

Docket File 40-8768
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URFO r/f

40-8768/SRG/86/08/29/0

- 1 -

SEP 30 1986

URFO:SRG
Docket No. 40-8768
04008768570E

MEMORANDUM FOR: Docket File No. 40-8768
FROM: Scott R. Grace, Project Manager
Licensing Branch
Uranium Recovery Field Office, Region IV
SUBJECT: RESTORATION REVIEW OF THE SEQUOYAH Q-SAND IN-SITU
LEACH R&D PROJECT

Background

Leaching operations in the Sequoyah Fuels Corporation's (SFC) Q-Sand well field began in October 1981, and continued through November 1984, at which time, restoration of the production zone was initiated. The restoration activities continued for 18 months, at which time, NRC participated in a water quality sample-split with SFC and the Wyoming Department of Environmental Quality (WDEQ) to determine the water quality as a result of ground water restoration activities.

The Q-Sand aquifer restoration plan was submitted by the licensee on June 13, 1984, and was approved and incorporated into Source Material License SUA-1387 as Amendment No. 11 on July 3, 1984. Presently, the Q-Sand restoration criteria is specified in License Condition No. 38, and the approved steps in the restoration program are as follows:

1. Phase 1 - Restoration
 - A. A restoration program lasting for about 8 months, at which time, it is expected that the ground-water quality parameters affected by this in-situ leach operation will have been returned to near baseline levels. During this phase of restoration, all monitoring wells shall be sampled and analyzed for chloride and total dissolved solids (TDS) every 2 weeks and for carbonate/bicarbonate, sodium, and sulfate once every month.

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B. After the restoration phase has been completed, the restoration/stability wells shown in the table and figure of Enclosure 1 were to be analyzed for the suite of parameters listed in the table of Enclosure 2. If results confirm that the first phase of restoration activities has been achieved, the data will be sent to WDEQ and NRC for approval.

2. Phase 2 - Stability Demonstration Period

Acceptance of the Q-Sand aquifer restoration-phase results by NRC and WDEQ will initiate a one year aquifer stability demonstration period which will consist of bi-monthly samples of excursion parameters from each of the wells in Enclosure 1. After completion of the stability demonstration period, the data will be analyzed and a final restoration and stability report will be submitted to NRC and WDEQ requesting release of the aquifer restoration bond and approval to begin plugging and abandonment of wells that will not be incorporated into the proposed commercial project.

Restoration criteria for the Q-Sand, as specified in License Condition No. 38, requires that restoration will be based on the well field as a whole, and on a parameter-by-parameter basis, and that all parameters are to be returned to as close to baseline as is reasonably achievable (pre-operational baseline plus 20 percent).

The licensee has completed an 18-month restoration period (phase 1) of the Q-Sand. To determine well field water quality at this milestone, SFC, NRC and WDEQ made a split of water samples on May 13, 1986, for independent laboratory analysis. On July 2, 1986, SFC submitted their analysis of the water sample split.

Discussion

A staff review of the May 13, 1986 water quality analysis from SFC, WDEQ, and NRC indicates that the first phase of the Q-Sand restoration program has been successful in reducing water quality parameters to the target values, except for uranium and sodium. The results of the May 13, 1986 sample analysis are included in table form as Enclosure 3. This table lists the target and baseline values for each parameter for each well and the results of the SFC, NRC and WDEQ analysis. The table also gives the sample mean value of parameters when they exceeded the target value.

Uranium exceeds the target value of 3.7 mg/l only in well QP-5, with a value of 4.1 mg/l. Uranium values are well below the target value for

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the other monitoring wells. The 4.1 mg/l value for QP-5 is below the WDEQ standard of 5 mg/l. As a result of the exceedance of the target value in only one well, and since the value is lower than the WDEQ standard, it is recommended that uranium be considered "returned to as close to baseline as is reasonably achievable," as required by License Condition No. 38.

Using the mean of the three-way sample split, sodium exceeds the target value of 41 mg/l in five of the eight monitoring wells (ranging from 26 to 73 mg/l. The well field mean is a value of 48 mg/l, which is one-half a standard deviation above the target value, and therefore, determined to be not significantly higher than the target value. Since there are no EPA or WDEQ standards for sodium and since the sodium values in the wells are relatively low, it is recommended that sodium be considered "returned to as close to baseline as is reasonably achievable," as required by License Condition No. 38.

This review has been coordinated with WDEQ and agreement with the WDEQ staff has been reached that the first phase of the restoration has been completed in the Q-Sand, and that the stability monitoring phase may begin.

Conclusion

As a result of the staff review, as well as agreement reached with WDEQ, it is recommended that the licensee be found to have completed the first phase of restoration and that the initiation of the stability monitoring period begin. The effective start for the stability monitoring period is retroactive to May 13, 1986, when the last round of split-samples were taken and will continue for a 12-month period.

151

Scott R. Grace, Project Manager
Licensing Branch 1
Uranium Recovery Field Office
Region IV

Approved by:

151

Edward F. Hawkins, Chief
Licensing Branch 1
Uranium Recovery Field Office, Region IV

Enclosures: As Stated

Case Closed: 04008768570E

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TABLE 3

**RESTORATION/STABILITY TEST WELLS
Q-SAND ISL PROJECT LICENSE SUA-1387**

Well QP-2	Well QI-7
Well QP-4	Well QI-8
Well QP-5	Well QI-9
Well QI-5	Well OI-10

FIGURE 1

"Q" SAND PROJECT WELL PATTERN

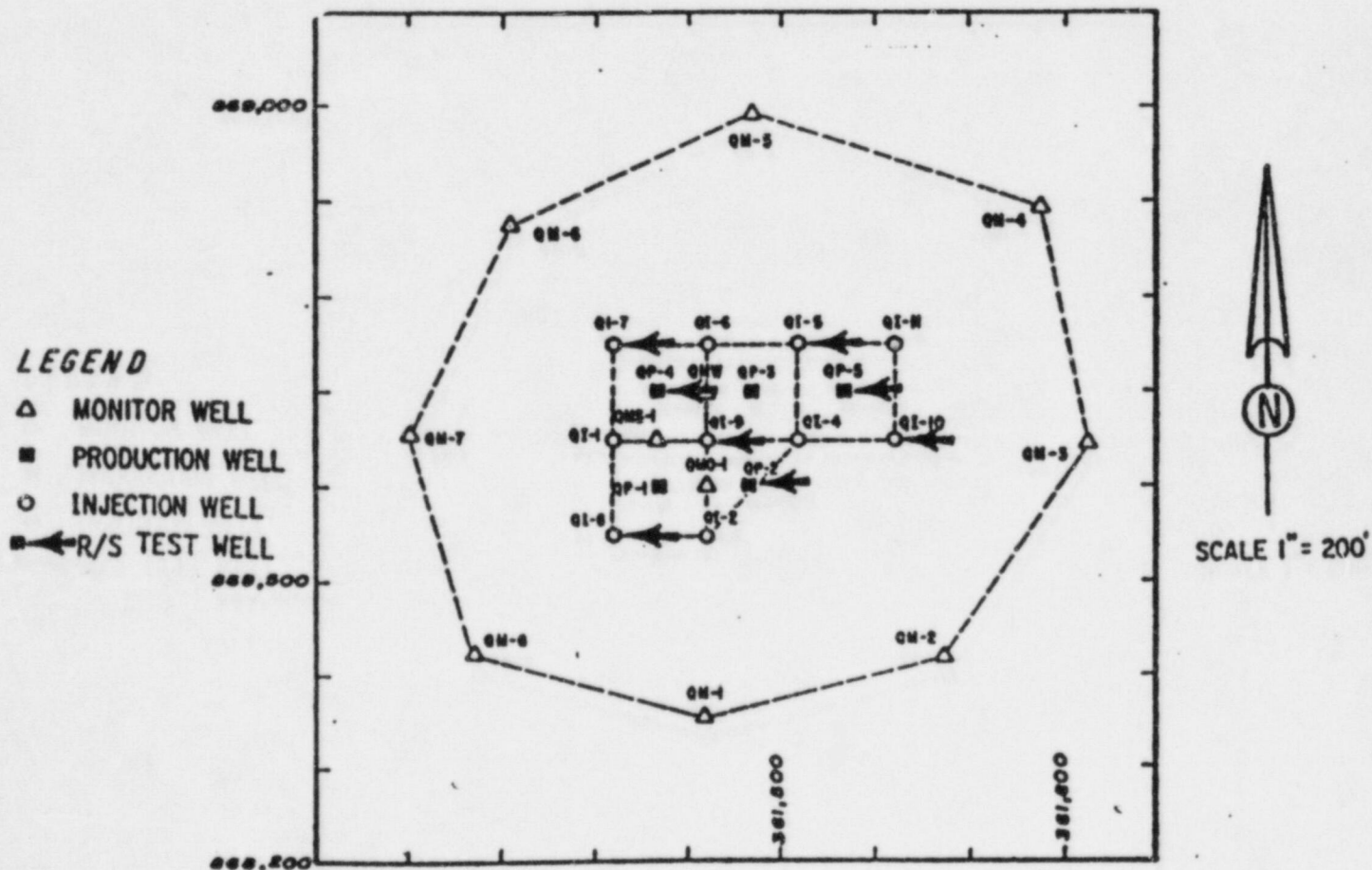


TABLE 2

RESTORATION/STABILITY SAMPLE PARAMETERS
Q-SAND ISL PROJECT LICENSE SUA-1387

<u>Parameter</u> ⁽¹⁾	<u>Leach Field HRV</u> ⁽²⁾	<u>EPA Standards</u> ⁽³⁾	<u>Wyoming DEQ</u> ⁽⁴⁾	<u>Higher of EPA or HRV plus 20%</u> ⁽⁵⁾
<u>Trace/Minor Elements</u>				
Arsenic	0.013	0.05	0.05	0.05
Boron	0.45	-	0.75	0.54
Iron	0.11	0.3	0.3	0.3
Manganese	0.077	0.05	0.05	0.092
Radium-226 - pCi/l	769	5	5	923
Selenium	0.024	0.01	0.01	0.029
Thorium 230 - pCi/l	4.68	-	-	5.62
Uranium	3.1	-	5	3.7
<u>Common Constituents</u>				
Bicarbonate	245	-	-	294
Calcium	100	-	-	120
Carbonate	13	-	-	16
Chloride	30	250	250	250
Magnesium	22	-	-	26
Potassium	19	-	-	23
Sodium	34	-	-	41
Sulfate	148	250	250	250
<u>Physical Indicators</u>				
Conductivity - umho/cm	689	-	-	827
Total Dissolved Solids	476	500	500	571
pH.- units	8.4	6.5-8.5	6.5-9.0	8.6

(1) All values are milligrams/liter, except where noted.

(2) Highest representative value - See Table 4.

(3) EPA Primary and Secondary Drinking Water Standards - 40 CFR 141.11 and 143.3 (July 1, 1983).

(4) Wyoming DEQ Class I Water Criteria.

(5) License SUA-1387 Condition 42.

COMPARISON OF 5/86 WATER QUALITY SAMPLE SPLITS
 SEQUOYAH FUELS ISL
 Q-SAND RESTORATION

Parameter	Target	WELL NO. <u>QP-2</u>				SAMPLE MEAN
		SFC	NRC	WDEQ	BASELINE	
Arsenic (As)	.05	.002	<.1	.003	.001	
Boron (B)	.54	.15	-	-	.24	
Iron (Fe)	.3	.01	<.03	.02	.015	
Manganese (Mn)	.09	.02	.03	<.01	.03	
Radium-226 (Ra)	923	261	249	202	61	
Selenium (Se)	.03	.007	<.2	.006	.008	
Thorium-230 (Th)	5.63	2.0	-	-	.16*	
Uranium (U)	3.7	1.1	1.03	1.9	.12	
Bicarbonate (HCO ₃)	294	264	218	215	179*	
Calcium (Ca)	120	72	70	65	76	
Carbonate (CO ₃)	16	0	0	0	10	
Chloride (Cl)	250	23	16	17	20	
Magnesium (Mg)	26	15	16	15	18	
Potassium (K)	23	7	8	7	11	
Sodium (Na)	41	69	77	72	24	73
Sulfate (SO ₄)	250	159	170	140	110	
Conductivity	827	769	791	710	591*	
TDS	571	517	520	492	395	
pH	6.5 - 8.6	7.2	7.4	7.2	7.7	

- Notes: 1) values in mg/l except for pH, Ra-226 and Th-230, which are in pCi/l.
 2) for baseline, indicates only one sample or analysis.
 3) - indicates no analysis.

COMPARISON OF 5/86 WATER QUALITY SAMPLE SPLITS
SEQUOYAH FUELS ISL
Q-SAND RESTORATION

Parameter	Target	WELL NO. <u>QP-4</u>					SAMPLE MEAN
		SFC	NRC	WDEQ	BASELINE		
Arsenic (As)	.05	.001	<.1	.002	.004		
Boron (B)	.54	.14	-	-	.17		
Iron (Fe)	.3	.02	.59	.59	.019		
Manganese (Mn)	.09	.07	.07	.06	.034		
Radium-226 (Ra)	923	542	487	474	395		
Selenium (Se)	.03	.004	<.2	.004	.002		
Thorium-230 (Th)	5.63	2.4	-	-	.19*		
Uranium (U)	3.7	1.4	1.4	3.4	.82		
Bicarbonate (HCO ₃)	294	224	176	176	198		
Calcium (Ca)	120	64	61	55	89		
Carbonate (CO ₃)	16	0	0	0	10		
Chloride (Cl)	250	18	13	13	7		
Magnesium (Mg)	26	14	14	14	21		
Potassium (K)	23	7	8	7	11		
Sodium (Na)	41	66	68	65	23	66	
Sulfate (SO ₄)	250	169	170	143	127		
Conductivity	827	734	712	680	670		
TDS	571	455	454	452	476		
pH	6.5 - 8.6	7.2	7.3	7.2	8.0		

Notes: 1) values in mg/l except for pH, Ra-226 and Th-230, which are in pCi/l.
2) for baseline, indicates only one sample or analysis.
3) - indicates no analysis.

COMPARISON OF 5/86 WATER QUALITY SAMPLE SPLITS
 SEQUOYAH FUELS ISL
 Q-SAND RESTORATION

Parameter	Target	SFC	NRC	WELL NO. <u>QP-5</u>		SAMPLE MEAN
				WDEQ	BASELINE	
Arsenic (As)	.05	.008	<.1	.007	.008	
Boron (B)	.54	.14	-	-	.35	
Iron (Fe)	.3	.11	<.03	<.01	.037	
Manganese (Mn)	.09	.07	.07	.06	.029	
Radium-226 (Ra)	923	424	541	577	687	
Selenium (Se)	.03	.006	<.2	.003	.014	
Thorium-230 (Th)	5.63	4.3	-	-	.27*	
Uranium (U)	3.7	4.1	3.6	2.9	3.1	3.5
Bicarbonate (HCO ₃)	294	239	207	200	206	
Calcium (Ca)	120	74	74	64	78	
Carbonate (CO ₃)	16	0	0	0	13	
Chloride (Cl)	250	14	9	9	24	
Magnesium (Mg)	26	17	16	16	18	
Potassium (K)	23	7	8	7	10	
Sodium (Na)	41	42	44	43	22	43
Sulfate (SO ₄)	250	139	130	124	116	
Conductivity	827	677	667	690	579*	
TDS	571	436	434	408	408	
pH	6.5 - 8.6	7.0	7.4	7.2	8.2	

- Notes: 1) values in mg/l except for pH, Ra-226 and Th-230, which are in pCi/l.
 2) for baseline, indicates only one sample or analysis.
 3) - indicates no analysis.

COMPARISON OF 5/86 WATER QUALITY SAMPLE SPLITS
SEQUOYAH FUELS ISL
Q-SAND RESTORATION

Parameter	Target	WELL NO. <u>QI-5</u>					SAMPLE MEAN
		SFC	NRC	WDEQ	BASELINE		
Arsenic (As)	.05	.001	<.1	.003	.006		
Boron (B)	.54	.14	-	-	.17		
Iron (Fe)	.3	.02	<.03	<.01	.01		
Manganese (Mn)	.09	.07	.07	.05	.01		
Radium-226 (Ra)	923	324	378	577	257		
Selenium (Se)	.03	.002	<.2	<.001	.011		
Thorium-230 (Th)	5.63	2.0	-	-	-		
Uranium (U)	3.7	1.4	1.4	2.9	.14		
Bicarbonate (HCO ₃)	294	239	194	200	184		
Calcium (Ca)	120	69	73	63	68		
Carbonate (CO ₃)	16	0	0	0	-		
Chloride (Cl)	250	15	11	11	13		
Magnesium (Mg)	26	19	16	17	16		
Potassium (K)	23	7	8	7	14		
Sodium (Na)	41	44	48	47	25	46	
Sulfate (SO ₄)	250	141	150	131	130		
Conductivity	827	689	685	670	566		
TDS	571	446	445	420	392		
pH	6.5 - 8.6	7.2	7.3	7.2	8.2		

Notes: 1) values in mg/l except for pH, Ra-226 and Th-230, which are in pCi/l.
2) for baseline, indicates only one sample or analysis.
3) - indicates no analysis.

COMPARISON OF 5/86 WATER QUALITY SAMPLE SPLITS
 SEQUOYAH FUELS ISL
 Q-SAND RESTORATION

WELL NO. QI-7

<u>Parameter</u>	<u>Target</u>	<u>SFC</u>	<u>NRC</u>	<u>WDEQ</u>	<u>BASELINE</u>	<u>SAMPLE MEAN</u>
Arsenic (As)	.05	.001	<.1	.003	.006	
Boron (B)	.54	.19	-	-	.17	
Iron (Fe)	.3	.01	<.03	<.01	.01	
Manganese (Mn)	.09	.05	.06	.05	.059	
Radium-226 (Ra)	923	282	238	213	198	
Selenium (Se)	.03	.003	<.2	.004	.002	
Thorium-230 (Th)	5.63	2.3	-	-	-	
Uranium (U)	3.7	1.1	1.0	.9	.09	
Bicarbonate (HCO ₃)	294	229	207	210	223	
Calcium (Ca)	120	74	72	63	77	
Carbonate (CO ₃)	16	0	0	0	-	
Chloride (Cl)	250	15	10	10	11	
Magnesium (Mg)	26	16	16	17	18	
Potassium (K)	23	7	8	7	12	
Sodium (Na)	41	40	42	42	24	41
Sulfate (SO ₄)	250	141	130	121	114	
Conductivity	827	689	670	680	595	
TDS	571	421	420	408	399	
pH	6.5 - 8.6	7.0	7.3	7.2	8.3	

Notes: 1) values in mg/l except for pH, Ra-226 and Th-230, which are in pCi/l.
 2) for baseline, indicates only one sample or analysis.
 3) - indicates no analysis.

COMPARISON OF 5/86 WATER QUALITY SAMPLE SPLITS
 SEQUOYAH FUELS ISL
 Q-SAND RESTORATION

Parameter	Target	WELL NO. <u>QI-8</u>					SAMPLE MEAN
		SFC	NRC	WDEQ	BASELINE		
Arsenic (As)	.05	.001	<.1	.02	.01		
Boron (B)	.54	.15	-	-	.15		
Iron (Fe)	.3	.02	<.03	<.01	.01		
Manganese (Mn)	.09	.01	.02	<.01	.019		
Radium-226 (Ra)	923	429	459	428	33		
Selenium (Se)	.03	.003	<.2	.004	.01		
Thorium-230 (Th)	5.63	2.3	-	-	-		
Uranium (U)	3.7	0.3	.5	1.02	.07		
Bicarbonate (HCO ₃)	294	239	183	185	143		
Calcium (Ca)	120	77	78	65	59		
Carbonate (CO ₃)	16	0	0	0	-		
Chloride (Cl)	250	16	12	12	12		
Magnesium (Mg)	26	17	17	17	11		
Potassium (K)	23	7	8	7	11		
Sodium (Na)	41	36	43	42	25	40	
Sulfate (SO ₄)	250	134	160	138	128		
Conductivity	827	677	697	700	518		
TDS	571	438	458	452	343		
pH	6.5 - 8.6	7.0	7.4	7.2	8.1		

Notes: 1) values in mg/l except for pH, Ra-226 and Th-230, which are in pCi/l.
 2) for baseline, indicates only one sample or analysis.
 3) - indicates no analysis.

COMPARISON OF 5/86 WATER QUALITY SAMPLE SPLITS
 SEQUOYAH FUELS ISL
 Q-SAND RESTORATION

<u>Parameter</u>	<u>Target</u>	<u>WELL NO. QI-9</u>				<u>SAMPLE MEAN</u>
		<u>SFC</u>	<u>NRC</u>	<u>WDEQ</u>	<u>BASELINE</u>	
Arsenic (As)	.05	.002	<.1	.003	.003	
Boron (B)	.54	.16	-	-	.19	
Iron (Fe)	.3	.01	.2	<.01	.02	
Manganese (Mn)	.09	.01	.02	<.01	.01	
Radium-226 (Ra)	923	429	432	440	30	
Selenium (Se)	.03	.003	<.2	<.001	.024	
Thorium-230 (Th)	5.63	2.3	-	-	-	
Uranium (U)	3.7	.3	.4	.4	.17	
Bicarbonate (HCO ₃)	294	239	164	166	-	
Calcium (Ca)	120	77	68	58	72	
Carbonate (CO ₃)	16	0	0	0	4	
Chloride (Cl)	250	16	9	9	30	
Magnesium (Mg)	26	17	15	15	8	
Potassium (K)	23	7	8	7	16	
Sodium (Na)	41	36	51	49	31	45
Sulfate (SO ₄)	250	134	160	136	111	
Conductivity	827	677	670	680	-	
TDS	571	438	435	404	228	
pH	6.5 - 8.6	7.0	7.5	7.3	9.4	

Notes: 1) values in mg/l except for pH, Ra-226 and Th-230, which are in pCi/l.
 2) for baseline, indicates only one sample or analysis.
 3) - indicates no analysis.

COMPARISON OF 5/86 WATER QUALITY SAMPLE SPLITS
 SEQUOYAH FUELS ISL
 Q-SAND RESTORATION

<u>Parameter</u>	<u>Target</u>	<u>SFC</u>	<u>NRC</u>	<u>WELL NO. QI-10</u>		<u>SAMPLE MEAN</u>
				<u>WDEQ</u>	<u>BASELINE</u>	
Arsenic (As)	.05	.008	<.1	.02	.013	
Boron (B)	.54	.17	-	-	.15	
Iron (Fe)	.3	.02	<.03	<.01	.11	
Manganese (Mn)	.09	.02	.04	.01	.019	
Radium-226 (Ra)	923	390	514	716	398	
Selenium (Se)	.03	.001	<.2	<.001	.002	
Thorium-230 (Th)	5.63	1.6	-	-	-	
Uranium (U)	3.7	0.7	.7	.8	1.19	
Bicarbonate (HCO ₃)	294	234	193	190	204	
Calcium (Ca)	120	79	77	66	70	
Carbonate (CO ₃)	16	0	0	0	-	
Chloride (Cl)	250	10	5	5	11	
Magnesium (Mg)	26	16	17	17	15	
Potassium (K)	23	7	8	7	9	
Sodium (Na)	41	25	30	24	22	26
Sulfate (SO ₄)	250	129	120	117	138	
Conductivity	827	610	621	630	566	
TDS	571	410	401	376	399	
pH	6.5 - 8.6	7.3	7.7	7.2	8.3	

- Notes: 1) values in mg/l except for pH, Ra-226 and Th-230, which are in pCi/l.
 2) for baseline, indicates only one sample or analysis.
 3) - indicates no analysis.