750.0	1020.0	570.0		690.0	450.0	440.0	710.0	580.0
Ammonia (as N)	mg/l	2.1	<0.05	<0.05		0.75	<0.05	<0.05	<0.05	<0.05
Vanadium	mg/l	0.006	0.007	0.006		<0.005	<0.005	<0.005	<0.005	<0.005
Silver	mg/l	0.003	0.003	0.001		0.0008	<0.0005	<0.0005	<0.0005	<0.0005
Uranium	mg/l	0.007	0.009	0.002		0.008	0.003	0.027	<0.001	<0.001
Ra 226	pCi/l	0.4 ± 0.4	0.4 ± 0.4	0.0 ± 0.3		0.3 ± 0.4	0.1 ± 0.3	0.1 ± 0.3	0.0 ± 0.3	0.2 ± 0.3
Gross α	pCi/l	4.7 ± 2.8	2.9 ± 6.6	2.7 ± 2.2		12.1 ± 4.0	1.6 ± 6.1	1.6 ± 1.2	4.6 ± 2.8	5.8 ± 3.6
Gross β	pCi/l	0 ± 20	0 ± 44	0 ± 22		21 ± 22	0 ± 11	0 ± 11	0 ± 22	34 ± 22

TABLE 5 ASSAY RESULTS - Private Wells 101, 102, 104, 109, 110, 119, 125, 3V, 788V

TABLE 5 ASSAY RESULTS - Private Wells 101, 102, 104, 109, 110, 119, 125, 3V, 788V

JANUARY, 1980

TABLE OF ASSAYS

Determination	Units	101	102	104	109	110	119	125	3V	786V
pH		8.0	8.2	8.7	Out of Order	8.3	7.7	8.8	8.6	8.6
Conductivity	umhos/cm	881.0	3390.0	1130.0		820.0	716.0	762.0	1590.0	1640.0
Sodium	mg/l	130.0	660.0	240.0		140.0	30.0	120.0	320.0	320.0
TDS (180°C)	mg/l	597.0	583.0	788.0		561.0	451.0	518.0	1100.0	1140.0
Arsenic	mg/l	0.014	0.017	0.010		0.01	<0.002	0.004	0.009	0.004
Selenium	mg/l	<0.005	0.008	0.007		<0.005	<0.005	0.005	0.005	<0.005
NO ₃ /NO ₂	mg/l	0.16	<0.05	0.12		<0.05	<0.05	0.05	<0.05	0.35
Barium	mg/l	<0.5	<0.5	<0.5		<0.5	<0.5	0.5	<0.5	<0.5
Boron	mg/l	0.1	0.7	0.3		0.1	<0.1	0.1	0.5	0.6
Cadmium	mg/l	<0.01	0.01	<0.01		<0.01	<0.01	0.01	<0.01	0.01
Chromium	mg/l	<0.02	<0.02	<0.02		0.02	<0.02	0.02	0.02	<0.02
Copper	mg/l	<0.05	0.05	0.21		<0.05	<0.05	0.05	<0.05	<0.05
Iron	mg/l	1.3	2.3	1.3		0.5	0.75	0.09	0.15	0.18
Lead	mg/l	<0.005	0.078	0.009		<0.005	<0.005	0.005	<0.005	<0.005
Manganese	mg/l	0.20	0.04	<0.02		0.10	0.19	0.02	0.02	0.02
Mercury	mg/l	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Nickel	mg/l	<0.05	<0.05	<0.05		<0.05	<0.05	0.05	<0.05	<0.05
Zinc	mg/l	0.03	43.0	0.18		0.06	20.35	0.10	0.01	0.04
Molybdenum	mg/l	<0.005	0.020	<0.005		<0.005	<0.005	0.005	<0.005	0.03
Calcium	mg/l	17.1	17.2	2.2		13.9	51.0	16.3	3.3	13.1
Magnesium	mg/l	17.9	13.0	1.4		16.9	42.6	23.7	2.0	11.5
Chloride	mg/l	7.0	11.0	4.0		7.0	<3.0	3.0	<3.0	4.0
Potassium	mg/l	9.0	10.6	3.5		9.1	7.3	7.0	4.2	13.3
Sulfate (as SO ₄ ²⁻)	mg/l	84.0	1100.0	154.0		64.0	561.0	190.0	296.0	336.0
Carbonate (as CO ₃ ²⁻)	mg/l	0.0	0.0	20.0		0.0	0.0	20.0	10.0	10.0
Bicarbonate (as HCO ₃ ⁻)	mg/l	520.0	1030.0	570.0		480.0	450.0	410.0	700.0	660.0
Ammonia (as N)	mg/l	0.37	0.35	0.13		0.15	<0.01	<0.1	<0.1	<0.1
Vanadium	mg/l	0.005	<0.005	0.007		<0.005	<0.005	0.005	<0.005	<0.005
Silver	mg/l	<0.01	<0.01	<0.01		<0.01	<0.01	0.01	<0.01	<0.01
Uranium	mg/l	0.005	0.009	0.012		0.004	<0.001	0.024	0.001	0.001
Ra 226	pCi/l	0.1 ± 0.3	0.2 ± 0.3	0.0 ± 0.2		0.2 ± 0.8	0.4 ± 0.3	0.4 ± 0.4	0.4 ± 0.4	0.1 ± 0.3
Gross α	pCi/l	62 ± 7	7.9 ± 6.7	6.9 ± 2.8		1.2 ± 1.5	1.6 ± 1.4	21 ± 4	1.5 ± 2.4	5.4 ± 3.1
Gross β	pCi/l	18 ± 12	9 ± 43	6 ± 12		0 ± 11	4 ± 9	10 ± 9	0 ± 16	7 ± 16

TABLE 6 ASSAY RESULTS - Private Wells 101, 102, 104, 109, 110, 119, 125, 3V, 786V

APRIL, 1980