Review of Groundwater Restoration Data

Mark S. Pelizza, P.G.

M.S. Pelizza & Associates LLC

June 8, 2015

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

February 17, 2012

EPA-SAB-12-005

The Honorable Lisa P. Jackson
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Subject: Advisory on EPA's Draft Technical Report entitled *Considerations Related to Post-Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery (ISL/ISR) Sites*

Dear Administrator Jackson:

The EPA is cons
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The EPA prepare
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The SAB makes
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The EPA draft technical report presents an excellent preliminary framework of considerations applicable to groundwater monitoring at ISL uranium mines. It emphasizes the relevance of *Groundwater Monitoring Requirements for Treatment, Storage, and Disposal Facilities (TSDF's)* in 40 CFR Part 264, Subpart F, in response to the Resource Conservation and Recovery Act (RCRA). The draft report also gives examples of ISL groundwater monitoring data and of statistical techniques for comparing post- and pre-operational monitoring data. However, although all pertinent topics are touched upon in the draft report, few topics contain sufficient detail to guide setting and implementing these standards.

The SAB recommends that the EPA expand greatly this draft technical report so that it is protective and realistic in guiding the monitoring program and evaluating its results. To be a guide for decisions that are based on knowledge of both the general behavior of groundwater constituents and the conditions at the mine under consideration, the draft technical report should include detailed discussion of the following critical activities by the EPA:

- Survey the extensive monitoring data available for ISL uranium mines to identify data sets suitable for building an evidence base that could inform EPA's regulations.
- Compile and systematically analyze these data sets to define the geology and hydrology of the site and support modeling of the interactions between pertinent groundwater constituents and associated geologic media.
- Apply environmental models to provide realistic predictions of the rates at which groundwater constitutents approach stable conditions following the cessation of mining operations, for a range of realistic bounding conditions.
- Describe systematic approaches for determining the optimal number, location, and sampling frequency of monitoring wells.
- Specify criteria for selecting groundwater analytes of primary and secondary importance for monitoring by emphasizing the linkages between analytes and monitoring objectives.
- Consider some alternative approaches to the described statistical treatment of differences between pre- and post-mining groundwater quality, and recognize that other factors may have more influence than statistical uncertainty on the reliability of these differences.

Regulated ISR Project Inventory (51 Sites)

Project	Operator	State	Status (2014)
Alta Mesa	Mestena	TX	Standby/Restoration
Benavides	URI, Inc.	TX	Restored/Released
Boots/Brown	U.S. Steel	TX	Restored/Released
Brelum	Mobil Oil	TX	Restored/Released
Brevard	Signal Equities	TX	Licensed/Undeveloped
Bruni	Westinghouse	TX	Restored/Released
Burns	U.S. Steel	TX	Restored/Released
Christensen Ranch	Uranium 1	WY	Restoration/Stability
Church Rock	Hydro Resources	NM	Licensed/Undeveloped
Clay West	U.S.Steel	TX	Restored/Released
Crow Butte	Cameco	NE	Operating/Restoration/Stability
Crownpoint	Hydro Resources	NM	Licensed/Undeveloped
El Mesquite	Cogema	TX	Restored/Released
Goliad	Uranium Energy Corp	TX	Licensed/Undeveloped
Gruy	Everest Minerals	TX	Undeveloped/Released
Highland	Cameco	WY	Restoration/Stability
Hobson	Everest Minerals	TX	Restored/Released
Hobson/Tex-1	Everest Minerals	TX	Restored/Released
Holiday	Cogema	TX	Restored/Released
Irigaray	Uranium 1	WY	Restored/Released
Kingsville Dome	URI, Inc.	TX	Stability
Lamprecht	Inter. Energy Corp	TX	Restored/Released
Las Palmas	Everest Minerals	TX	Restored/Released
Lance	Strata	WY	Licensed/Undeveloped
Longoria	URI, Inc.	TX	Restored/Released
Lost Creek	UrEnergy	WY	Operating
Luenberger	Teton	WY	Restored/Released
McBride	Caithness	TX	Restored/Released
Mt Lucas	Everest Minerals	TX	Restored/Released
Mosier	U.S. Steel	TX	Restored/Released
Nell	Mobil Oil	TX	Restored/Released
Nichols Ranch	Uranerz	WY	Operating
North Butte	Cameco	WY	Operating
North Platte	URI, Inc.	WY	Restored/Released
OHern	Cogema	TX	Restored/Released
Palangana Dome 1	Chevron	TX	Restored/Released
Palangana Dome 2	Uranium Energy Corp	TX	Operating
Pawlik	U.S. Steel	TX	Restored/Released
Pawnee	Inter. Energy Corp	TX	Restored/Released
Reno Creek	Rocky Mt. Energy	WY	Restored/Released
Rosita	URI , Inc.	TX	Standby/Released
Ruth	Cameco	WY	Restored/Released
Section 9 Pilot	Mobil Oil	NM	Restored/Released
Smith Ranch	Cameco	WY	Operating/Restoration
Trevino	Conoco	TX	Restored/Released
Unit 1	Hydro Resources	NM	Licensed/Undeveloped
Vasquez	URI, Inc.	TX	Restored/Stability
West Cole	Cogema	TX	Restored/Released
Willow Creek	Uranium 1	WY	Operating
Zamzow	Inter. Energy Corp.	TX	Restored/Released

USGS
science for a changing world

USGS Study on Texas Uranium Restoration released in 2009.

Report used by the environmental community to claim that ISR uranium mines have not been able to restored back to baseline.

Groundwater Restoration at Uranium In-Situ Recovery Mines, South Texas Coastal Plain

Open-File Report 2009–1143

U.S. Department of the Interior
U.S. Geological Survey

Restoration Table Elements and EPA Standards

	EPA Primary Standard	EPA Secondary Standard
Calcium	None	Non
Magnesium	None	None
Potassium	None	None
Carbonate	None	None
Bicarbonate	None	None
Ammonia-N*	None	None
Molybdenum	None	None
Silica	None	None
Conductivity	None	None
Alkalinity	None	None
Sodium	None	None
pH	None	6.5 to 8.5
Iron	None	0.3 ppm
Manganese	None	0.05 ppm
Sulfate	None	250 ppm
Chloride	None	250 ppm
TDS	None	500 ppm
Fluoride	4 ppm	2 ppm
Nitrate-N	10 ppm	None
Arsenic	0.01 ppm	None
Cadmium*	0.005 ppm	None
Lead*	0.015 ppm	None
Mercury*	0.002 ppm	None
Selenium	0.05 ppm	None
Uranium	0.03 ppm	None
Radium-226	5 pCi/l	None

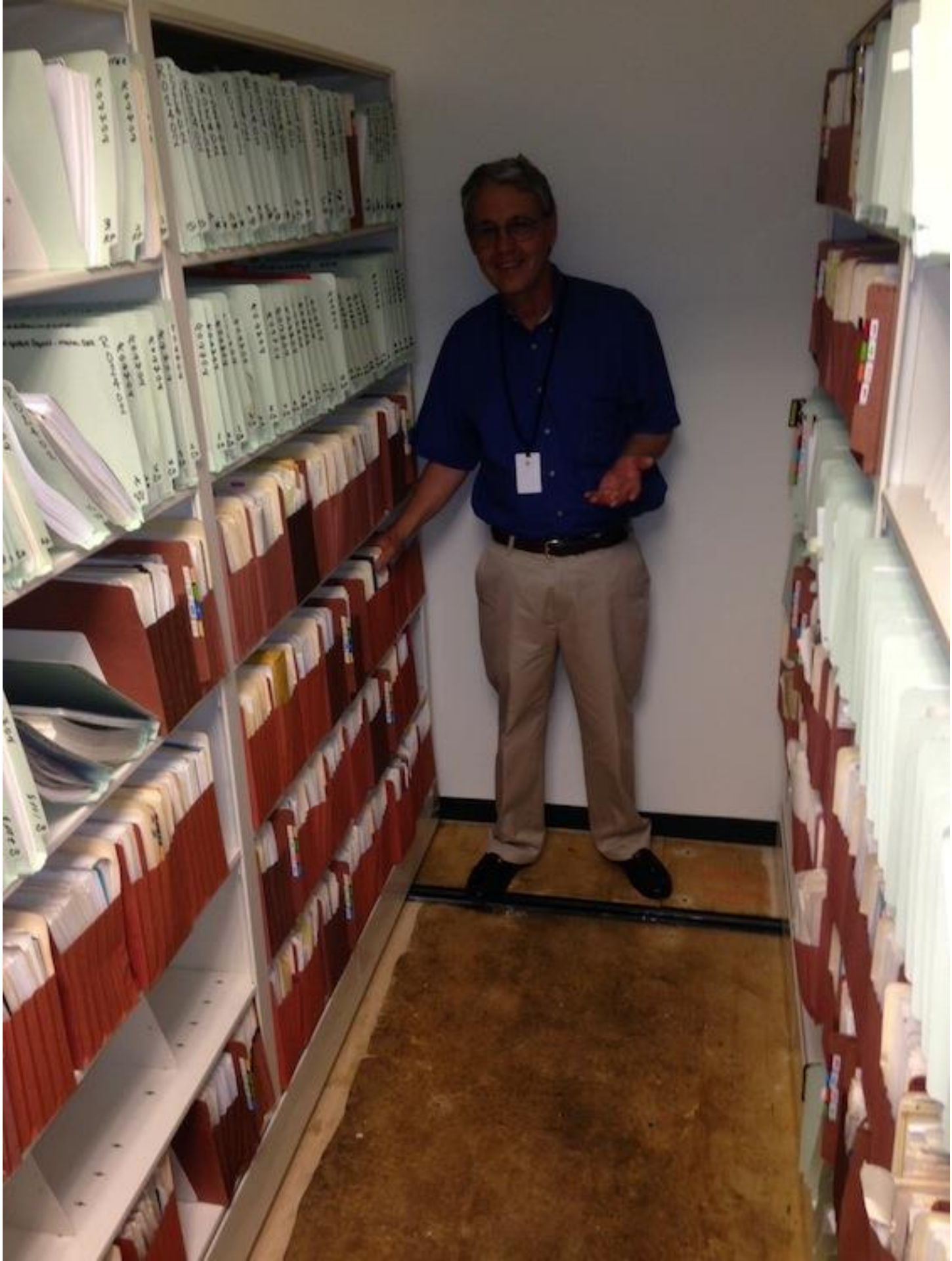
* Ions not introduced while mining

Total Dissolved Solids (Hall's 22 Sites)

Mine	Baseline (ppm)	Restored Value (ppm)	Amended Value (ppm)	Change between Baseline and Restored Value
Bruni-5-2	2282	1366	2282	-40%
Bruni-5-1	2282	1395	2282	-39%
Pawnee	903	710	900	-21%
Benavides-4	1211	1088	1211	-10%
O'Hern-2	979	890	**	-9%
Longoria-1	1928	1860	1928	-4%
Brelum-2	6349	6155	6349	-3%
Holiday-3	1442	1414	1442	-2%
Benavides-1	1211	1351	1211	0%
Brelum-1	5970	6065	5971	0%
Bruni-6	1333	***	1333	0%
El Mesquite-1	1071	1075	1071	0%
Nell-1	5383	5372	5383	0%
Trevino-2A	1635	1628	1884	0%
Trevino-2B	1635	1627	1635	0%
Trevino-1	1577	1661	1700	+5%
McBryde-1	1580	1727	1738	+9%
Longoria-2	2013	2208	2200	+10%
Benavides-2	1663	1875	2100	+13%
Benavides-3	1356	1560	1358	+15%
El Mesquite-3	786	900	910	+15%
Hobson-1	1111	1379	1492	+24%

Historic Data at TECQ. 28 ISR Projects, 92 PAs (MUs)

Review is a Work in Progress



RESTORATION/STABILITY REPORTS AND DATA RESTORATION TABLE AMENDMENT ANALYSIS REPORTS (33)	
1	UR01890-21 Burns/Mosier Restoration Report
2	UR01890-031 Burns/Mosier Restoration Report
3	UR01941-040 O'Hern Restoration Table Amendment Report
4	UR02155-021 El Mesquite Restoration Table Amendment Report
5	UR02155-031 El Mesquite Restoration Table Amendment Report
6	UR02155-041 El Mesquite Restoration Table Amendment Report
7	UR02156-011 Holiday H-1 (EXT) Restoration Table Amendment Report
8	UR02156-011 Holiday Restoration Table Amendment Report
9	UR02156-021 Restoration Table Amendment Report
10	UR02156-051 Holiday Restoration Table Amendment Report
11	UR02156-061 Holiday Restoration Table Amendment Report
12	UR02156-071 Holiday Restoration Table Amendment Report
13	UR02156-071 Holiday Restoration Table Amendment Report
14	UR02208-011 Hobson Amendment Report_ Stabilization
15	URO2381-011 Mt Lucas Restoration Table Amendment Report
16	URO2381-021 Mt Lucas Restoration Table Amendment Report
17	URO2381-031 Mt Lucas Restoration Table Amendment Report
18	URO2381-041 Mt Lucas Restoration Table Amendment Report
19	URO2381-051 Mt Lucas Restoration Table Amendment Report
20	URO2381-061 Mt Lucas Restoration Table Amendment Report
21	URO2381-071 Mt Lucas Restoration Table Amendment Report
22	URO2381-081 Mt Lucas Restoration Table Amendment Report
23	UR02407PAA011 Trevino Restoration Report 1988-07-29
24	UR02407PAA021 Trevino Restoration Report 1986-07-25
25	UR02441-011 Las Palmas Restoration Table Amendment Report & Data
26	UR02441-021 Las Palmas Restoration Table Amendment Report & Data
27	UR02441-011 Las Palmas Restoration Table Amendment Report & Data
28	UR02463-031 West Cole Restoration Table Amendment Report
29	UR02463-031 West Cole Restoration Table Amendment Report
30	UR02827-011 Kingsville Dome Restoration Justification Report
31	URO2827-021 Kingsville Dome Restoration Justification Report
32	URO2880-011 Rosita Restoration Table Amendment Reports

RESTORATON CERTIFICATES WITH DATA (21)

1. UR01941-021 OHern TCEQ Restoration Certificate
2. UR01942-051-1 Bruni TCEQ Restoration Certificate
3. UR01942-051-2 Bruni TCEQ Restoration Certificate
4. UR02050-011 Pawnee TCES Stability File
5. UR02151-011 Brelum TCEQ Restoration Certificate
6. UR02151-021 Brelum TCEQ Restoration Certificate
7. UR02155-011 El Mesquite TCEQ Restoration Certificate
8. UR02156-031 Holiday TCEQ Restoration Certificate
9. UR02156-031 Restoration Certificate
10. UR02202-011 Nell TCEQ Restoration Certificate
11. UR02208-011 Hobson TCEQ Restoration Certificate
12. UR02222-011 Longoria TCEQ Restoration Certificate
13. UR02222-021 Longoria TCEQ Restoration Certificate
14. UR02312-011 Benavides TCEQ Restoration Certificate
15. UR02312-021 Benavides TCEQ Restoration File
16. UR02312-031 Benavides TCEQ Restoration Certificate
17. UR02312-031 Benavides TCEQ Restoration File
18. UR02407-011 Trevino TCEQ Restoration Certificate
19. UR02407-021a Trevino TCEQ Restoration Certificate
20. UR02407-021b Trevino TCEQ Restoration Certificate
21. UR02420-011 McBride TCEQ Restoration Certificate

SUMMARY OF ISR RESTORATION DATA - URANIUM									
Permit ID	Start	End	Approximate Water Consumption (million gallons)	Stab. Mo.	Uranium Stability (mg/l)				Source
					1st	2nd	3rd	Avg.	
TEXAS									
UR01890-021	6/86	Nov 1997	1,633	6	1.77	2.21	2.9	2.29	USX Rpt. 6/18/98
UR01890-031	6/86	Nov 1997	410	6	2.28	1.72	1.2	1.73	USX Rpt. 6/18/98
UR02155-021	10/86	12/95	426	6	1.3	1.26	1.33	1.3	COGEMA Rpt. 11/27/96
UR02155-041	1/90	10/97	252	6	1.90	1.49	1.69	1.70	COGEMA Rpt. 9/11/98
UR02827-011	12/99	4/03	733	72	0.76	0.84	0.93	0.84	URI Company Report 10/13/13
UR02827-021	1/04	10/10	1,000	24	0.74	0.94	0.75	0.81	URI Company Reports 10/13/13
UR02880-011	8/05	5/08	490	60	0.58	0.70	0.90	0.73	URI Company Reports 12/22/10
UR0-2880-021	5/01	3/06	732	60	0.65	0.85	0.86	0.79	URI Company Reports 12/6/10
UR02381-021	4/92	6/92	95	3	0.366	0.354	0.373	0.375	Everest Mt. Lucas RTA Report 6/29/92

Texas
General Post Restoration Results

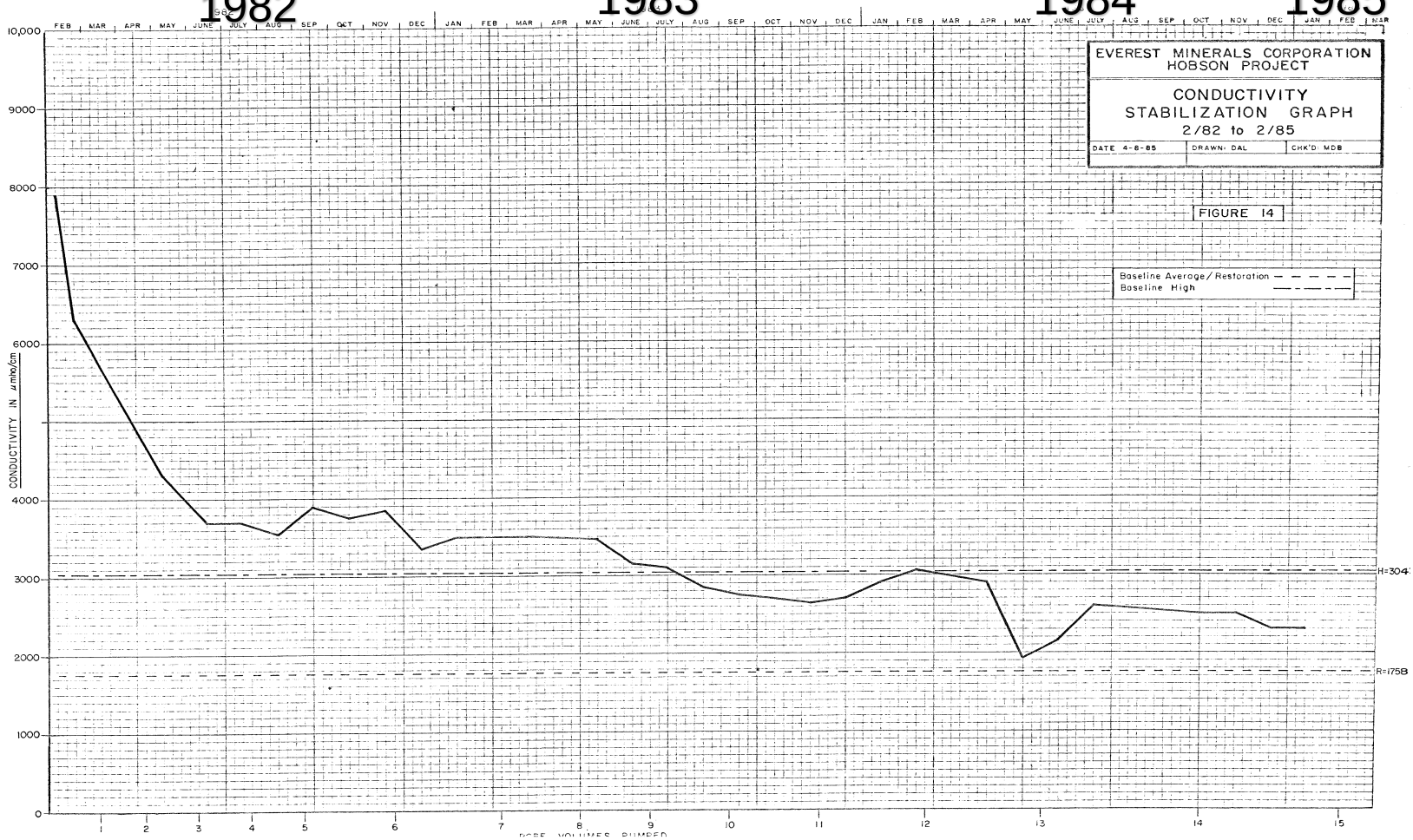
Avg. Uranium 50 PAs (MUs)				Avg. Radium 50 PAs (MUs)			
Baseline Average	Post Stability Average	Δ	MCL	Baseline Average	Post Stability Average	Δ	MCL
0.45 mg/l	**1.13 mg/l**	**0.68 mg/l**	**0.03 Δ mg/l**	**124 pCi/l**	**128 pCi/l**	**4 pCi/l**	**5 pCi/l**

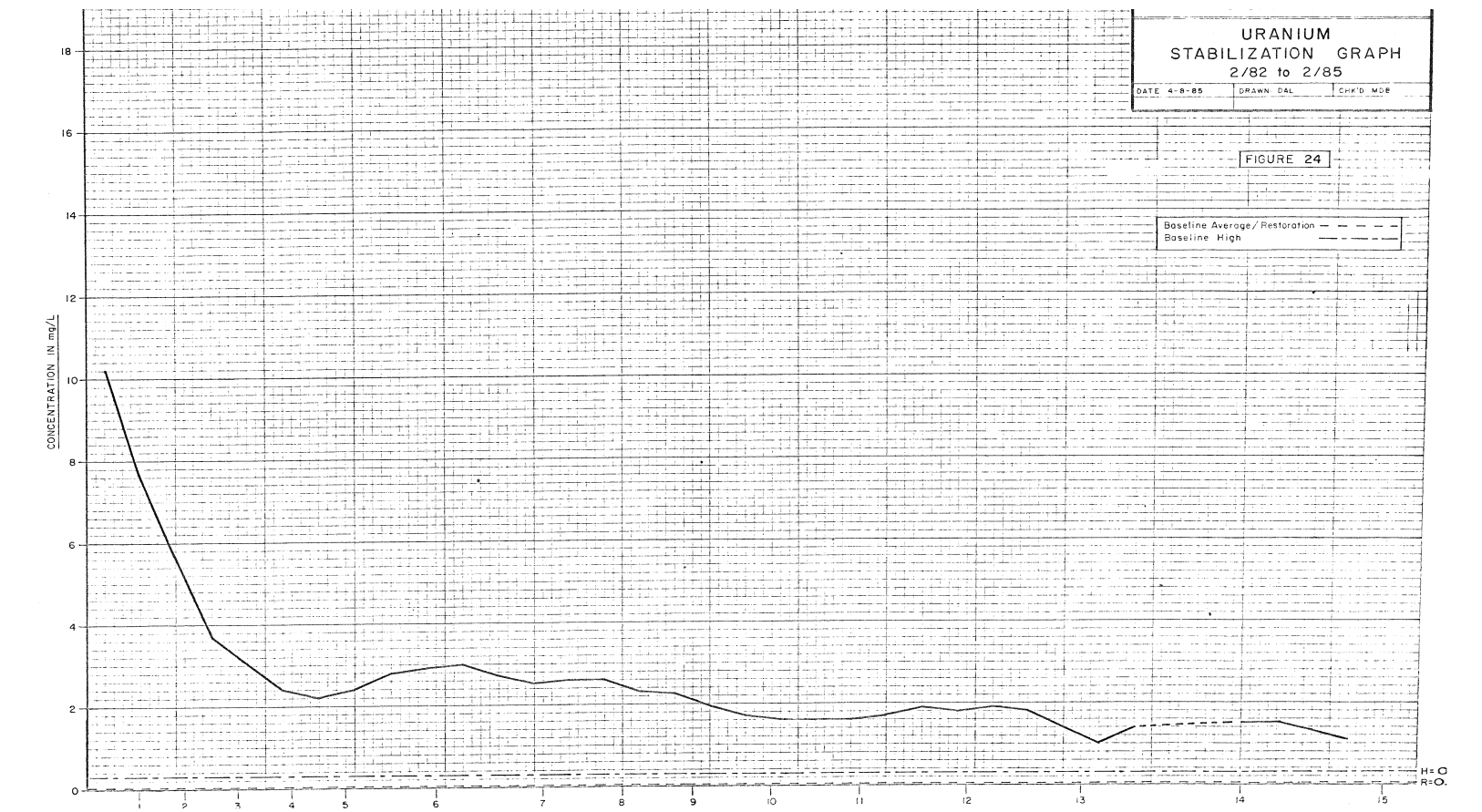
Gallons to achieve restoration in 33 out of 50 of these PAs (MUs) – 11,400,000,000

Restoration Reports - 33 PAs (MUs)

Generally each report includes, as required by TCEQ rules, an analysis of:

- uses for which the groundwater in the production area was suitable at baseline water quality levels;
- actual existing use of groundwater in the production area prior to and during mining;
- potential future use of groundwater of baseline quality and of proposed restoration quality;
- the effort made by the permittee to restore the groundwater to baseline;
- technology available to restore groundwater for particular parameters;
- the ability of existing technology to restore groundwater to baseline quality in the area under consideration;
- the cost of further restoration efforts;
- **the consumption of groundwater resources during further restoration; and**
- the harmful effects of levels of particular parameter.


1982
1983
1984
1985
FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC JAN FEB MAR
10,000
9000
8000
7000
6000
4000
3000
2000
1000
0
CONDUCTIVITY IN µmho/cm
H=3043
R=1758
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
PORE VOLUMES PUMPED
EVEREST MINERALS CORPORATION
HOBSON PROJECT
CONDUCTIVITY
STABILIZATION GRAPH
2/82 to 2/85
DATE 4-8-85
DRAWN DAL
CHK'D MDB
FIGURE 14
Baseline Average/Restoration
Baseline High


18
16
14
12
10
8
6
4
2
0
CONCENTRATION IN mg/L
H=0
R=0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
URANIUM
STABILIZATION GRAPH
2/82 to 2/85
DATE 4-8-85
DRAWN DAL
CHK'D MDB
FIGURE 24
Baseline Average/Restoration
Baseline High

New Mexico
Mobil Section 9 Reviewed Technical and Restoration Reports

1 In-Situ Leaching of Crownpoint, New Mexico, Uranium Ore: Part 1-Mineralogical Frame of Reference. Vogt et. al. SPE Journal

2 In-Situ Leaching of Crownpoint, New Mexico, Uranium Ore: Part 2-Laboratory Study of a Mild Leaching System. Vogt et. al. SPE Journal

3 In-Situ Leaching of Crownpoint, NM, Uranium Ore: Part 3-Laboratory
Study of Strong Leaching Systems: Sodium Hypochlorite. Vogt et. al. SPE Journal

4 In-Situ Leaching of Crownpoint, NM, Uranium Ore: Part 4-Laboratory Study of Strong Leaching Systems: Oxidant/Sulfuric Acid. Vogt et. al. SPE Journal

5 In-Situ Leaching of Crownpoint, New Mexico, Uranium Ore: Part 5-
Laboratory Study of Strong Leaching Systems: Oxidant-Heat. Vogt et. al. SPE Journal

6 In-Situ Leaching of Crownpoint, New Mexico, Uranium Ore: Part 6-Section 9 Pilot Test. Vogt et. al. SPE Journal

7 Annual Restoration Reports w/data to NMED - 1981, 1982, 1983, 1984, 1985, 1986,1987, 1988. Mobil Oil Corp.

8 HRI/ Town of Crownpoint down gradient water quality data.

Wyoming

1. Irigaray Water Wells, 37 Years of Down Gradient Monitoring.

2. Well Field Restoration Reports Christensen Ranch

3. Well Field Restoration Reports Irigaray Ranch

4. Results from R&D and Commercial Applications and Mine Unit reports.

Area of Review Background Data Assessments
UIC Area Permit Applications and EAs

- Agency validated background water quality data and hydrogeologic tests and analysis from Production Area Authorizations, Mine Unit Authorizations, responses to requests for additional information (RAIs)
- UR02051. Union Carbide Palangana Domestic Well Sample History
- UR02154. Re-permitting/licensing of the Boots/Brown ISPR Project. Baseline/AOR well resampling information.
- UR02312 & UR02463. Background maps, water well inventory and analytical data for AOR wells for the West Cole Project (Benavides)
- UR02381. Background maps, water well inventory and analytical data for AOR wells for the Mt Lucas Project. Baseline well turned over to landowner.
- UR02155 & UR02156. Background maps, water well inventory and analytical data for AOR wells for the – El Mesquite Project
- UR02208. Background maps, water well inventory and analytical data for AOR wells for the Hobson Project
- UR02020, UR02407 & UR02914. Background maps, water well inventory and analytical data for AOR wells for the Trevino/Gruy/McBride Projects

TRCB EA-6

ENVIRONMENTAL ASSESSMENT RELATED TO TENNECO URANIUM, INC. WEST COLE PROJECT WEBB COUNTY, TEXAS

Radiation Control Branch
Division of Occupational Health
and Radiation Control
Texas Department of Health

May 29, 1981

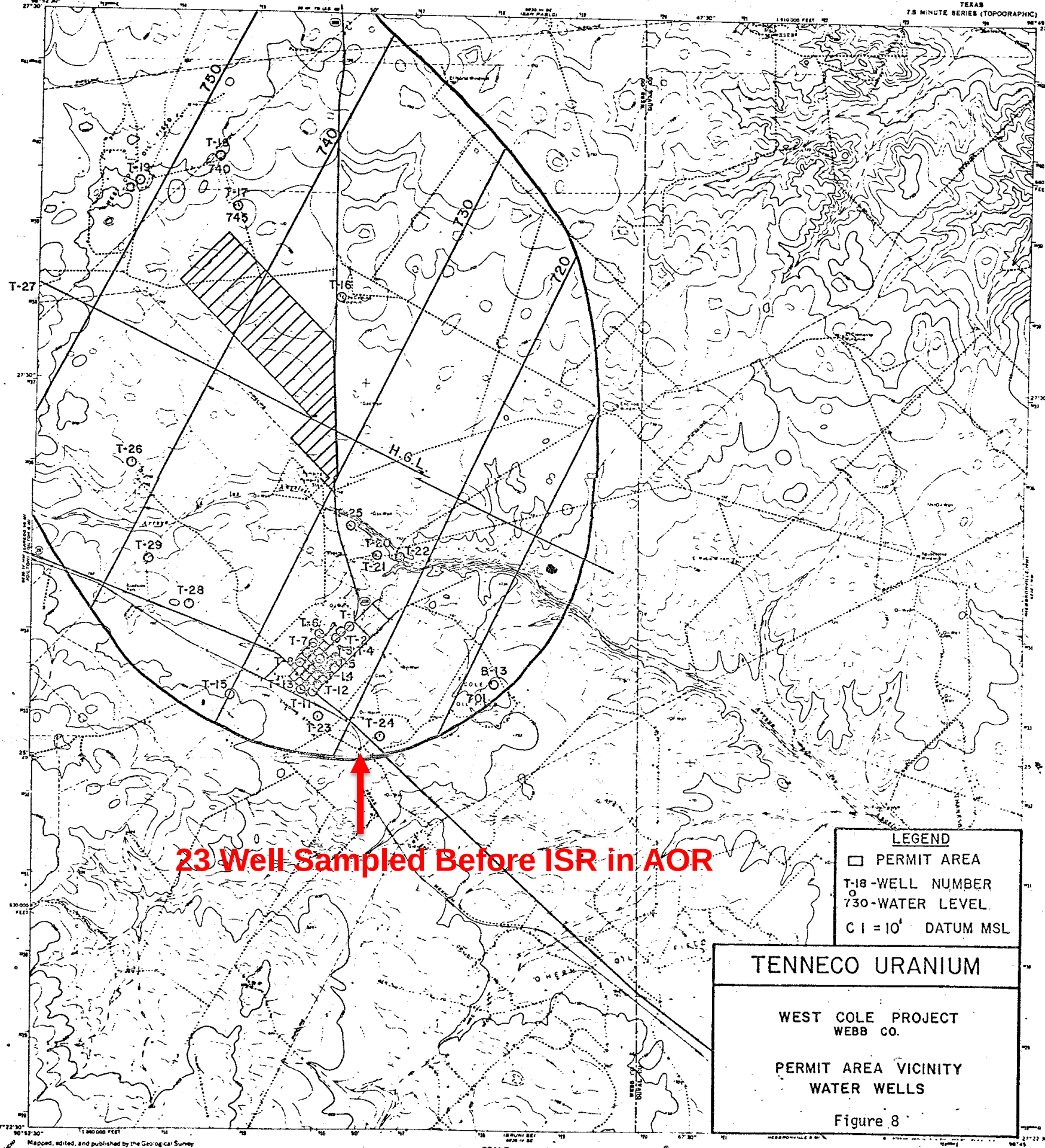

TEXAS
7.5 MINUTE SERIES (TOPOGRAPHIC)
750
740
730
720
T-18
740
T-19
T-17
745
T-27
T-16
T-26
H.G.L.
T-25
T-29
T-20
T-22
T-21
T-28
T-6
T-7
T-2
T-4
T-5
T-1
T-3
T-15
T-12
B-13
701
T-11
T-23
T-24
23 Well Sampled Before ISR in AOR
LEGEND
PERMIT AREA
T-18 -WELL NUMBER
730-WATER LEVEL
C I = 10' DATUM MSL
TENNECO URANIUM
WEST COLE PROJECT
WEBB CO.
PERMIT AREA VICINITY
WATER WELLS
Figure 8
Mapped, edited, and published by the Geological Survey

TABLE 2

WATER SUPPLY WELL PHYSICAL DATA

WELL NO.	OWNER AND ADDRESS	LESSEE & ADDRESS	PRODUCTION METHOD	USE	DATE DRILLED	TOTAL DEPTH	CASING TYPE	COMPLETION METHOD	PREVIOUS USE	WATER LEVEL (msl)
T-1	Larry G. Lowe P. O. Box 130 Bruni, Texas 78344	None	Submersible Pump	Domestic	11-21-77	206'	PVC	Slotted w/ perforation	None	40' approx.
T-2	Policarpio Vasquez, Sr. P. O. Box 44 Bruni, Texas 78344	None	Submersible Pump	Domestic	7-1978	270'	PVC	Slotted w/ perforation	None	48' approx.
T-3	C. F. Vandergrift P. O. Box 87 Bruni, Texas 78344	None	Submersible Pump	Domestic	1960	190'	PVC	Perforated	None	40' approx.
T-4	C. F. Vandergrift P. O. Box 87 Bruni, Texas 78344	None	Submersible Pump	Irrigation & Industrial	1965	400'	Steel	Slotted	None	42' approx.
T-5	Bruni School System P. O. Box 206 Bruni, Texas 78344	None	Submersible Pump	Domestic	8-7-67	345'	Steel	Slotted	None	X
T-6	Bruni School System Football Field P. O. Box 206 Bruni, Texas 78344	None	Submersible Pump	Domestic & Irrigation	9-28-66	340'	Steel	Slotted	None	84.5'
T-7	V. Vasquez P. O. Box 53 Bruni, Texas 78344	None	Windmill	Irrigation	#	#	Steel	#	None	X
T-8	Bruni Water Works Commercial P. O. Box 192 Bruni, Texas 78344	None	Turbine	Industrial	1953	407'	Steel	#	None	X
T-9	Bruni Water Works City Water Supply State Well #2 P. O. Box 192 Bruni, Texas 78344	None	Submersible Pump	Domestic	1967	360'	Steel	Slotted	None	X
T-10	Bruni Water Works City Water Supply State Well #3 Bruni, Texas 78344	None	Submersible	Domestic	1969	360'	Steel	Slotted	None	X
T-11	L. Valdez P. O. Box 94 Bruni, Texas 78344	None	Windmill	Domestic & Irrigation	1930	400'	Steel	#	None	74.5' approx.
T-12	V. L. Clarwitz- B. Kohetck P. O. Box 33 Bruni, Texas 78344	A	Pump							
T-13	W. Reyes P. O. Box 93 Bruni, Texas 78344	X	Submersible Pump	Domestic	1978	#	#	#	None	X
T-14	S. Marshall, Jr. P. O. Box 266 Bruni, Texas 78344	X	Submersible Pump	Domestic	#	250'	Steel	#	None	X
T-15	Romero Vasquez 411 Hickory Hebbronville, Tx. 78361	X	Windmill	Domestic & Livestock	#	#	Steel	#	X	X
T-16	A. T. Benavides P. O. Box 1 Bruni, Texas 78344	X	Submersible Pump	Livestock	#	#	Steel	#	None	X
T-17	L. Valdez P. O. Box 94 Bruni, Texas 78344	X	Windmill	Livestock	#	#	Steel	#	X	45.87' approx
T-18	E. Cantu 1601 Cortez Laredo, Tx. 78404	Rey Farias, Jr. 409 Bessie Hebbronville, Tx	Windmill	Livestock	#	#	Steel	#	X	62.35'
T-19	L. Valdez P. O. Box 94 Bruni, Texas 78344	X	Windmill	Irrigation	#	#	#	#	X	48.45' approx.
T-20	A. T. Benavides P. O. Box 1 Bruni, Texas 78344	X	Submersible	Domestic & Livestock	#	#	Steel	#	X	X
T-21	A. T. Benavides P. O. Box 1 Bruni, Texas 78344	X	Submersible Pump	Domestic	#	290'	PVC	Slotted	X	X

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

COMPANY: URANIUM RESOURCES INC. REPORT DATE: MAY 16, 1980
IDENTIFICATION: T 1 4-30-80
L. G. LOWE
LABORATORY: JORDAN LABORATORIES, INC.

MAJOR A

ITEM

COMPANY: URANIUM RESOURCES INC. REPORT DATE: MAY 16, 1980
IDENTIFICATION: T 2 4-30-80
P. VASQUEZ
LABORATORY: JORDAN LABORATORIES, INC.

MAJOR AND SECONDARY CONSTITUENTS

ITEM

COMPANY: URANIUM RESOURCES INC. REPORT DATE: MAY 16, 1980
IDENTIFICATION: T 6 4-30-80
BRUNI SCHOOL SYSTEM FOOTBALL FIELD
LABORATORY: JORDAN LABORATORIES, INC.

MAJOR AND SECONDARY CONSTITUENTS

ITEM

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

COMPANY: URANIUM RESOURCES INC. REPORT DATE: MAY 20, 1980
IDENTIFICATION: T 20 5-7-80
A. T. BENAVIDES
LABORATORY: JORDAN LABORATORIES, INC.

MAJOR AND SECONDARY CONSTITUENTS

ITEM

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

COMPANY: URANIUM RESOURCES INC. REPORT DATE: MAY 20, 1980
IDENTIFICATION: T 21 5-7-80
A. T. BENAVIDES BIG HOUSE
LABORATORY: JORDAN LABORATORIES, INC.

MAJOR AND SECONDARY CONSTITUENTS

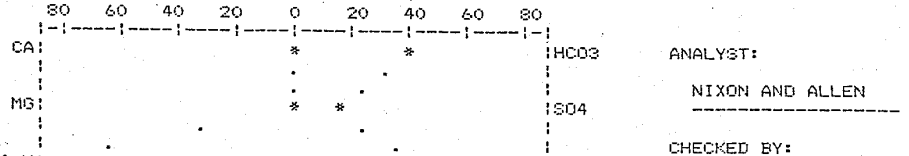
ITEM	STORET	MG/L	EPM	CONDUCTANCE	%EPM
CALCIUM(CA)	00915	5.1	0.25	13.00	1.71
MAGNESIUM(MG)	00925	1.8	0.15	6.99	1.02
SODIUM(NA)	00929	324	14.09	689.00	96.11
POTASSIUM(K)	00937	6.8	0.17	12.24	1.16
	TOTAL CATION		14.66		
CARBONATE(CO3)	00445	5	0.17	14.38	1.15
BICARBONATE(HCO3)	00440	344	5.64	245.90	38.19
SULFATE(SO4)	00945	105	2.19	161.84	14.83
CHLORIDE(CL)	00940	240	6.77	513.84	45.84
NITRATE(NO3-N)	71851	1.3			
FLUORIDE(F)	00951	0.75	TOTAL	1657.20	
SILICA(SIO2)	00955	41			
	TOTAL ANION		14.77		
	TOTAL ION	1075		ACCURACY CHECK	
					RANGE
TDS(180 C)	70300	940		ION 0.993	(.96 TO 1.04)
TOT ION-0.5 HCO3=		903		TDS 1.041	(.90 TO 1.10)
EC(25 C)	00095	1530 UMHOS		EC 0.990	(.95 TO 1.05)
EC(DIL)=98.2 X 16.7 =		1640 UMHOS			
ALK. AS CACO3	00410	290			
PH		8.42			

RADIATION-PICOCURIES/LITER

GROSS ALPHA	7.5	+/- 8.2
GROSS BETA	5.7	+/- 8.5
RADIUM 226	0.1	+/- 0.3

MINOR AND TRACE CONSTITUENTS

ITEM	MG/L	ITEM	MG/L	ITEM	MG/L
ARSENIC(AS)	0.064	MANGANESE(MN)		VANADIUM(V)	
BARIUM(BA)		MERCURY(HG)		ZINC(ZN)	
CADMIUM(CD)		MOLY.(MO)	<0.01	BORON(B)	
CHROM.(CR)		NICKEL(NI)		AMMONIA-N	
COPPER(CU)		SELENIUM(SE)	<0.001		
IRON(FE)		SILVER(AG)			
LEAD(PB)		URANIUM(U)	0.024		



ANALYST:

NIXON AND ALLEN

CHECKED BY:

LAB.NO:M17/42

ENVIRONMENTAL ASSESSMENT, SAFETY EVALUATION REPORT, AND PROPOSED LICENSE CONDITIONS RELATED TO THE TEXACO INC. — SUNOCO ENERGY DEVELOPMENT COMPANY HOBSON TEX-1 PROJECT KARNES COUNTY, TEXAS

BUREAU OF RADIATION CONTROL
TEXAS DEPARTMENT OF HEALTH
APRIL 3, 1984

Texaco AOR Wells

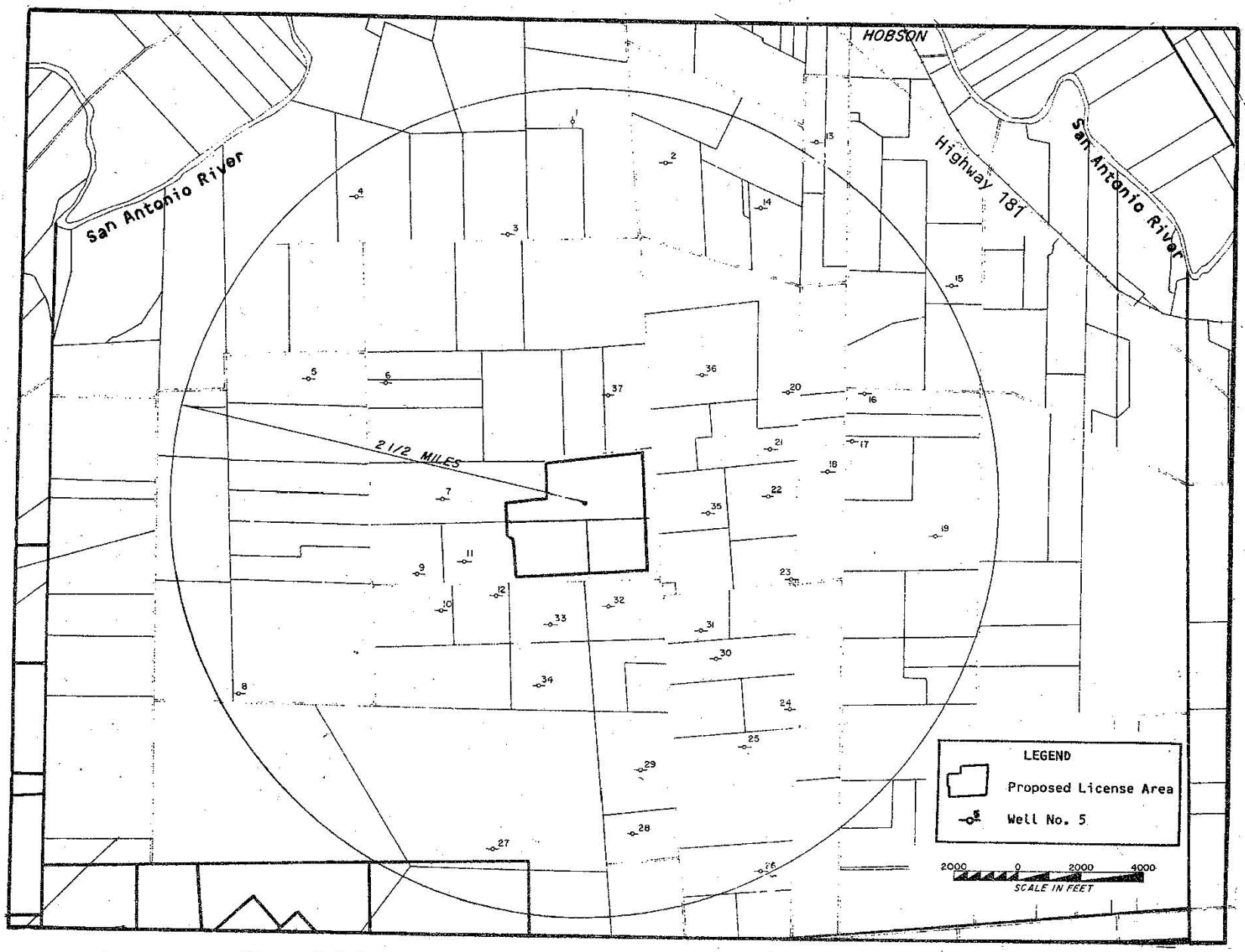


Figure 2.7-9 Location of Area Water Wells, Hobson Tex-1 Project
(Modified from Reed and Associates, 1978)

Table 2.7-1 Total Dissolved Solids, Gross Alpha, and Radium-226 Levels in Area Water Wells, Hobson Tex-1 Project (Modified from Reed and Associates, 1978)

Water Well*	Total Dissolved Solids	Radium-226 (pCi/l)	Gross Alpha (pCi/l)
1	1520	102.0 ± 5	59 ± 21
2	870	0.97 ± 0.21	6 ± 11
3	1150	1.83 ± 0.38	36 ± 19
4	2140	0.	
5	712	1.	
6	412		
7	1620	0.	
8	510	12.	
9	800		
10	1330		
11	802		
12	1000		
13	944	3.	
14	990	0.	
15	1190	0.	
16	1100	0.	
17	3340	0.	
18	1520	0.	
19	1600	0.	
20	3110	0.	
21	4440	0.	
22	1210	0.	
23	2870	0.	
24	852	0.	
25	872	0.	
26	846	0.	
27	1220	0.	
28	1950	0.	
29	1080		
30	3440	0.	
31	894	0.	
32	2420	0.	
33	1030		
34	906	0.	
35	892	0.	
36	1800	0.	
37	1800	0.	

*Location of water wells is indicated in Fig

Texas Department of Water Resources—Geological Services

Permit No.

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No.

Production

Submitted By TEXACO Date Collected: 11-6-78 ; By

Company TEXACO Mine WELL# 1 ROHAN; KA

SAMPLE METHODS: Calibrate Ec Meter (1) Page 71, Pump Well Until Ec is Approx.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)
1				
2				
3				

Spec. Cond. at Well:

Normal Water Level:

Pump: Set at

Bottom of: Casing

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items; One quart plastic (full) for Spec

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.

ANALYSIS: Lab Name CORE LABORATORIES, INC. Date Received 11-8-78

MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)
A.	Calcium (Ca)	00915	348	= 20.04 x		x 52.0 =
B.	Magnesium (Mg)	00925	31.8	= 12.16 x		x 46.6 =
C.	Sodium (Na)	00929	259	= 22.99 x		x 48.9 =
D.	Potassium (K)	00937		= 39.10 x		x 72.0 =
E.			Total Cation	....		
F.	Carbonate (CO_3)	00445	22.3	= 30.00 x		x 84.6 =
G.	Bicarbonate (HCO_3)	00440	100	= 61.02 x		x 43.6 =
H.	Sulfate (SO_4)	00945	517	= 48.03 x		x 73.9 =
I.	Chloride (Cl)	00940	58 5	= 35.45 x		x 75.9 =
J.	Nitrate (NO_3-N)	71851	3.29			Total
K.	Fluoride (F)	00951				
L.	Silica (SiO_2)	00955				
M.			Total Anion	...		
N.	Total Ion	....				Ion (E:M)
P.	TDS (180 C)	70300	1520			TDS (P:O)
Q.	TDS = N x .5G		=			Ec (S:T)
R.	Ec (25 C)	00095	2900			
S.	Ec (Dilute) = ____ x ____		=		µmhos	
T.	Alk. as $CaCO_3$	00410			µmhos	
V.	pH	00403				

DIAGRAM % CATI

80 60 40 20

Ca

Mg

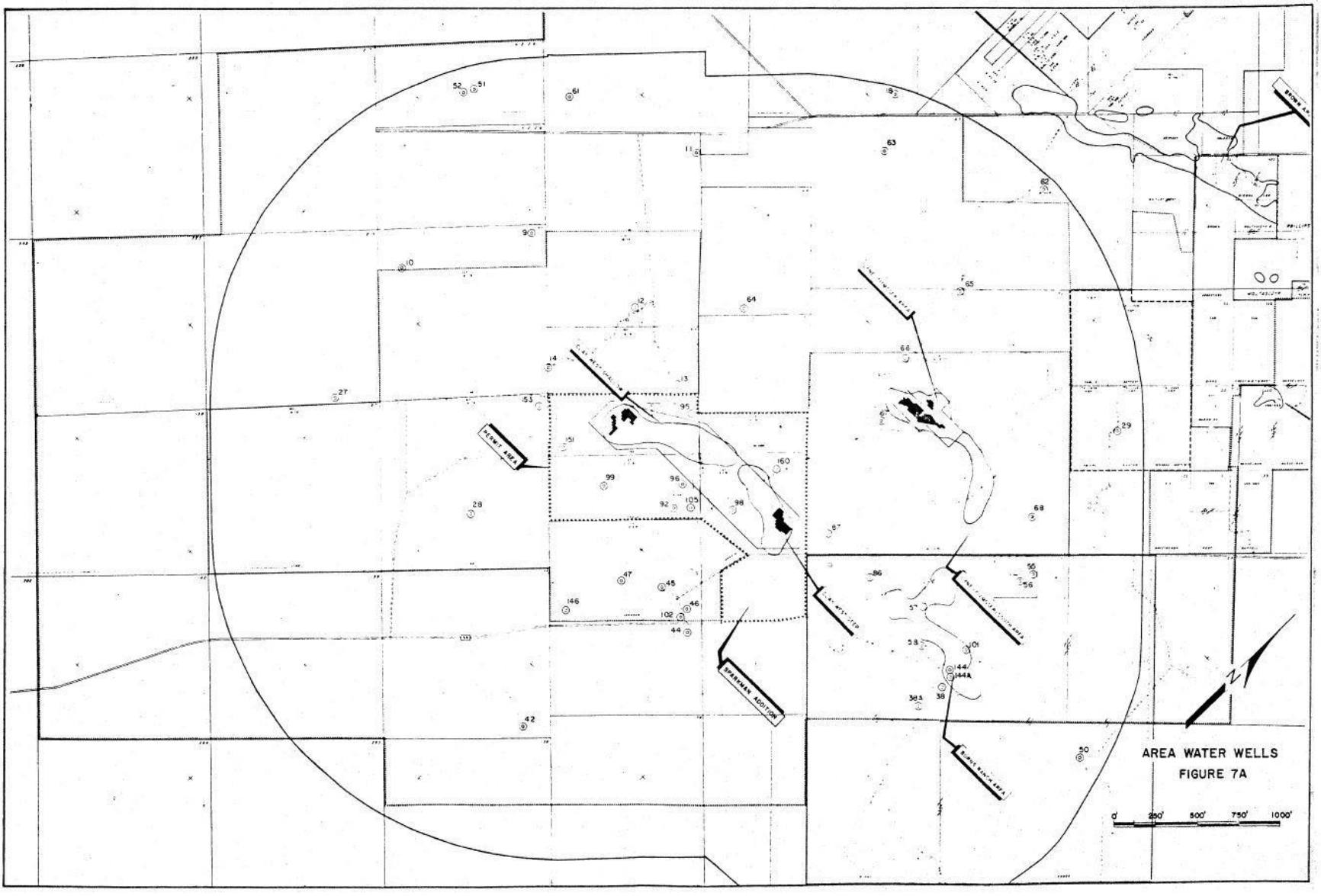
Na+K

(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l
* Arsenic (As)		* Manganese (Mn)	
* Barium (Ba)		* Mercury (Hg)	
* Cadmium (Cd)		* Moly. (Mo)	

U.S. Steel Clay West AOR Wells



Everest Las Palmas AOR Wells

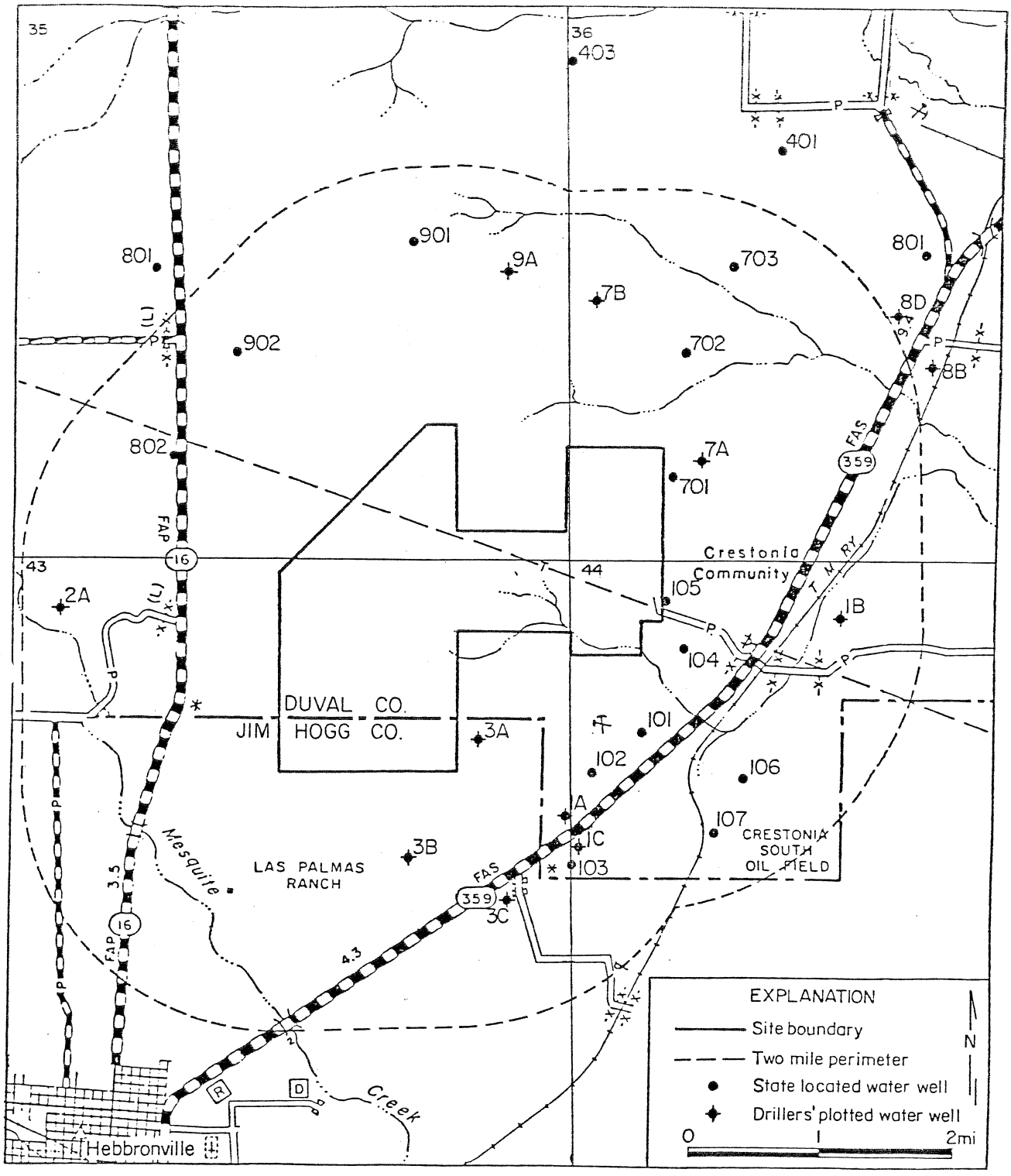


Figure II Location of Area Water Wells, Everest Minerals Corporation, Las Palmas Site (State located wells have been field checked and verified by a state official. Drillers' plotted wells have been tentatively located from individual drillers' logs.)

EVEREST EXPLORATION, INC.
POST OFFICE BOX 1339
CORPUS CHRISTI, TEXAS 78403
(512) 883-2831
FACSIMILE (512) 883-9628

August 8, 1996

Mr. John Santos
Industrial and Hazardous Waste Division
UIC, Uranium and Radioactive Waste Section
Texas Natural Resource Conservation Commission
P. O. Box 13087
Austin, Texas 78711-3087

RE: Mt. Lucas UR02381, Wells left for use of the Landowner

Dear Mr. Santos:

Enclosed are copies of signed and notarized Well Transfer Agreements for the eleven (11) wells left for the Mt. Lucas landowner, Mr. Lon Cartwright. Mr. Cartwright intends to utilize these wells for his ranch use. A description of each of these wells is listed below:

Mt. Lucas Plant water supply well
Mt. Lucas "EA" Wellfield (UR02381-021) overlying aquifer well (#MA)
Mt. Lucas "H" Wellfield (UR02381-031) water supply well
Mt. Lucas "HM" Wellfield (UR02381-041), well (#HMW)
Mt. Lucas "J" Wellfield (UR02381-071) overlying aquifer wells MA-20, 22, and 23
Mt. Lucas "South J" Wellfield (UR02381-081) overlying aquifer well MA-24
Mt. Lucas West Regional Baseline Wells, RM-12, RM-14, and RM-15

If you have any questions or need additional information, please let me know.

Sincerely,

Michael D. Buckley

Enclosures

F:\DATA\EEINC\ML\CARTWELL.DOC

TCEQ Sponsored Program

- Independently Resampled Well In The Area of Review (AOR) of Historic ISR Operations
- Compare with Per ISR Background
- Determine changes in water quality two to three decades after ISR operations have closed
- Begin October 1, 2015

Prepared for

Signal Equities, LLC
111 W. San Antonio St., Suite 250
New Braunfels, TX 78130
(830) 632-7744

REPORT ON FINDINGS RELATED TO THE GEOCHEMISTRY OF GROUNDWATER AT A FORMER IN-SITU URANIUM MINE: EVIDENCE OF NATURAL ATTENUATION AND THE POTENTIAL FOR ACCELERATED GROUNDWATER QUALITY RESTORATION BY THE USE OF REDUCTANTS

BROWN PROPERTY
LIVE OAK COUNTY, TEXAS

2/20/2014

Prepared by

Geosyntec consultants

engineers | scientists | innovators

8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757

Project Number: TXR0316

Issued and Revised: February 2014

Contamination of Overlying Zones

Data from…

- Production Area or Mine Unit Hydrologic Test Documents
- Pump testing to assure adequate confinement
- Background water quality differences in adjacent zones
- MIT success
- Routine monitoring results

Concern if founded by reports in old literature,1980s, from early operations.