Technical Report Revision Index Table - January 2013

License Condition ID	License Condition Subject	Description of Revision	TR Replacement Page(s) Location	TR Replacement Page(s)
10.13	Wellfield Package Review and Approval	Revise language in the TR to clearly state that the initial wellfield package will be provided to NRC for review and verification, and that subsequent wellfield packages will be reviewed by the SERP and approved by WDEQ/LQD.	Sections 3.1.6, 5.7.8.1, and 6.1.2.5	3-21, 5-78, 5-80, 5-83, 6-8
12.7	Baseline Water Quality	Update Table 2.7-28, 2.7-29, 2.7-34, and 2.7-40 with water quality data collected from the SM and DM in 2011.	Section 2.7.3.5.2.2 and Tables 2.7-28, 2.7-29, 2.7-34, and 2.7-40	2-165, 2-215, 2-216, 2-216a, 2-222, 2-222a, 2-228, 2-228a
12.12 and 12.13	Background Radiological Characteristics	Update Tables 2.9-6, and 2.9-24 to include additional sediment and game tissue samples and to clarify where sediment samples were collected in stream channels.	Sections 2.9.2.3, 2.9.2.11, and Tables 2.9-6 and 2.9-24	2-293, 2-309, 2-310, 2-317, 2-337
12.14	Background Radiological Characteristics	Update Table 2.9-9 to include 2011 and 2012 Radon air sampling results.	Section 2.9.2.5 and Table 2.9-9	2-297, 2-298, 2-320, 2-320a, 2-320b
12.17	Aquifer Restoration	Revise Addendum 6.1-A of the TR for consistence concerning the number of pore volumes proposed during aquifer restoration.	Addendum 6.1-A	6, 8, 9, 10, 22, 24, 27

highest concentrations of dissolved salts. Table 2.7-37 presents the quarterly groundwater monitoring results for the OZ wells.

Major ion water chemistry of the OZ wells is illustrated in Figure 2.7-31. The piper diagram shows that the 12-18OZ well was slightly dominated by bicarbonate, while the majority anion in the remaining wells was sulfate. Generally, sulfate contributes about 45% to 65% of anions, while bicarbonate/carbonate contribute 35% to 55%. Cations comprise almost exclusively sodium.

As previously discussed, groundwater quality in the OZ aquifer is distinct from the other zones due to elevated concentrations of radionuclide constituents. While all OZ wells measured increased concentrations of uranium and constituents in the uranium decay series, the highest concentrations were measured in the 12-18OZ, 14-18OZ and 34-18OZ wells. These wells measured the greatest concentrations of Rn-222, Pb-210, Po-210, and Ra-226.

A comparison of OZ aquifer groundwater quality to WDEQ standards indicates that the water is likely suitable only for industrial use (Class IV). A summary of the constituents exceeding the class of use standards is presented in Table 2.7-38. The WDEQ Class I, II and III standard for gross alpha is 15 pCi/L. The table shows that all wells exceeded the gross alpha standard. Additionally, wells 12-18OZ and 34-18OZ also exceeded the Class I, II and III combined radium-226 and 228 standard of 5 pCi/L.

The groundwater in the OZ wells was also compared to EPA drinking water standards, as summarized in Table 2.7-39. The EPA MCLs for gross alpha and combined Ra-226 and 228 are the same as the WDEQ standards. Therefore, all wells exceed the gross alpha MCL. Additionally, four of the six wells exceeded the uranium MCL and two of the six wells exceeded the Ra-226 and 228 MCL. In 1999, the EPA proposed a drinking water standard for radon of 300 pCi/L. The Rn-222 measured in all of the OZ wells exceeds the proposed EPA standard. In two of six wells, the measured Rn-222 concentration was higher than 30,000 pCi/L, or more than 100 times the proposed EPA Standard.

DM Zone

With two exceptions, water quality within each of the six DM wells did not vary significantly during the baseline monitoring. The exceptions occurred in the 1Q10 samples from two of the six DM wells (34-18DM and 42-19DM), where the water quality (especially chloride) varied from the latter three

Table 2.7-28. Regional Baseline Monitoring Network General Water Quality

Well Zone	**Major Ion Chemistry**	**TDS (mg/L)**
SA	Sodium bicarbonate	370 – 1,230
SM	Sodium bicarbonate-sulfate	830 – 1,340
OZ	Sodium sulfate-bicarbonate	1,140 – 2,070
DM	Sodium chloride	870 – 2,130

Table 2.7-29. Cluster Well Water Quality

Parameter	Units	Zone			
		SA	**SM**	**OZ**	**DM**
Field					
Field conductivity	µmhos/cm	725 - 2030	1436 - 3360	1654 - 3660	1525 - 4000
Field pH	s.u.	7.9 - 10.3	8.8 - 12.8	8.4 - 9.4	9.0 - 12.9
Field turbidity	NTUs	0.1 - 99.4	0.03 - 884	0 - 154	1 - 780
Depth to water	ft	10.6 - 50.9	52.5 - 155.7	84.0 - 303.9	83.0 – 288.0
Temperature	Deg C	9.3 - 20.2	9.6 - 18.4	10.1 - 14.4	10.1 - 21.7
ORP	millivolts	-185 - 193	-351 - 220	-233 - 257	-431 - 83
Dissolved oxygen	mg/L	1.7 - 6.1	0.8 - 8.2	0.9 - 6.7	0.9 - 7.9
General					
Alkalinity (as CaCO3)	mg/L	151 - 531	282 – 685	471 - 568	336 - 605
Ammonia	mg/L	<0.1 - 0.5	<0.1 - 2.8	0.2 - 0.8	<0.1 - 3.9
Fluoride	mg/L	0.1 - 0.5	0.8 - 2.1	0.3 - 1.2	0.8 - 1.6
Laboratory conductivity	µmhos/cm	554 - 1860	1200 - 2240	1640 - 2810	1600 - 3390
Laboratory pH	s.u.	8.1 - 10	8.7 - 11.6	8.4 - 9	8.7 - 11.7
Nitrate/nitrite	mg/L	<0.1 - 1.1	<0.1	<0.1 - 0.3	<0.1
Total dissolved solids	mg/L	370 - 1230	830 - 1340	1140 - 2070	870 – 2130
Major Ions					
Calcium	mg/L	2 - 46	<1 – 3	4 - 9	1 – 8
Magnesium	mg/L	<1 - 33	<1 – 2	1 - 3	<1 – 2
Potassium	mg/L	7 - 22	4 - 47	4 - 17	8 – 48
Sodium	mg/L	84 - 400	275 – 520	368 - 644	302 – 807
Bicarbonate	mg/L	84 - 572	<5 – 752	478 - 662	<5 – 488
Carbonate	mg/L	<5 - 193	25 – 250	8 - 52	22 – 324
Chloride	mg/L	2 - 86	2 – 8	3 - 10	139 – 818
Sulfate	mg/L	91 - 343	179 – 458	295 - 937	<1 – 234
Metals					
Aluminum, dissolved	mg/L	<0.1	<0.1 - 0.5	<0.1 - 0.5	<0.1 - 0.6
Arsenic, dissolved	mg/L	<0.005	<0.005 - 0.023	<0.005	<0.005 - 0.014
Barium, dissolved	mg/L	<0.5	<0.5	<0.5	<0.5
Boron, dissolved	mg/L	<0.1 - 0.3	0.2 - 0.7	0.3 - 0.6	0.3 – 1
Cadmium, dissolved	mg/L	<0.002	<0.002	<0.002	<0.002
Chromium, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01
Copper, dissolved	mg/L	<0.01	<0.01 - 0.02	<0.01	<0.01
Iron, dissolved	mg/L	<0.05 - 0.18	<0.05 – 0.21	<0.05 - 0.69	<0.05 - 0.40
Iron, total	mg/L	<0.05 - 5.68	<0.05 – 35	<0.05 - 3.38	<0.05 – 23.3
Lead, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02
Manganese, total	mg/L	<0.02 - 0.36	<0.02 - 0.88	<0.02 - 0.06	<0.02 - 0.37
Mercury	mg/L	<0.001	<0.001	<0.001	<0.001
Molybdenum, dissolved	mg/L	<0.02 - 0.06	<0.02 - 0.05	<0.02	<0.02 - 0.06
Nickel, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01
Selenium, dissolved	mg/L	<0.005	<0.005 – 0.009	<0.005 - 0.009	<0.005 - 0.030
Silver, dissolved	mg/L	<0.003 - 0.006	<0.003 - 0.011	<0.003	<0.003 – 0.005
Uranium, dissolved	mg/L	<0.001 - 0.007	<0.001 - 0.004	0.005 - 0.109	<0.001 - 0.003
Uranium, suspended	mg/L	<0.001	<0.001	<0.001 - 0.003	<0.001 - 0.001
Vanadium, dissolved	mg/L	<0.02	<0.02 - 0.02	<0.02	<0.02
Zinc, dissolved	mg/L	<0.01 - 1.32	<0.01 - 0.03	<0.01 - 0.02	<0.01 - 0.09
Radiological					
Lead 210, dissolved	pCi/L	<1	<1 – 5.2	<1 - 4.89	<1 - 1.2
Lead 210, suspended	pCi/L	<1	<1 – 1.1	<1 - 32.2	<1 - 1.5
Polonium 210, dissolved	pCi/L	<1	<1 – 1.9	<1 - 22.9	<1 – 1.3
Polonium 210, suspended	pCi/L	<1	<1	<1 - 35	<1
Ra-226, dissolved	pCi/L	<0.2 - 0.5	<0.2 – 3.7	0.71 - 12.01	<0.2 - 0.7

Table 2.7-29. Cluster Well Water Quality (Continued)

Parameter	Units	Zone			
		SA	**SM**	**OZ**	**DM**
Ra-226, suspended	pCi/L	<0.2 - 0.24	<0.2 - 0.28	<0.2 - 4.24	<0.2 - 0.8
Ra-228, dissolved	pCi/L	<1 - 1.2	<1 - 2.3	<1	<1 – 2.2
Radon-222	pCi/L	NM	<28 – 443	4580 - 35100	<25 – 242
Th-230, dissolved	pCi/L	<0.2	<0.2	<0.2	<0.2 - 0.24
Th-230, suspended	pCi/L	<0.2	<0.2 – 0.4	<0.2 - 0.95	<0.2 - 0.33
Gross alpha	pCi/L	<2 - 13.8	<2 - 12.2	15.4 - 222	<2 - 28.3
Gross beta	pCi/L	5.3 - 15.8	<2 – 319	4.2 - 43.2	3.1 - 41

Table 2.7-34. SM Zone Monitoring Results

Parameter	Units	12-18SM								14-18SM								21-19SM							
		1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11	1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11	1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11
Field																									
Field Conductivity	µmhos/cm	1487	1436	1657	1642	1461	1449	1588	1467	1569	1548	1611	1781	1633	1670	1668	1653	1874	1719	2300	2190	2230	1991	1966	1945
Field pH	s.u.	9.25	9.22	9.06	8.98	8.97	9.19	9.19	8.81	9.56	9.64	9.31	9.17	9.19	9.39	9.34	8.93	10.17	9.97	9.97	9.85	10.09	9.78	9.67	9.11
Field turbidity	NTUs	1.99	0.54	0.84	0.57	11.21	14.86	2.59	26	2.53	0.6	0.09	0.05	0.3	0.41	3.9	0.6	4.06	0.12	2.61	0.49	0.74	0.08	0.03	1.79
Depth to Water	ft	88.89	90.88	91.21	91.12	85.07	81.06	78.69	76.87	66.87	66.72	66.72	66.9	63.24	61.26	59.19	58.63	85.07	84.88	84.9	85.18	82.21	79.97	77.52	77
Temperature	Deg C	11	11.8	13.9	13.3	11.4	11	11.9	11.1	10.8	11.2	11.9	11.6	10.5	10.8	12.8	10.5	10.2	11.5	13	12.4	10.4	11.4	10.8	11.1
ORP	millivolts		-190	-10	26	-151	-181	-253	-47			-200	131	-232	-245	-299	-93		36	160	137	-209	-167	-127	-18
Dissolved oxygen	mg/L		0.75	6.36	5.16		1.91	4.7	1.32	2.39	1.04	2.44	5.61		1.78	4.73	1.34	1.66	1.98	4.28	3.77		3.25	3.44	1.43
Dissolved oxygen, pct	%	32.1	16.9	63.4	53	27.1	20	42.3	12.2	21.3	10.2	22.8	51.6	43.3	17.7	48.2	12.4	15	18.7	42.9	35.6	59.8	30.4	34.7	13.4
General																									
Alkalinity (as CaCO3)	mg/L	531	528	532	534	534	532	530	528	551	556	581	582	581	583	579	579	572	602	647	633	685	628	622	619
Ammonia	mg/L	<0.1	<0.1	0.2	0.4	0.3	0.1	0.2	0.2	<0.1	<0.1	0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	0.2	1.1	0.6	0.3	0.1	<0.1	0.2
Fluoride	mg/L	2.1	1.7	1.9	2.1	1.9	2	1.5	2	1.6	1.5	1.6	1.5	1.6	1.6	1.5	1.6	1	1	1.1	1.1	1.1	1	1.1	1.2
Laboratory conductivity	µmhos/cm	1420	1440	1430	1450	1350	1200	1520	1580	1480	1520	1560	1560	1470	1400	1710	1720	1770	1970	2000	1960	1940	1740	1680	2070
Laboratory pH	s.u.	8.8	8.8	8.7	8.8	8.8	8.8	8.8	8.8	9.2	9.1	8.9	9	9	8.8	9	8.8	9.6	9.3	9.9	9.6	9.9	9.4	9.1	8.9
Nitrate/Nitrite	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Dissolved Solids	mg/L	970	980	980	970	990	970	940	940	1020	1040	1010	1000	1050	1110	1060	1030	1270	1330	1310	1300	1340	1310	1270	1270
SAR	unitless	43.4	41.8	45.1	47.2	47.6	47.2	47.6	55.3	50.3	50.5	53.6	51.7	59.2	57.3	69.4	59.7	61.2	63.0	75.9	75.3	82.7	80.8	86.9	85.9
Major Ions																									
Calcium	mg/L	3	3	3	3	3	3	3	2	2	2	2	2	2	2	1	2	2	2	1	1	1	1	1	1
Magnesium	mg/L	1	1	1	1	1	1	1	1	<1	<1	1	1	1	1	<1	1	<1	<1	<1	<1	<1	<1	1	1
Potassium	mg/L	8	5	6	6	4	4	4	4	6	8	7	8	7	7	6	6	32	31	47	37	43	28	20	19
Sodium	mg/L	341	328	354	371	374	371	374	385	350	352	373	360	412	399	412	416	426	439	451	447	491	480	516	510
Bicarbonate	mg/L	577	578	598	573	593	579	590	583	526	566	603	599	597	622	597	628	399	532	347	491	365	560	634	643
Carbonate	mg/L	35	33	25	38	28	34	28	30	72	55	52	54	55	44	54	39	146	99	218	138	231	101	61	56
Chloride	mg/L	5	3	3	4	4	5	4	4	4	3	2	2	3	3	4	4	3	8	3	2	3	4	4	4
Sulfate	mg/L	236	218	212	216	242	221	206	213	232	241	238	230	241	227	283	234	383	396	336	335	350	366	342	359
Metals																									
Aluminum, dissolved	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic, dissolved	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.012	0.009	0.007	0.005	<0.005	0.008	0.005	<0.005	0.023	0.009	0.009	0.006	<0.005	0.006	0.006	0.006
Barium, dissolved	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron, dissolved	mg/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.6	0.5	0.6	0.5	0.6	0.2	0.5	0.6	0.6	0.6	0.6	0.6	0.6
Cadmium, dissolved	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron, dissolved	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron, total	mg/L	0.09	0.06	0.07	0.06	0.29	0.6	0.07	0.91	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lead, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese, total	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Mercury	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Molybdenum, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium, dissolved	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006
Silver, dissolved	mg/L			0.004	<0.003	<0.003	<0.003	0.011	<0.003			<0.003	<0.003	<0.003	<0.003	<0.003	<0.003			<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Uranium, dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0003	<0.0003	<0.0003	<0.001	<0.001	<0.001	<0.001	0.0008	0.0007	0.0006	<0.0003	0.003	0.003	0.004	0.003	0.0021	0.0012	0.0006	0.0005
Uranium, suspended	mg/L		<0.001	<0.001			<0.0003	<0.0003			<0.001	<0.001			<0.0003	<0.0003			<0.001	<0.001			<0.0003	<0.0003	
Vanadium, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Zinc, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Radiological																									
Lead 210, dissolved	pCi/L		<1	<1			<1	<1			<1	<1			<1	<1			<1	<1			<1	1.5	
Lead 210, suspended	pCi/L		<1	<1			<1	1.1			<1	<1			<1	<1			<1	<1			<1	<1	
Polonium 210, dissolved	pCi/L		<1	<1			<1	<1			<1	<1			<1	<1			<1	<1			<1	<1	
Polonium 210, suspended	pCi/L		<1	<1			<1	<1			<1	<1			<1	<1			<1	<1			<1	<1	
Ra-226, dissolved	pCi/L	<0.2	0.24	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	3.7	<0.2	<0.2	0.2
Ra-226, suspended	pCi/L		<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2	
Ra-228, Dissolved	pCi/L	<1	<1	<1	2.27	<1	<1	<1	<1	<1	1.29	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Radon-222	pCi/L	309								300								353							
Th-230, dissolved	pCi/L		<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2	
Th-230, suspended	pCi/L		<0.2	<0.2			<0.2	0.4			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2	
Gross Alpha	pCi/L	<2	2.1	<2	<2	<5	<2	<5	<3	2.8	3.1	<3.5	11.2	<5	<2	<6	<5	3.1	5.4	6.6	12.2	<5	<3	<6	<4
Gross Beta	pCi/L	3.3	<6.8	<3	9.4	<8	<4	<7	<5	7.2	7	<6.8	12.4	<8	4.4	<8	<7	22.2	19	29.8	42.5	22.9	12.6	12.5	14.2
QA/QC																									
Anion Sum	meq/L	15.76	15.29	15.23	15.38	15.91	15.49	15.07	15.21	16.03	16.29	16.71	16.56	16.8	16.54	17.66	16.64	19.54	20.55	20.06	19.75	21.12	20.33	19.73	20.03
Cation Sum	meq/L	15.26	14.67	15.77	16.5	16.6	16.5	16.61	17.02	15.48	15.6	16.61	16.02	18.31	17.72	18.14	18.4	19.45	19.97	20.88	20.43	22.52	21.63	23.11	22.8
Total Anion/Cation Balance	%	1.62	2.07	1.73	3.5	2.12	3.17	4.87	5.59	1.75	2.14	0.3	1.63	4.3	3.45	1.33	5.01	0.23	1.44	1.98	1.69	3.2	3.11	7.88	6.46
Total Dissolved Solids (calc)	mg/L	910	880	900	920	950	930	910	930	920	940	970	950	1020	990	1050	1010	1190	1240	1230	1200	1300	1250	1260	1270

Table 2.7-34. SM Zone Monitoring Results (Continued)

Parameter	Units	34-7SM								34-18SM								42-19SM							
		1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11	1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11	1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11
Field																									
Field Conductivity	µmhos/cm	1788	1595	2060	2080	1960	1995	1998	1957	3360	2610	2470	2040	2120	1736	2180	2530	1897	1452	1642	1839	1951	1939	1929	2630
Field pH	s.u.	9.82	9.79	9.23	9.04	9.04	9.18	9.25	8.78	12.82	12.61	11.98	10.91	10.15	10.12	9.9	9.7	12.34	12.24	10.78	10.69	9.98	10.52	10.42	9.88
Field turbidity	NTUs	19.97	3.14	2.11	1.93	2.21	6.71	3.57	884	7.06	5.79	3.92	6.19	5.52	9.02	4.9	15.05	40.2	5.39	6.39	2.93	4.42	1.34		5.12
Depth to Water	ft	56.73	56.13	56.11	56.18	54.71	53.11	52.76	52.5	136.25	136.19	136.18	136.11	134.62	133.8	133.3	132.07	155.65	155.57	155.64	155.55	154.92	154.5	153.43	152.74
Temperature	Deg C	10.6	12.1	13.1	12.8	10.1	10.7	12.5	10.9	10.5	18.4	14.1	11.6	9.6	11.4	15.8	10.6	10.8	12	16.3	15.4	10.9	12.7	11.1	9.6
ORP	millivolts		152	177	174	-257	-224	-317	-104		68	147	-166	-272	-278	-302	-57		34	188	220	-169	-351	-51	-115
Dissolved oxygen	mg/L	2.63	4.09	6.84	5.38		2.24	6.52	1.5	1.55	8.15	v	7.37		7.38	6.98	4.46	3.3	1.78	4.95	7.06		7.49	5.8	2.08
Dissolved oxygen, pct	%	23.1	39.3	69	53.4	35.5	28.5	64.7	13.8	14	85.2	v	69.5	59	70.2	74	41.3	30.2	18.2	54.3	73.8	52.1	72.2	56.5	18.5
General																									
Alkalinity (as CaCO3)	mg/L	595	628	647	658	672	677	683	685	521	486	484	458	558	559	540	537	420	282	303	319	386	430	470	518
Ammonia	mg/L	<0.1	0.2	0.2	0.5	0.3	<0.1	<0.1	0.3	1.9	1.4	1.2	1	0.5	0.3	<0.1	<0.1	2.8	1.4	1.2	0.8	0.4	0.4	0.3	0.4
Fluoride	mg/L	0.9	1	0.9	0.9	0.8	1.1	1	1	1.4	1.3	1.2	0.9	0.9	0.9	1.1	1.1	1.6	1.5	1.5	1.4	1.2	1.1	1.4	0.9
Laboratory conductivity	µmhos/cm	1650	1840	1800	1830	1730	1620	1980	2040	2240	2190	2070	1800	1890	1720	2120	2080	1690	1540	1580	1620	1760	1760	2110	2160
Laboratory pH	s.u.	9.4	9	9	8.9	8.8	8.8	8.8	8.8	11.6	11.5	11.4	10.5	9.9	9.7	9.6	9.4	11.5	10.8	10.6	10.3	10.2	10	9.9	9.5
Nitrate/Nitrite	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Dissolved Solids	mg/L	1150	1200	1240	1260	1280	1280	1210	1260	1040	1100	1060	1140	1300	1330	1310	1310	830	970	990	1040	1200	1300	1330	1350
SAR	unitless	71.7	59.9	61.2	61.9	52.2	54.5	52.1	73.0	51.6	57.6	60.6	64.5	81.8	68.5	85.4	74.7	35.0	54.7	57.6	54.4	75.3	74.1	82.5	77.8
Major Ions																									
Calcium	mg/L	1	2	2	2	3	3	3	2	2	1	1	<1	1	2	1	2	3	1	1	1	1	1	1	2
Magnesium	mg/L	<1	1	1	1	2	2	2	1	<1	<1	<1	<1	<1	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	14	13	10	10	8	8	7	12	31	28	26	20	21	18	15	15	17	11	10	11	11	13	13	15
Sodium	mg/L	426	417	426	431	478	499	477	508	359	342	360	383	486	477	507	520	275	325	342	323	447	440	490	542
Bicarbonate	mg/L	508	631	674	682	731	731	752	725	<5	<5	<5	51	299	408	438	429	<5	<5	12	64	123	222	296	393
Carbonate	mg/L	107	66	57	60	43	47	40	55	168	173	189	250	188	135	114	111	137	152	175	160	171	149	136	118
Chloride	mg/L	4	7	3	3	4	4	4	4	6	5	4	3	3	4	5	5	7	5	4	4	8	5	6	5
Sulfate	mg/L	312	312	298	300	307	306	272	303	293	295	304	367	418	433	458	410	179	405	371	414	462	469	574	457
Metals																									
Aluminum, dissolved	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic, dissolved	mg/L	0.016	0.011	0.009	0.008	0.009	0.008	<0.005	0.008	0.009	0.011	0.012	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Barium, dissolved	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron, dissolved	mg/L	0.4	0.5	0.6	0.6	0.5	0.7	0.6	0.6	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.5	0.3	0.4	0.4	0.4	0.8	0.4	0.5	0.5
Cadmium, dissolved	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron, dissolved	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	0.06	0.21	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron, total	mg/L	0.8	0.11	0.08	0.06	0.12	0.18	0.12	35	0.07	0.12	0.11	0.07	0.12	0.13	0.1	0.25	0.66	0.11	0.16	<0.05	0.08	<0.05	0.05	0.08
Lead, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese, total	mg/L	0.03	0.02	0.02	0.02	<0.02	<0.02	0.02	0.88	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Mercury	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Molybdenum, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium, dissolved	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.009	<0.005	<0.005	<0.005	<0.005	0.017	<0.005	<0.005	0.005
Silver, dissolved	mg/L			<0.003	<0.003	<0.003	<0.003	<0.003	<0.003			0.004	<0.003	<0.003	<0.003	<0.003	<0.003			<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Uranium, dissolved	mg/L	<0.001	0.001	0.002	0.001	0.002	0.001	0.0005	0.0012	<0.001	<0.001	<0.001	<0.001	0.0009	0.0007	0.0008	0.0011	<0.001	<0.001	<0.001	<0.001	<0.0003	<0.0003	<0.0003	<0.0003
Uranium, suspended	mg/L		<0.001	<0.001			<0.0003	0.0004			<0.001	<0.001			<0.0003	<0.0003			<0.001	<0.001			<0.0003	<0.0003	
Vanadium, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Zinc, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	<0.01	0.02	<0.01
Radiological																									
Lead 210, dissolved	pCi/L		1.34	<1			<1	5.2			<1	<1			<1	<1			<1	<1			1.8	1.5	
Lead 210, suspended	pCi/L		<1	<1			1	<1			<1	<1			<1	<1			<1	<1			<1	1.4	
Polonium 210, dissolved	pCi/L		<1	<1			<1	1.9			<1	<1			<1	<1			<1	<1			<1	<1	
Polonium 210, suspended	pCi/L		<1	<1			<1	<1			<1	<1			<1	<1			<1	<1			<1	<1	
Ra-226, dissolved	pCi/L	0.21	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	0.3	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.21	<0.2	<0.2	<0.2	<0.2	<0.2
Ra-226, suspended	pCi/L		0.28	<0.2			<0.2	0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2	
Ra-228, Dissolved	pCi/L	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.6	<1
Radon-222	pCi/L	443								35								<28							
Th-230, dissolved	pCi/L		<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2	
Th-230, suspended	pCi/L		<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2	
Gross Alpha	pCi/L	4.7	6.2	4.1	10.1	4.9	<2	<7	<6	<2	<2	<3.5	<2	<4	<4	<6	<6	<2	<2	2.78	2.8	<5	<3	<4	5.2
Gross Beta	pCi/L	8.7	10.3	5.8	9.7	<7	<3	13.6	319	18.7	17.3	16.5	11	13.2	10.4	8.4	<8	10.8	6.8	6.9	6	<7	<8	5.9	9
QA/QC																									
Anion Sum	meq/L	18.55	19.3	19.26	19.51	19.95	20.08	19.47	20.18	16.74	16.08	16.19	16.93	20	20.34	20.53	19.47	12.41	14.28	13.97	15.18	17.62	18.54	21.56	20.08
Cation Sum	meq/L	18.95	18.64	18.98	19.2	21.27	22.17	21.25	22.61	16.48	15.66	16.4	17.16	21.71	21.4	22.58	23.1	12.53	14.49	15.18	14.41	19.75	19.55	21.7	24.04
Total Anion/Cation Balance	%	1.05	1.72	0.74	0.8	3.19	4.94	4.38	5.67	0.79	1.32	0.63	0.67	4.09	2.55	4.75	8.52	0.47	0.74	4.13	2.58	5.69	2.65	0.3	8.97
Total Dissolved Solids (calc)	mg/L	1110	1130	1130	1140	1200	1230	1180	1240	1000	960	990	1050	1260	1270	1310	1270	730	920	910	950	1160	1190	1370	1330

Table 2.7-40. DM Zone Monitoring Results

Parameter	Units	12-18DM								14-18DM								21-19DM							
		1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11	1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11	1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11
Field																									
Field Conductivity	µmhos/cm	3400	3080	2420	2420	2370	2500	2440	2820	2800	2860	2370	2410	2320	2450	2240	2810	2760	1874	2420	2390	2390	2450	2220	2790
Field pH	s.u.	12.64	12.23	10.2	9.85	9.72	9.9	9.55	9.25	10.57	10.06	9.48	9.32	9.42	9.64	9.41	9.2	10.32	10.01	9.3	9.31	9.19	9.26	9.47	8.98
Field turbidity	NTUs	21.7	6.54	3.35	2.43	5.06	4.25	1.02	1.6	122	31.2	14.03	3.31	3.21	1.4	1.2	1.01	32.4	35.4	5.02	4.2	1.88	4.67	5.07	4.41
Depth to Water	ft		175.54	176.08	175.91	174.71	172.8	173.53	173.51	157.17	156.65	158.16	156.48	153.47	152.85	151.72	151.82	196.48	196.09	196.39	196.12	193.88	192.83	192.45	193.11
Temperature	Deg C	10.5	12.4	16.3	15.9	13	12.6	13.5	12.3	11.5	12.1	13.7	12.6	10.1	12.5	15.1	11.3	10.8	14	14	14.8	10.7	12.6	13.4	12.5
ORP	millivolts		-221	-23	-106	-295	-397	-261	-99			-95	10	-132	-214	-216	-56		83	-140	14.8	-130	-130	-188	29
Dissolved oxygen	mg/L	5.08	1.14	6.69	6.55		3.81	5.04	2.45	2.72	1.97	6.03	5.91		5.62	5.81	0.86	2.8	4.26	2.58	6.76		5.14	4.71	2.35
Dissolved oxygen, pct	%	48.5	10.9	70.2	67.8	47.1	38	50.9	23.5	25.1	18.6	59.3	55.7	57.7	56	62.2	8.1	25.2	42.6	26.7	66.2	50.1	50.5	47.7	23
General																									
Alkalinity (as CaCO3)	mg/L	466	415	418	411	426	406	419	441	439	422	416	422	414	411	404	405	408	413	429	431	414	413	409	413
Ammonia	mg/L	2.4	1.4	0.9	0.6	0.7	0.5	0.5	0.1	0.6	0.4	0.5	0.5	0.5	0.4	0.4	<0.1	0.6	0.5	0.2	0.9	0.3	0.3	0.3	0.5
Fluoride	mg/L	1	0.9	1	1.2	1	1.2	1.2	1.2	1.1	1.1	1.2	1.1	1.2	1.1	1.1	1.3	1.2	1.1	1.2	1.2	1.2	1.1	1.2	1.1
Laboratory conductivity	µmhos/cm	2400	2290	2150	2180	2080	1740	2290	2390	2030	2170	2190	2150	2040	1900	2320	2350	2000	2150	2130	2170	2040	1920	2240	2340
Laboratory pH	s.u.	11.5	11.2	10	9.7	9.5	9.4	9.3	9	10	9.5	9	9.2	9.3	9.1	9.1	8.9	9.7	9.4	9.2	9.1	8.9	8.9	8.8	8.7
Nitrate/Nitrite	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Dissolved Solids	mg/L	1140	1190	1260	1240	1290	1260	1240	1240	1220	1260	1220	1240	1260	1270	1240	1150	1200	1250	1240	1250	1270	1220	1200	1240
SAR	unitless	37.8	51.6	79.1	80.2	77.7	74.8	76.1	70.9	66.1	64.2	59.6	57.8	65.3	69.2	69.0	67.3	66.5	66.4	59.4	57.2	65.7	58.8	57.3	62.1
Major Ions																									
Calcium	mg/L	8	3	1	1	2	2	2	3	2	2	3	3	3	3	3	3	2	3	3	3	3	4	4	4
Magnesium	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	1	<1
Potassium	mg/L	39	31	23	16	15	13	12	11	34	22	15	13	12	11	9	9	23	21	17	14	11	10	8	8
Sodium	mg/L	427	405	470	476	541	521	530	557	460	447	468	454	513	544	542	529	463	522	467	449	516	509	496	538
Bicarbonate	mg/L	<5	<5	159	256	324	336	379	438	188	337	399	391	366	383	396	427	246	338	398	426	433	445	455	460
Carbonate	mg/L	171	200	172	121	96	78	65	50	171	87	54	61	68	58	48	33	124	82	62	49	36	29	22	22
Chloride	mg/L	376	362	395	402	513	508	476	484	449	392	437	438	513	528	526	508	473	535	425	438	530	555	501	504
Sulfate	mg/L	30	37	29	28	25	29	23	15	23	4	1	<1	<1	<1	<1	<1	11	4	2	<1	<1	<1	<1	<1
Metals																									
Aluminum, dissolved	mg/L	0.6	0.5	0.3	0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic, dissolved	mg/L	0.007	0.008	0.007	0.005	0.009	0.005	0.007	<0.005	0.008	0.005	<0.005	<0.005	<0.005	0.007	0.009	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	0.005	0.007	<0.005
Barium, dissolved	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron, dissolved	mg/L	0.4	0.5	0.7	0.7	0.8	0.8	0.9	0.8	0.6	0.7	0.8	0.9	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.9	0.8	0.8	0.8	0.9
Cadmium, dissolved	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron, dissolved	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron, total	mg/L	0.15	0.06	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	2.92	0.72	0.33	0.15	0.08	<0.05	0.07	<0.05	0.73	0.87	0.17	0.09	0.05	0.14	0.11	0.08
Lead, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese, total	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	0.03	0.02	<0.02
Mercury	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Molybdenum, dissolved	mg/L	0.06	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium, dissolved	mg/L	0.012	0.017	0.013	0.008	0.02	0.015	0.023	0.006	0.014	0.012	0.012	0.01	0.016	0.026	0.028	<0.005	0.014	0.014	0.009	0.013	0.018	0.021	0.025	0.007
Silver, dissolved	mg/L			<0.003	<0.003	<0.003	<0.003	0.005	<0.003			<0.003	<0.003	<0.003	<0.003	<0.003	<0.003			<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Uranium, dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0003	<0.0003	<0.0003	<0.001	<0.001	<0.001	<0.001	0.0006	<0.0003	<0.0003	<0.0003	<0.001	<0.001	<0.001	<0.001	<0.0003	<0.0003	0.0005	<0.0003
Uranium, suspended	mg/L		<0.001	<0.001			<0.0003	<0.0003			0.001	<0.001			<0.0003	<0.0003			<0.001	<0.001			<0.0003	<0.0003	
Vanadium, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Zinc, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.01	<0.01	<0.01	0.02	<0.01	0.02	0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01
Radiological																									
Lead 210, dissolved	pCi/L		<1	<1			<1	<1			1.1	<1			<1	<1			1.16	<1			<1	<1	
Lead 210, suspended	pCi/L		<1	<1			<1	<1			<1	<1			<1	<1			1.25	<1			<1	<1	
Polonium 210, dissolved	pCi/L		<1	<1			<1	<1			<1	<1			<1	1.3			<1	<1			<1	<1	
Polonium 210, suspended	pCi/L		<1	<1			<1	<1			<1	<1			<1	<1			<1	<1			<1	<1	
Ra-226, dissolved	pCi/L	0.28	0.22	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	0.35	0.21	<0.2	0.4	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ra-226, suspended	pCi/L		<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2	
Ra-228, Dissolved	pCi/L	<1	<1	<1	<1	<1	<1	1.4	<1	<1	<1	<1	1.56	<1	1	<1	1.7	<1	<1	<1	<1	1.3	<1	2.2	<1
Radon-222	pCi/L	242								156															
Th-230, dissolved	pCi/L		<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			0.24	<0.2			<0.2	<0.2	
Th-230, suspended	pCi/L		<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2	
Gross Alpha	pCi/L	4.7	3.2	<2	<2	<5	<4	<4	<3	13.7	2.1	<3.1	28.3	<4	<4	<6	<4	<2	2.3	3.53	4.5	<5	<4	<6	<6
Gross Beta	pCi/L	24.1	18.8	12	11.8	<8	<8	<7	<8	32.3	17.2	8.24	41	7.2	<7	<7	<7	16.2	13	8.33	9.2	<8	7	<8	<8
QA/QC																									
Anion Sum	meq/L	20.6	19.32	20.15	20.19	23.55	23.11	22.34	22.85	21.98	19.65	20.74	20.84	22.79	23.16	22.98	22.49	21.8	23.5	20.66	21.03	23.3	23.96	22.36	22.55
Cation Sum	meq/L	19.97	18.51	21.07	21.14	24.01	23.12	23.49	24.61	21	20.14	20.89	20.2	22.74	24.1	23.95	23.39	20.83	23.4	20.87	20.03	22.87	22.66	22.04	23.8
Total Anion/Cation Balance	%	1.54	2.14	2.25	2.3	0.96	0.01	2.51	3.7	2.28	1.22	0.36	1.55	0.1	1.99	2.06	1.96	2.26	0.21	0.49	2.43	0.92	2.77	0.73	2.7
Total Dissolved Solids (calc)	mg/L	1160	1090	1170	1170	1350	1320	1300	1330	1230	1120	1170	1160	1290	1330	1320	1290	1220	1330	1170	1160	1310	1330	1250	1300

Table 2.7-40. DM Zone Monitoring Results (Continued)

Parameter	Units	34-7DM								34-18DM								42-19DM							
		1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11	1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11	1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11
Field																									
Field Conductivity	µmhos/cm	4000	3370	3470	3430	3730	3530	3470	3990	3380	1779	2240	2540	2460	1963	2480	2950	2890	1525	1970	2260	2240	2330	1879	2640
Field pH	s.u.	10.85	10.92	10.52	10.24	11.53	10.34	10.37	9.79	12.91	10.9	10.32	9.29	9.4	9.38	9.2	8.98	12.66	11.49	9.71	9.47	9.52	9.66	9.49	9.25
Field turbidity	NTUs	45.2	48.9	60	69.6	56.7	214	780	89	23.3	5.29	2.02	2	1.41	1.04	1.19	2.67	6.99	31.2	11.67	2.26	3.36	2.31		3.87
Depth to Water	ft	85.33	87.81	89.04	89.42	89.04	83.01	90.11	91.05	269.85	272.57	272.64	273.63	270.55	270.22	270.95	270.73	286.01	286.32	287.28	287.9	286.82	287.17	287.35	287.95
Temperature	Deg C	11.6	13.7	15.7	14.3	10.6	11.9	15.6	11.1	11.2	15.9	13.8	14.7	11.5	12.4	15.6	11.1	10.9	21.7	16	14.5	11.3	11.9	13.2	10.9
ORP	millivolts		49	-28	21	-327	-431	-279	-10		77	14	-70	-238	-362	-114	76		21	-42	-11	-110	-160	-298	-81
Dissolved oxygen	mg/L	7.66	7.77	6.7	7.92		7.33	7.06	5.05	3.9	5.42	1.6	1.18		1.09	4.58	1.68	1.86		6.73	7.32		6.98	4.54	0.88
Dissolved oxygen, pct	%	76	74.9	67.9	77.8	62	73.7	77.1	47.2	36	57.4	16.1	12	27.4	10.8	49.6	15.8	17.4		71.5	74.8	64.1	58.2	45.8	8.1
General																									
Alkalinity (as CaCO3)	mg/L	463	449	547	447	605	422	421	404	498	336	360	427	444	458	453	455	481	352	386	443	431	445	443	452
Ammonia	mg/L	0.8	1.8	2.4	1.5	2.9	1.5	1	1	3.9	0.9	1.8	0.6	0.4	0.4	0.3	<0.1	2.5	2.1	0.6	0.4	0.4	0.4	0.4	0.5
Fluoride	mg/L	0.9	1.1	0.9	0.9	0.8	1.2	1	1	1.2	1.1	1.2	1	1	1.1	1.3	1.1	1.2	1.6	1.4	1.4	1.3	1.2	1.5	1.2
Laboratory conductivity	µmhos/cm	2740	3080	3220	3100	3390	2680	3330	3370	2170	2040	1980	2210	2130	2010	2500	2530	2000	1600	1920	2040	1920	1880	2260	2240
Laboratory pH	s.u.	10	10.1	10.8	9.9	11.1	9.7	9.9	9.5	11.7	10	10	9.3	9.1	9.1	8.9	8.8	11.5	10.9	9.6	9.3	9.3	9.2	9.1	9
Nitrate/Nitrite	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Dissolved Solids	mg/L	1600	1760	1900	1860	2130	1990	1840	1820	870	1160	1110	1300	1320	1320	1310	1540	940	960	1080	1170	1140	1260	1230	1210
SAR	unitless	75.0	103.7	87.6	92.6	80.1	101.8	111.9	103.1	34.9	67.9	58.2	64.9	71.5	70.5	79.8	68.7	33.5	42.6	56.0	68.9	62.2	60.7	64.7	68.1
Major Ions																									
Calcium	mg/L	3	2	3	2	6	2	2	2	4	2	2	2	2	3	2	3	5	4	2	2	3	3	3	3
Magnesium	mg/L	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1
Potassium	mg/L	32	23	36	22	37	19	32	21	44	21	21	15	15	12	11	10	48	27	11	10	11	11	10	11
Sodium	mg/L	686	722	688	645	807	709	779	718	302	473	405	452	498	554	556	540	315	369	390	480	489	477	508	535
Bicarbonate	mg/L	168	143	<5	208	<5	247	205	267	<5	133	134	374	429	453	481	488	<5	<5	282	389	388	430	445	462
Carbonate	mg/L	195	199	312	166	324	132	152	111	128	137	150	72	56	52	35	33	160	195	93	74	67	56	47	44
Chloride	mg/L	699	818	539	640	638	759	696	731	139	523	371	422	526	576	575	547	182	326	345	385	451	477	463	452
Sulfate	mg/L	75	71	146	123	234	143	152	118	29	12	15	6	4	<1	1	1	42	30	9	7	5	3	3	2
Metals																									
Aluminum, dissolved	mg/L	<0.1	0.5	0.1	<0.1	0.1	0.4	0.4	0.3	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic, dissolved	mg/L	0.014	0.009	0.008	0.007	0.008	0.008	0.01	<0.005	0.007	0.007	0.008	<0.005	0.006	0.005	0.008	<0.005	0.01	0.01	0.006	<0.005	<0.005	0.005	<0.005	<0.005
Barium, dissolved	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron, dissolved	mg/L	0.8	0.9	0.8	1	0.8	0.9	1	0.9	0.3	0.5	0.6	0.8	0.9	1	0.9	1	0.4	0.5	0.7	0.8	0.8	0.8	0.9	0.9
Cadmium, dissolved	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron, dissolved	mg/L	<0.05	0.21	0.08	0.1	0.1	0.18	0.4	0.1	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron, total	mg/L	1.02	1.81	10.2	2.22	3.75	6.29	23.3	3.02	0.39	0.11	0.29	<0.05	<0.05	<0.05	<0.05	<0.05	0.21	0.36	0.31	<0.05	0.1	0.06	0.1	<0.05
Lead, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese, total	mg/L	<0.02	<0.02	0.15	0.02	0.05	0.08	0.37	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Mercury	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Molybdenum, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium, dissolved	mg/L	0.017	0.023	0.016	0.014	0.025	0.024	0.03	0.006	0.008	0.009	0.006	0.01	0.022	0.023	0.029	0.007	0.008	<0.005	0.012	0.01	0.017	0.017	0.017	0.007
Silver, dissolved	mg/L			<0.003	<0.003	<0.003	<0.003	<0.003	<0.003			<0.003	<0.003	<0.003	<0.003	<0.003	<0.003			<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Uranium, dissolved	mg/L	0.001	0.002	<0.001	<0.001	<0.001	0.0004	0.0004	0.0004	<0.001	0.003	<0.001	<0.001	<0.0003	<0.0003	<0.0003	<0.0003	<0.001	<0.001	<0.001	<0.001	<0.0003	<0.0003	<0.0003	<0.0003
Uranium, suspended	mg/L		<0.001	<0.001			0.0006	<0.0003			<0.001	<0.001			<0.0003	<0.0003			<0.001	<0.001			<0.0003	<0.0003	
Vanadium, dissolved	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Zinc, dissolved	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.09	0.02	<0.01	0.04	0.01	<0.01	0.02	<0.01	0.04	<0.01	0.04	0.02	0.04	<0.01	0.01	<0.01
Radiological																									
Lead 210, dissolved	pCi/L		<1	<1			<1	<1			<1	<1			<1	<1			<1	<1			<1	1.2	
Lead 210, suspended	pCi/L		<1	1			1.2	<1			<1	<1			<1	<1			<1	<1			<1	1.5	
Polonium 210, dissolved	pCi/L		<1	<1			<1	<1			<1	<1			<1	<1			<1	<1			<1	<1	
Polonium 210, suspended	pCi/L		<1	<1			<1	<1			<1	<1			<1	<1			<1	<1			<1	<1	
Ra-226, dissolved	pCi/L	<0.2	<0.2	<0.2	<0.2	0.2	0.3	<0.2	0.2	<0.2	<0.2	<0.2	0.3	<0.2	0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2
Ra-226, suspended	pCi/L		<0.2	0.5			0.8	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2	
Ra-228, Dissolved	pCi/L	<1	<1	<1	<1	1.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Radon-222	pCi/L	<25								<29								<28							
Th-230, dissolved	pCi/L		<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2	
Th-230, suspended	pCi/L		<0.2	0.325			0.3	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2			<0.2	<0.2	
Gross Alpha	pCi/L	3.5	4.4	20	10.5	<5	<2	<7	<14	<2	<2	<3.5	3.1	<4	<4	<4	<5	<2	<2	<3.5	<2	<3	<4	<3	<4
Gross Beta	pCi/L	19.4	10.5	28	16.3	12.6	3.1	<10	<20	32.6	13.1	10.1	6.6	<7	<7	<8	<8	34.3	19.7	<6.8	8.9	<7	<7	6.1	<7
QA/QC																									
Anion Sum	meq/L	30.57	33.57	29.22	29.61	35	32.87	34.38	31.19	14.56	21.77	18.03	20.62	23.86	25.46	25.35	24.62	15.69	16.94	17.72	19.95	21.52	22.48	22.05	21.88
Cation Sum	meq/L	30.93	32.08	31.01	28.7	36.34	31.43	34.81	31.85	14.47	21.21	18.22	20.15	22.13	24.65	24.54	23.98	15.18	16.94	17.36	21.22	21.68	21.16	22.48	23.7
Total Anion/Cation Balance	%	0.57	2.27	2.96	1.54	1.88	2.24	0.61	1.04	0.29	1.29	0.52	1.17	3.74	1.62	1.62	1.3	1.64	0.01	1.03	3.09	0.38	3.02	0.97	3.98
Total Dissolved Solids (calc)	mg/L	1770	1900	1740	1700	2080	1880	1910	1830	820	1230	1030	1150	1310	1420	1420	1380	880	970	990	1150	1220	1240	1250	1270

natural background in mineralized areas. Overall, the concentrations for all samples were less than the MPCs for release of effluents in water to unrestricted areas as defined in 10 CFR 20, Appendix B, Table 2.

2.9.2.3 Sediment Sampling

Summary and Overview

Sediment samples were collected in August of 2010 at the Oshoto Reservoir and the three surface water monitoring stations. Regulatory Guide 4.14 recommends that sediment samples be obtained from the following types of locations.

- ♦ Large, permanent water impoundments on or offsite that could be impacted by direct surface drainage from contaminated areas.
- ♦ Surface water passing through site or offsite surface waters (e.g., "streams") that could be impacted by surface drainage

Number and Location of Samples

One sediment sample was collected from each surface water monitoring station as well as Oshoto Reservoir. NRC Regulatory Guide 4.14 for sediment recommends sampling in flowing bodies of water and suggests two samples representing spring and late summer. Since the streams within the proposed project area are ephemeral the samples were collected during late summer and just after spring runoff.

Sample Methods and Frequency

The sediment samples were collected from the thalweg portion of the stream channels at each surface water monitoring station. Due to the ephemeral nature of the streams in the project area, samples were not collected along a traverse and composited as recommended in NRC Regulatory Guide 4.14.

Radionuclide Analysis

All sediment samples were analyzed for uranium, Ra-226, Th-230, and Pb-210 per NRC Regulatory Guide 4.14. Table 2.9-5 summarizes the analytes, analytical methods and MDLs for sediment samples.

Data Presentation

The results of the sediment sampling are presented in Table 2.9-6.

mobile in the atmosphere than the other particulate radionuclides which result from resuspension of soil particles. Conclusions on seasonal variations will be made when all four quarters of data are available.

2.9.2.5 Radon in Air

Summary and Overview

Regulatory Guide 4.14 recommends that radon in air measurements be co-located with the air particulate monitoring stations. Since ISR activities at the site will occur at the CPP and over the ore bodies, which are generally long, narrow and discontinuous, Strata located the radon detectors at the air monitoring stations and other locations commensurating with the TLD baseline monitoring program. These locations are consistent with the layout of modern ISRs and areas with potential radiological impacts.

Radon sampling was conducted with Landauer high sensitivity environmental radon Trak-Etch detectors. The first radon detectors were deployed to the site between January 12 and January 15, 2010.

Number and Location of Samples

A total of 17 radon sampling locations were used as part of the baseline monitoring program. As depicted on Figure 2.9-26, the radon detectors were located at each air particulate sampling station, the four residences nearest to the site, the potential locations for the CPP and evaporation ponds, the former Nubeth R&D site, and over two of the ore bodies identified for potential mining. These locations provided a baseline characterization of the areas with the greatest potential for radiological impact from the mining and milling process. Two of the stations (16 and 17) were established in mid-2010 with decommissioning occurring in the second and third quarters of 2012.

Sampling Methods and Frequency

Radon concentrations tend to be highly variable, both diurnally and seasonally, and require long-term continuous monitoring to be effectively characterized. The method employed for the Ross ISR Project used “alpha track” detectors (specifically, Radtrak detectors available from Landauer, Inc.) for the measurement of radon. The detector incorporates a radiosensitive element that records alpha emissions (that become visual tracks when subsequently processed) from the decay of radon and its short-lived decay products. The number of tracks over a pre-determined area is counted using a microscope or optical reader. The radon concentration (in pCi/L of air) is determined by the number of tracks per unit area in combination with the time of exposure.

Radon monitoring was completed in accordance with procedures described in SOP 1, provided in Addendum 2.9-A. The monitors were mounted approximately one meter off the ground from either steel posts driven in the ground for this purpose or on fence posts at locations where fencing was already present. Detectors were exchanged and returned for analysis to the vendor on a quarterly basis.

Radionuclide Analysis

Detectors were analyzed by Landauer, the supplier. The sensitivity of the RadTrak detector is typically in the range of 20 to 40 pCi/L/day. Assuming a quarterly (90 day) exposure period, the minimum detectable concentration is around 0.22 to 0.44 pCi/L radon in air.

Data Presentation

Results for three quarters of the baseline radon in air sampling program are provided in Table 2.9-9.

Conclusions

The results for all 17 locations and all quarters were consistent in that no unusual anomalies or unexpected results were reported. Results for all locations during all quarters were in the range of 0.1-2.0 pCi/L in air, which is a typical range for out of doors background in the Rocky Mountain States. In addition, the data indicated that there were no seasonal trends.

2.9.2.6 Soil Samples

Summary and Overview

The baseline soil sampling program was completed between June and August 2010. The soil sampling program involved surface and subsurface

Sample Methods and Frequency

Sample collection was performed in accordance with SOP 10, provided in Addendum 2.9-A. An edible tissue sample was taken from beef cattle samples at the time of slaughter in July.

Radionuclide Analysis

Radionuclide analysis coincided with requirements listed in Table 2.9-17.

Data Presentation

Radionuclide analysis results for beef samples are provided in Table 2.9-23.

Conclusions

The beef results were near or below detectable limits for analyzed radionuclides. The sample provides a baseline for radionuclides in edible meat samples near the proposed Ross ISR Project.

2.9.2.11 Animal Tissue Sampling- Large Game Wildlife

Summary and Overview

A sample of deer meat was collected with cooperation from a local landowner in October of 2010 and November of 2011.

Number and Location of Samples

Several species of wild game hunted for meat regularly cross the proposed project area. These species include, but are not limited to: whitetail deer, mule deer, pronghorn antelope, cottontail rabbits, sharptail grouse, sage grouse, and wild turkey. Surveys of the wildlife on the permit area were completed as part of the baseline monitoring program. A discussion of wildlife species observed is provided in Section 2.8.4.2. Based on the wildlife surveys and resident hunting habits, deer and antelope were identified as the only wildlife hunted for human consumption. One sample from a deer harvested within the greater ecological area was provided by a local landowner.

Sample Methods and Frequency

One deer sample was donated as a frozen meat sample following processing. The sample was collected during the 2010 hunting season. A deer sample was also collected following the 2011 hunting season.

Radionuclide Analysis

Radionuclide analysis coincided with the requirements listed in Table 2.9-17.

Data Presentation

Results of the radionuclide analysis of the deer tissue is provided in Table 2.9-24.

Conclusions

Analysis of the deer tissue sample indicated generally low radionuclide levels (as compared to the MDL for the methods). Overall, the results were consistent with concentrations measured in the beef sample, with the exception of Pb-210. Due to the migratory nature of deer it is difficult to attribute radionuclide concentration origins to any particular site.

2.9.2.12 Animal Tissue Sampling - Fish

Summary and Overview

Fish samples were collected in September, 2010. Regulatory Guide 4.14 recommends sampling of the edible portions of fish from all applicable bodies of water at least twice prior to construction.

Number and Location of Samples

Oshoto Reservoir is the only water impoundment within the proposed project area capable of supporting edible fish. All other water impoundments within the proposed project area are located in ephemeral drainages and therefore are unable to sustain edible fish populations.

A total of 99 fish were caught from Oshoto Reservoir to create a composite sample of edible tissue from the site. Landowner interviews indicated that residents do not typically consume fish from the reservoir and therefore fish from the reservoir is not a pathway to the human food chain. Nonetheless,

Table 2.9-6. Sediment Sampling Analytical Results

Sample ID	Sample Date	Total Uranium (mg/kg)	Gross Alpha (pCi/g)	Pb-210 (pCi/g)	Ra-226 (pCi/g)	Th-230 (pCi/g)
SW-1-SED	8/25/10	2.11	2.8 ± 0.6	471 ± 6.1	1.5 ± 0.1	371 ± 58
	5/4/11	1.48	Not analyzed	1.6 ± 0.4	0.6 ± 0.1	<0.2
OSHOTO-RES-SED	8/25/10	1.32	<1	1.7 ± 0.5	1.0 ± 0.1	0.87 ± 0.21
	5/4/11	3.40	Not analyzed	1.8 ± 1.0	1.0 ± 0.1	0.5 ± 0.2
SW-2-SED	8/25/10	0.876	1.1 ± 0.4	<1	0.9 ± 0.1	0.39 ± 0.14
	5/4/11	1.33	Not analyzed	2.4 ± 0.4	1.0 ± 0.1	0.9 ± 0.2
SW-3-SED	8/25/10	2.24	1.6 ± 0.4	2.1 ± 1.0	0.8 ± 0.1	0.84 ± 0.21
	5/4/11	2.51	Not analyzed	3.2 ± 0.5	1.3 ± 0.1	0.8 ± 0.2
CSRES02	5/16/11	0.74	Not analyzed	<1.0	<0.5	0.3 ± 0.1
CSRES03	5/16/11	0.89	Not analyzed	<1.0	<0.5	0.5 ± 0.2

Table 2.9-9. Radon Air Sampling Program Results (all results pCi/L in air)

Sample Site	Quarter 1			Quarter 2			Quarter 3			Quarter 4		
	Start Date	**End Date**	**Avg Radon Con.**	**Start Date**	**End Date**	**Avg Radon Con.**	**Start Date**	**End Date**	**Avg Radon Con.**	**Start Date**	**End Date**	**Avg Radon Con.**
Office Site (1)	1/12/10	4/22/10	1.7 ±0.12	4/22/10	7/19/10	0.7 ±0.05	7/19/10	10/15/10	0.8 ±0.06	10/15/10	1/12/11	0.5 ±0.04
Met Station (2)	1/12/10	4/22/10	2.0 ±0.13	4/22/10	7/19/10	0.6 ±0.05	7/19/10	10/15/10	0.4 ±0.04	10/15/10	1/12/11	0.2 ±0.02
Southwest Site (3)	1/12/10	4/22/10	1.9 ±0.13	4/22/10	7/19/10	1.1 ±0.07	7/19/10	10/15/10	1.0 ±0.07	10/15/10	1/12/11	0.5 ±0.05
East Site (4)	1/12/10	4/22/10	1.7 ±0.12	4/22/10	7/19/10	0.7 ±0.05	7/19/10	10/15/10	0.6 ±0.05	10/15/10	1/14/11	0.6 ±0.05
South Site (5)	1/15/10	4/22/10	0.5 ±0.05	4/22/10	7/19/10	0.8 ±0.06	7/19/10	10/15/10	0.8 ±0.06	10/15/10	1/14/11	0.6 ±0.04
Wesley Site (6)	1/12/10	4/22/10	0.9 ±0.08	4/22/10	7/19/10	1.0 ±0.07	7/19/10	10/15/10	0.9 ±0.06	10/15/10	1/12/11	0.5 ±0.04
Wood Site (7)	1/12/10	4/22/10	1.1 ±0.09	4/22/10	7/19/10	0.9 ±0.06	7/19/10	10/15/10	1.3 ±0.08	10/15/10	1/12/11	0.5 ±0.04
Strong Site (8)	1/12/10	4/22/10	0.8 ±0.07	4/22/10	7/19/10	0.7 ±0.05	7/19/10	10/15/10	0.9 ±0.06	10/15/10	1/12/11	0.5 ±0.04
Site 9	1/15/10	4/22/10	0.3 ±0.04	4/22/10	7/19/10	0.9 ±0.06	7/19/10	10/15/10	0.8 ±0.06	10/15/10	1/14/11	0.9 ± 0.06
Site 10	1/15/10	4/22/10	0.4 ±0.04	4/22/10	7/19/10	0.8 ±0.06	7/19/10	10/15/10	1.2 ±0.07	10/15/10	1/14/11	0.7 ±0.05
Site 11	1/15/10	4/22/10	0.6 ±0.06	4/22/10	7/19/10	0.6 ±0.04	7/19/10	10/15/10	0.6 ±0.05	10/15/10	1/14/11	0.5 ±0.04
Site 12	1/15/10	4/22/10	0.5 ±0.05	4/22/10	7/19/10	0.8 ±0.06	7/19/10	10/15/10	0.7 ±0.05	10/15/10	1/14/11	0.4 ±0.03
Site 13	1/12/10	4/22/10	1.7 ±0.12	4/22/10	7/19/10	0.8 ±0.06	7/19/10	10/15/10	1.2 ±0.08	10/15/10	1/12/11	0.7 ±0.05
Site 14	1/12/10	4/22/10	0.8±0.07	4/22/10	7/19/10	0.6 ±0.04	7/19/10	10/15/10	0.8 ±0.06	10/15/10	1/12/11	0.6 ±0.04
Site 15	1/12/10	4/22/10	0.7 ±0.07	4/22/10	7/19/10	0.8 ±0.06	7/19/10	10/15/10	0.7 ±0.05	10/15/10	1/12/11	0.5 ±0.04
Site 16	N/A	N/A	N/A	5/20/10	7/19/10	1.4 ±0.10	7/19/10	10/15/10	0.8 ±0.06	10/15/10	1/12/11	0.6 ±0.05
Site 17	N/A	N/A	N/A	5/20/10	7/19/10	1.4 ±0.10	7/19/10	10/15/10	0.8 ±0.06	10/15/10	1/12/11	0.5 ±0.04

Table 2.9-9. Radon Air Sampling Program Results (all results pCi/L in air) (continued)

Sample Site	Quarter 5			Quarter 6			Quarter 7			Quarter 8		
	Start Date	End Date	Avg Radon Con.	Start Date	End Date	Avg Radon Con.	Start Date	End Date	Avg Radon Con.	Start Date	End Date	Avg Radon Con.
Office Site (1)	1/12/11	4/13/11	0.4 ±0.03	4/13/11	7/12/11	0.4 ±0.03	7/12/11	10/18/11	0.8 ±0.05	10/18/11	1/10/12	0.9 ±0.06
Met Station (2)	1/12/11	4/13/11	0.4 ±0.03	4/13/11	7/12/11	0.6 ±0.04	7/12/11	10/18/11	0.7 ±0.05	10/18/11	1/10/12	1.1 ±0.07
Southwest Site (3)	1/12/11	4/13/11	0.2 ±0.02	4/13/11	7/12/11	0.4 ±0.03	7/12/11	10/18/11	1.1 ±0.06	10/18/11	1/10/12	1.4 ±0.08
East Site (4)	1/14/11	4/13/11	0.2 ±0.02	4/13/11	7/12/11	0.4 ±0.03	7/12/11	10/18/11	0.9 ±0.06	10/18/11	1/10/12	1.1 ±0.07
South Site (5)	1/14/11	4/13/11	0.2 ±0.02	4/13/11	7/12/11	0.5 ±0.04	7/12/11	10/18/11	0.7 ±0.05	10/18/11	1/10/12	0.9 ±0.06
Wesley Site (6)	1/12/11	4/13/11	0.2 ±0.02	4/13/11	7/12/11	0.4 ±0.03	7/12/11	10/18/11	0.9 ±0.06	10/18/11	1/10/12	1.3 ±0.08
Wood Site (7)	1/12/11	4/13/11	0.3 ±0.03	4/13/11	7/12/11	0.7 ±0.05	7/12/11	10/18/11	1.0 ±0.06	10/18/11	1/10/12	1.0 ±0.06
Strong Site (8)	1/12/11	4/13/11	0.1	4/13/11	7/12/11	0.5 ±0.04	7/12/11	10/18/11	0.7 ±0.05	10/18/11	1/10/12	0.9 ±0.06
Site 9	1/14/11	4/13/11	0.4 ±0.03	4/13/11	7/12/11	0.5 ±0.04	7/12/11	10/18/11	1.0 ±0.06	10/18/11	1/10/12	1.0 ±0.06
Site 10	1/14/11	4/13/11	0.3 ±0.02	4/13/11	7/12/11	0.5 ±0.04	7/12/11	10/18/11	1.2 ±0.07	10/18/11	1/10/12	1.0 ±0.06
Site 11	1/14/11	4/13/11	0.4 ±0.03	4/13/11	7/12/11	0.5 ±0.04	7/12/11	10/18/11	0.8 ±0.05	10/18/11	1/10/12	0.9 ±0.06
Site 12	1/14/11	4/13/11	0.3 ±0.02	4/13/11	7/12/11	0.5 ±0.04	7/12/11	10/18/11	0.5 ±0.04	10/18/11	1/10/12	0.9 ±0.06
Site 13	1/12/11	4/13/11	0.2 ±0.02	4/13/11	7/12/11	0.4 ±0.03	7/12/11	10/18/11	0.9 ±0.06	10/18/11	1/10/12	1.0 ±0.06
Site 14	1/12/11	4/13/11	0.4 ±0.03	4/13/11	7/12/11	0.5 ±0.04	7/12/11	10/18/11	0.8 ±0.05	10/18/11	1/10/12	1.0 ±0.06
Site 15	1/12/11	4/13/11	0.3 ±0.03	4/13/11	7/12/11	0.2 ±0.02	7/12/11	10/18/11	0.8 ±0.05	10/18/11	1/10/12	1.1 ±0.07
Site 16	1/12/11	4/13/11	0.2 ±0.02	4/13/11	7/12/11	0.4 ±0.04	7/12/11	10/18/11	0.8 ±0.05	10/18/11	1/10/12	0.9 ±0.06
Site 17	1/12/11	4/13/11	0.5 ±0.04	4/13/11	7/12/11	0.3 ±0.03	7/12/11	10/18/11	1.0 ±0.06	10/18/11	1/10/12	0.8 ±0.05

Table 2.9-9. Radon Air Sampling Program Results (all results pCi/L in air) (continued)

Sample Site	Quarter 9			Quarter 10		
	Start Date	End Date	Avg Radon Con.	Start Date	End Date	Avg Radon Con.
Office Site (1)	1/10/12	3/30/12	0.5 ±0.04	---	---	Decommissioned 3/30/12
Met Station (2)	1/10/12	4/5/12	1.1 ±0.07	4/5/12	7/13/12	0.4 ±0.03
Southwest Site (3)	1/10/12	4/5/12	1.2 ±0.07	4/5/12	7/13/12	1 ±0.06
East Site (4)	1/10/12	4/5/12	0.2 ±0.02	4/5/12	7/13/12	0.7 ±0.05
South Site (5)	1/10/12	4/5/12	0.3 ±0.02	4/5/12	7/13/12	0.7 ±0.05
Wesley Site (6)	1/10/12	4/5/12	0.5 ±0.03	4/5/12	7/13/12	0.6 ±0.04
Wood Site (7)	1/10/12	4/5/12	0.7 ±0.04	4/5/12	7/13/12	0.8 ±0.05
Strong Site (8)	1/10/12	4/5/12	0.3 ±0.02	4/5/12	7/13/12	0.5 ±0.04
Site 9	1/10/12	4/5/12	0.2 ±0.02	4/5/12	---	NM[1]
Site 10	1/10/12	4/5/12	0.7 ±0.05	4/5/12	7/13/12	0.1[1]
Site 11	1/10/12	4/5/12	0.6 ±0.04	4/5/12	7/13/12	0.6 ±0.04[1]
Site 12	1/10/12	4/5/12	0.7 ±0.05	4/5/12	7/13/12	2.8 ±0.12[1]
Site 13	1/10/12	4/5/12	0.6 ±0.04	4/5/12	7/13/12	0.8 ±0.05
Site 14	1/10/12	4/5/12	0.7 ±0.05	4/5/12	7/13/12	0.5 ±0.04
Site 15	1/10/12	4/5/12	0.6 ±0.04	4/5/12	7/13/12	0.6 ±0.04
Site 16	1/10/12	4/5/12	0.8 ±0.05	4/5/12	7/13/12	0.6 ±0.04
Site 17	1/10/12	4/5/12	0.5 ±0.04	4/5/12	7/13/12	0.7 ±0.05

[1] Livestock damage, radon cup either missing or displaced

Table 2.9-24. Wild Game Tissue Sample Analysis

Sample Date	Analyte				
	Pb-210 (pCi/kg)	**Po-210 (pCi/kg)**	**Ra-226 (pCi/kg)**	**Th-230 (pCi/kg)**	**U-nat (mg/kg)**
10-18-10	13.0 ± 7.5	3.68 ± 3.75	1.8 ± 1.5	7.6 ± 4.2	<0.001
11-20-11	17 ± 1	<1.0	0.5 ± 0.4	<0.2	0.025

office in the appropriate hole record and provided with the respective wellfield data package. Anecdotal data collected during the abandonment process will provide valuable information for future abandonment operations. For example, during abandonment of 55 boreholes in the vicinity of the 12-18 regional baseline well cluster it was noted that natural sealing of the clays above the ore zone sands is common, and that circulation of water and minor drilling fluids was necessary to get the holes sufficiently cleaned out prior to cementing.

Monitor wells installed as part of the wellfield data package will be constructed per WDEQ/LQD guidelines and a passing MIT record will be provided as part of the wellfield package as per Section 5.7.8.1 of this Technical Report.

3.1.7 Wellfield Leak Detection and Instrumentation

Wellfield control and monitoring will be conducted in the Module buildings' Programmable Logic Controllers (PLCs) and the data relayed to the Master Control System (MCS) in the control room at the CPP. The MCS will remotely monitor and be capable of shutting down any device or process at the module buildings. Starting capabilities will reside solely at the module buildings. The wellfield control philosophy at the proposed Ross ISR Project will be based around a fault hierarchy which allows adjustment through the PLC for fault settings and allowable time intervals for fault values. This will allow parameters to stabilize, such as during startup or in the event of a brief anomalous condition, before triggering a fault. In this manner, Strata will reduce the number of automatic faults and subsequent shutdowns that occur.

Flows and pressures for the main injection and recovery trunklines will be monitored continuously and displayed at the CPP control room. Proposed leak detection and monitoring equipment from the wellfields to the CPP is depicted on Figure 3.1-15. Changes in flow or pressure that are outside of normal operating parameters will result in the activation of visual and audible alarms and eventually automatic sequential shutdown of pumps and control valves if the condition is not corrected promptly. The flows and pressures of the injection/recovery feeder lines and the individual injection/recovery wells will be monitored locally at the module building and on a display located at the CPP control room. If flows and pressures are not maintained within a set operating range, a visual and audible alarm will be activated at the CPP.

Leak detection sensors will be located in the module building sumps and the valve manholes, which will trigger audible and visual alarms at the location monitoring as described further described in Section 2.9) since 10 CFR 40.65 does not specifically require "measurement" of effluent at the source. The MILDOS–AREA computer code as previously described will be used, in conjunction with the process parameters applicable to the previous 6 months of facility operation, to estimate the semi annual radon source term. It will be conservatively assumed that the radon progeny are in equilibrium with the radon parent when released in estimating the total quantities of radionuclides emitted during the previous six-month period.

Furthermore, the disperse and diffuse nature of potential radon releases from multiple locations at ISRs makes empirical measurement impractical and unnecessary. Throughout the 30 years of ISR operational experience in the US there is no evidence of public exposure from radon releases in excess of public exposure criteria. For example, NUREG-1910, Table 4.2-2 presents numerous dose estimates to offsite receptors solely from radon releases from ISR facilities, all of which are ≤40 mrem/yr. Further, Section 4.2.11.2.1 states "all doses reported are well within the 10 CFR 20 annual radiation dose limit for the public of 1 mSv (100 mrem/yr)." See also the discussion on effluent reporting at 5.7.1.1.2.

5.7.8 Groundwater/Surface Water Monitoring Programs

During operations at the proposed Ross ISR Project, a detailed water sampling program will be conducted to identify any potential impacts to water resources of the area. The operational water monitoring program includes evaluation of groundwater on a regional basis, groundwater within the permit or licensed area, and surface water on both a regional and site specific basis. A summary of the proposed groundwater and surface water monitoring programs is given in Table 5.7-1.

5.7.8.1 Wellfield Baseline Groundwater and Construction Phase Surface Water Monitoring

A groundwater and surface water monitoring program will be instituted after license approval in order to gather the required data to prepare a comprehensive wellfield package and to assess the impacts of construction activities for the Ross ISR infrastructure. The initial wellfield package for the first mine unit will be submitted to WDEQ/LQD for approval, as well as to NRC for review and verification. Subsequent wellfield packages will be reviewed by the SERP, and approved by WDEQ/LQD. All wellfield packages will be available for NRC review in accordance with SERP record keeping procedures discussed in Section 5.2.4.2.

groundwater rights are predicted, Strata may request that data logging pressure transducers be installed in the well(s) in order to monitor any potential abstractions during operations.

Wellfield Baseline Monitoring - Wellfield

The wellfield baseline monitoring program is designed to define the primary restoration goals, determine upper control limits for horizontal excursions of lixiviant into the ore zone aquifer outside of the wellfield, and potential vertical excursions into the overlying or underlying water-bearing intervals. This program will be based on information obtained from baseline geologic and hydrologic information, groundwater model simulations, wellfield aquifer testing, and wellfield groundwater baseline sampling, which is described in detail below.

Strata understands that a license is necessary to conduct construction activities as detailed in 10 CFR Part 51. However, in order to facilitate project development, Strata will likely submit an exemption request in order to conduct site exploration to establish the necessary monitoring network to develop additional background information related to the site suitability. In order to support the request to conduct additional pre-construction activities (beyond the limited work to develop the pre-license baseline data), Strata has initiated a geologic evaluation using GemCom Gems of the first mine unit in order to provide more detailed resolution of the key upper and lower confining intervals as well as intervening shales that might play a role in fluid movement through the mineralized portions of the sandstones. The improved geologic resolution will be integrated with the current groundwater model to aid in predicting the capability of the proposed monitoring network to provide strong detection and mitigation efforts. These data would be provided to the NRC and DEQ to support Strata's request along with an analysis to demonstrate the need and small environmental consequences.

In order to determine operational groundwater monitoring objectives, a wellfield data package containing results of aquifer tests, potentiometric surface maps, water quality results, and groundwater modeling predictions will be assembled for WDEQ/LQD approval. Based on the results of the pre-license monitoring efforts, the following program is proposed.

In accordance with LQD Chapter 11, one baseline well cluster will be installed for every four wellfield acres. The proposed Ross ISR Project wellfield *apparent in the perimeter wells, well before any geochemical influences would be detected.*

The groundwater model developed in support of the wellfield data packages will be utilized to confirm or adjust the spacing and offset distances of the perimeter monitor well ring. Strata proposes to present the wellfield package groundwater model results as a work plan to WDEQ/LQD prior to the monitor well installation. The wellfield data package will include model simulations demonstrating that the monitoring networks are sufficient to detect a hydraulic anomaly resulting from a local wellfield imbalance. In addition, initial model simulations clearly indicate the effects of an unbalanced wellfield. Thus, upon submittal the wellfield package will be hydraulically balanced.

Aquifer tests will be conducted following installation of the perimeter, deep, shallow and ore zone wellfield baseline wells. The tests will serve three purposes: one, to demonstrate that the overlying and underlying aquifers are hydrologically isolated from the mineralized sandstone; two, that the perimeter monitor wells are in communication with the ore zone and spaced to effectively detect an operational wellfield imbalance, and; three, to further improve and calibrate the groundwater model developed in support of the wellfield package. Wellfield aquifer testing will only be completed after nearby exploration and delineation boreholes which are within the area of influence (AOI) of the tests, have been abandoned with cement from bottom to top, as well as after MITs have been completed on the all existing wells that will be used during operations.

Water quality data acquisition during wellfield baseline characterization will include at least four samples, with a minimum of 2 weeks between sampling events, for all perimeter, deep monitor (DM), OZ baseline wells and shallow monitoring (SM) wells. In addition, the SA well network will continue to be sampled on a quarterly basis through the wellfield data acquisition phase and be available for more frequent monitoring in the event of an upset condition, such as a significant spill or pipeline leak. The first and second sample events will include analyses for all WDEQ/LQD Guideline 8, Appendix 1, parts III and IV (WDEQ/LQD 2005), and NRC NUREG-1569, Table 2.7.3-1 parameters as shown in Table 5.7-2. The third and fourth sampling events may be analyzed for a reduced list of parameters as defined by the results of the previous sample events and pre-permit baseline efforts. Results from the brine as compared to single-pass treatment. This will help reduce the amount of groundwater consumptive use during RO treatment with permeate injection.

6.1.2.4 Groundwater Recirculation

After completing the RO treatment with permeate injection phase, the groundwater recirculation phase will commence. In this phase, water from the production zone will be pumped from recovery wells and recirculated into injection wells in the same module. This recirculation will homogenize the groundwater and help reduce the risk of "hot spots," or areas of unusually high concentrations of dissolved constituents. The only treatment that will occur during recirculation will be filtration, uranium/vanadium removal, and/or reductant addition along with minimizing the amount of oxygen introduced into the injection stream.

6.1.2.5 Groundwater Stability Monitoring

Following active groundwater restoration, Strata will initiate the stability monitoring phase to ensure that chemical species of concern do not increase in concentration subsequent to restoration. The following sections describe the proposed stability monitoring phase, including monitoring, evaluating stability based on monitoring results, corrective actions to address constituents with increasing trends, hot spots or excursions, and reporting.

Wells to be Monitored

During baseline characterization of each Mine Unit, Strata will sample recovery and monitor wells to assess baseline water quality within the production zone and underlying and overlying aquifers. Strata will evaluate the results of the pre-ISR water quality and recommend specific recovery wells to be sampled during stability monitoring. These recommendations will be included in the wellfield baseline packages submitted per Section 5.7.8.1 of this Technical Report.

Monitor wells (perimeter wells and wells completed in the underlying and overlying aquifers) will also be sampled during the post-restoration stability monitoring period at the frequency discussed below.

RESTORATION ACTION PLAN

A. INTRODUCTION

The following summarizes the Restoration Action Plan for the CPP, first five (5) wellfield modules and all related facilities anticipated to be constructed during the first year of licensed activities of the Ross ISR Project near Oshoto, Wyoming. The estimate puts the costs of restoration to be performed by an independent contractor at $9,822,600.63 over an approximately 3-year period during which the CPP, the initial five (5) wellfield modules, and associated infrastructure would be reclaimed to a condition agreed upon by NRC that would return the site to unrestricted use. The RAP encompasses the full cycle of activities necessary for:

- Facility decommissioning,
- Aquifer restoration and well plugging,
- Radiological survey and environmental monitoring,
- Project management and miscellaneous costs, and
- Labor and equipment overhead and contractor profit.

Strata's submittal presented herein employs assumptions that are based on best professional judgment given the data currently available. Annual reviews would provide the iterative format by which NRC can continually update the financial assurance amount based on work completed at the site and newly available information.

B. FINANCIAL ASSURANCE MECHANISM

The financial assurance mechanism to be used by Strata is shown in Attachment RAP-1.

C. CONSOLIDATION OF STATE, EPA AND NRC FINANCIAL ASSURANCE INSTRUMENTS

In addition to being crafted to comply with NRC criteria, Strata's proposed financial assurance estimate is designed to address the U.S. Environmental Protection Agency (EPA) Underground Injection Control criteria and the Wyoming Environmental Quality Act requirements for a reclamation

The following tabulation summarizes the costs necessary to hire an independent contractor to assume all decommissioning and reclamation activities required after full development of the CPP, first five (5) wellfield modules and associated facilities. Descriptions of the work are provided below, and detailed costs estimates for each major item of work are provided in attachments RAP-2(A) through (G).

Item	Cost
Aquifer restoration	$ 2,940,923.42
Facilities area reclamation	$ 2,344,689.50
Wellfield equipment & disposal	$ 1,653,423.27
Well abandonment	$ 1,030,261.08
Radiological surveys	$ 37,857.50
Revegetation	$ 66,000.00
Misc. reclamation activities	$ 268,082.14
Subtotal	$ 8,395,385.15
Project management @ 2%	$ 167,907.70
Contingency @ 15%	$ 1,259,307.77
Total	$ 9,822,600.63

1. Aquifer Restoration

1.1. Introduction

Aquifer restoration costs for the first five wellfield modules are presented in Attachment RAP-2(A). The costs are broken down into separate phases of work:

- Groundwater sweep,
- Reverse osmosis (RO) with permeate injection,
- Groundwater recirculation,
- Monitoring,
- Labor, and
- Miscellaneous.

For each phase of work, the estimated number of pore volume displacements (PVDs) required to complete that phase is provided in the attachment. The tables also provide the assumptions and unit prices for all the work necessary to complete each phase of work for the first five wellfield modules. A summary sheet is provided showing the total costs for each phase, followed by detailed calculation sheets to show how the total costs were derived. For the first five wellfield modules, the PVDs of water to be handled and the aquifer restoration costs are estimated to be as follows:

Item	PVDs	Cost
Groundwater sweep	0.5	$ 52,669.28
RO with permeate injection	8.0	$ 596,091.13
Groundwater recirculation	1.0	$ 12,613.01
Monitoring	---	$ 94,500.00
Labor	---	$1,943,550.00
Miscellaneous	---	$ 241,500.00
Total for groundwater restoration	9.5	$2,940,923.42

Restoration progress is typically measured on the basis of the number of PVDs processed during each phase of groundwater restoration. A pore volume is a term used by the ISR industry to define an indirect measurement of a unit volume of aquifer affected by ISR recovery or restoration (ISR GEIS, NRC 2009). This report distinguishes between the *in-situ* pore volume (PV) and the pore volume displacement (PVD), which is used to describe the volume of water displaced during ISR uranium recovery and aquifer restoration. Following industry standard, Strata proposes to calculate a PVD as follows:

PVD = thickness x wellfield area x porosity x flare x conversion factor

The **thickness** is the average completion thickness for the recovery and injection wells. Based on exploration drilling, the ore zone thickness ranges from 5 to 30 feet and averages approximately 9 feet across the proposed project area. The average completion thickness is typically about 20% greater than the average ore zone thickness and is expected to average approximately 11 feet. This method of calculation is consistent with currently permitted and operating ISR production facilities (COGEMA 2008, CBR 2000).

The **wellfield area** is the surficial area of the injection and recovery well patterns for each wellfield module. Based on the delineation of recoverable resources within the proposed project area, the average area per wellfield module is estimated to be 248,000 square feet.

The **porosity** or pore space is defined as the collective open spaces of the formation or a measure of the amount of liquid or gas that may be absorbed or produced by a particular formation (ISR GEIS). The porosity of the ore zone within the proposed project area was determined by laboratory analysis of core samples collected during exploration drilling. The porosity is estimated to average 34% across the proposed project area.

The **flare** is a proportionality factor that estimates the amount of aquifer water outside of the pore volume that has been affected by lixiviant flow during the recovery phase (GEIS). Flare estimates usually include a horizontal and vertical flare factor. The horizontal flare is the volume of water affected by lixiviant outside the edge of the wellfield pattern. The vertical flare is the volume of water affected by lixiviant above and below the completion interval. Strata estimates the horizontal flare at 35% and the vertical flare at 20%. This is consistent with other ISRs as described in TR Section 6.1.6. The horizontal flare estimate is also supported by the results and simulations presented in the groundwater model report as described in TR Addendum 2.7-H.

An estimate of the PVD of a typical wellfield module is calculated as follows, where 7.48 is the conversion factor for cubic feet to gallons of water:

$$\text{PVD} = 11.0 \text{ feet} \times 248{,}000 \text{ ft}^2 \times 0.34 \times 1.62 \times 7.48 = 11.2 \text{ million gallons}$$

The duration of the aquifer restoration phase was based on the processing and circulation of 9.5 pore volumes of groundwater at the liquid processing rates specified in the calculation work sheets for each phase in Attachment RAP-2(A). The financial assurance will be maintained at this level until the number of pore volumes required to satisfactorily complete each phase has been demonstrated.

Strata will adjust the financial assurance budget for aquifer restoration during each annual update review to reflect experience gained from actual

RECLAMATION SUMMARY

	Item	**Attachment**	**Worksheets**	**Cost**
I.	Aquifer Restoration	RAP-2(a)	AR-1 through AR-8	$ 2,940,923.42
II.	Facilities Area	RAP-2(b)	FAC-1 through FAC-12	$ 2,398,837.74
III.	Wellfield Equipment	RAP-2(c)	WF-1 through WF-12	$ 1,653,423.27
IV.	Well Abandonment	RAP-2(d)	WA-1	$ 1,030,261.08
V.	Radiological Survey	RAP-2(e)	RAD-1	$ 37,857.50
VI.	Revegetation	RAP-2(f)	VEG-1	$ 66,000.00
VII.	Miscellaneous	RAP-2(g)	MISC-1 through MISC-2	$ 268,082.14
	Subtotal			$ 8,395,385.15
VIII.	Project Management @ 2%			$ 167,907.70
IX.	Contingency @ 15%			$ 1,259,307.77
	Total Reclamation Cost			**$ 9,822,600.63**

I. AQUIFER RESTORATION SUMMARY AR-1

	Item	Cost	
I.	Groundwater Sweep	$	52,669.28
II.	Reverse Osmosis with Permeate Injection	$	596,091.13
III.	Groundwater Recirculation	$	12,613.01
IV.	Monitoring	$	94,500.00
V.	Labor	$	1,943,550.00
VII.	Miscellaneous	$	241,500.00
	Total Aquifer Restoration Cost	**$**	**2,940,923.42**

I. AQUIFER RESTORATION - RO TREATMENT WITH PERMEATE INJECTION

REVERSE OSMOSIS TREATMENT WITH PERMEATE INJECTION COST PER MODULE			
Operating Assumptions			
Average flow rate	515	gpm	TR Table 6.1-4
PVDs required	8	PVDs	Refer to RAP text
Total RO/permeate injection volume	89,914,528	gal	Calculated
Total RO/permeate injection volume	89,915	kgal	Calculated
Duration of RO treatment with permeate injection			
Minutes	174,591	min	Calculated
Days	121	days	Calculated
Recovery Well Pumping Costs			
Average flow rate per pump	17	gpm	Estimated average recovery rate based on aquifer tests
Number of pumps required	31		Calculated
Power input per pump	4.0	kW	Reference P-1
Electrical requirement	124.0	kW	Calculated
Electrical consumption	360,822	kWh	Calculated
Power cost	$ 0.04	/kWh	Tiered rate is $0.03 to $0.04 per PRECorp
Total Recovery Well Pumping Cost	$ 14,432.88		
Recovery Booster Pumps			
Average flow rate	515	gpm	
Electrical requirement	20.0	kW	Reference P-2
Electrical consumption	58,197	kWh	Calculated
Power cost	$ 0.04	/kWh	Tiered rate is $0.03 to $0.04 per PRECorp
Total Recovery Booster Pumping Cost	$ 2,327.88		
Reverse Osmosis Treatment			
2-Stage RO treatment cost	$ 0.88	/kgal	Reference RO-1
Total RO Treatment Cost	$ 79,124.78		
Brine Disposal			
Brine volume after Stage 1 RO	26,974	kgal	30% of influent (TR Fig. 3.1-13)
Brine volume after Stage 2 RO	13,487	kgal	50% of influent (TR Fig. 3.1-13)
Cost per kgal	$ 1.10	/kgal	Reference DDW-1
Total Brine Disposal Cost	$ 14,835.90		
CPP Permeate Pumps			
Average flow rate per pump	467.5	gpm	TR Figure 3.1-13 (935 gpm/2 - 2 modules in RO treatment/permeate injection at once)
Electrical requirement	15	kW	Reference P-4
Electrical consumption	43,648	kWh	Calculated
Power cost	$ 0.04	/kWh	Tiered rate is $0.03 to $0.04 per PRECorp
Total CPP Permeate Pump Cost	$ 1,745.91		
Injection Booster Pump			
Average flow rate per pump	467.5	gpm	See above
Electrical requirement	58	kW	Reference P-3
Electrical consumption	168,772	kWh	Calculated
Power cost	$ 0.04	/kWh	Tiered rate is $0.03 to $0.04 per PRECorp
Total Injection Booster Pump Cost	$ 6,750.86		
TOTAL COST PER MODULE	**$ 119,218.23**		
TOTAL COST FOR 5 MODULES	**$ 596,091.13**		