

ADDENDUM 2.9-D

BASELINE RADIOLOGICAL MONITORING

RESULTS AND FINAL CONCLUSIONS

4TH QUARTER

2.9.2.4-D: Supplement to Results and Conclusions – Radionuclide Particulates in Air

Results

Presented on Table 1 are the results of the quarterly air particulate sampling program. A detailed description of this program is located in section 2.9.2.4 of the Technical Report. These results are being provided as an addendum to Section 2.9.2.4. Results from all four quarters have been included for ease of data comparison. Consider Table 1 a replacement in its entirety for Table 2.9-8 in the Technical Report. Appendix A of this addendum includes air particulate lab reports for the 4th quarter of the sampling program. Lab reports for the previous 3 quarters are included in TR Addendum 2.9-C.

Table 1. Air Particulate Sampling Program Results for Four Quarters

Site	Analyte	1Q2010		2Q2010		3Q2010		4Q2010	
		Sample Result ($\mu\text{Ci}/\text{mL}$)	DL ¹ ($\mu\text{Ci}/\text{mL}$)	Sample Result ($\mu\text{Ci}/\text{mL}$)	DL ¹ ($\mu\text{Ci}/\text{mL}$)	Sample Result ($\mu\text{Ci}/\text{mL}$)	DL ¹ ($\mu\text{Ci}/\text{mL}$)	Sample Result ($\mu\text{Ci}/\text{mL}$)	DL ¹ ($\mu\text{Ci}/\text{mL}$)
Met	Pb-210	3.87E-15	6.25E-17	1.64E-15	7.29E-17	4.77E-15	7.17E-17	1.83E-14	5.14E-16
	Ra-226	< DL	6.25E-17	< DL	7.29E-17	< DL	7.17E-17	< DL	2.57E-17
	Th-230	< DL	6.25E-17	< DL	7.29E-17	< DL	7.17E-17	2.57E-17	2.57E-17
	Uranium	< DL	3.12E-17	< DL	3.65E-17	3.59E-16	3.59E-17	< DL	2.57E-17
Southwest	Pb-210	4.19E-15	5.98E-17	1.51E-15	5.81E-17	9.44E-15	6.97E-17	2.54E-14	8.31E-16
	Ra-226	< DL	5.98E-17	< DL	5.81E-17	< DL	6.97E-17	< DL	4.16E-17
	Th-230	< DL	5.98E-17	< DL	5.81E-17	< DL	6.97E-17	8.31E-17	4.16E-17
	Uranium	8.02E-17	2.99E-17	1.17E-16	2.90E-17	< DL	3.48E-17	< DL	4.16E-17
South	Pb-210	4.39E-15	5.90E-17	1.64E-15	6.70E-17	8.74E-15	6.50E-17	1.61E-14	8.28E-16
	Ra-226	< DL	5.90E-17	< DL	6.70E-17	0.00E+00	6.50E-17	< DL	4.14E-17
	Th-230	< DL	5.90E-17	< DL	6.70E-17	9.74E-17	6.50E-17	2.07E-16	4.14E-17
	Uranium	< DL	2.95E-17	< DL	3.35E-17	< DL	3.25E-17	< DL	4.14E-17
East	Pb-210	4.20E-15	6.56E-17	1.64E-15	6.83E-17	1.11E-14	7.26E-17	2.20E-14	8.22E-16
	Ra-226	< DL	6.56E-17	< DL	6.83E-17	< DL	7.26E-17	< DL	4.11E-17
	Th-230	< DL	6.56E-17	< DL	6.83E-17	< DL	7.26E-17	1.23E-16	4.11E-17
	Uranium	< DL	3.28E-17	< DL	3.41E-17	< DL	3.63E-17	< DL	4.11E-17
Office	Pb-210	3.84E-15	2.31E-17	1.52E-15	2.01E-17	1.14E-14	1.88E-17	1.09E-14	2.08E-16
	Ra-226	< DL	2.31E-17	< DL	2.01E-17	< DL	1.88E-17	2.08E-17	1.04E-17
	Th-230	< DL	2.31E-17	< DL	2.01E-17	3.77E-17	1.88E-17	2.08E-17	1.04E-17
	Uranium	< DL	1.16E-17	4.04E-17	1.00E-17	6.59E-17	9.41E-18	1.04E-17	1.04E-17

¹ DL – Sample specific detectable limit as reported by the laboratory. Meets or exceeds NRC DL requirements per Regulatory Guide 4.14 (Uranium= 1.0E-16 $\mu\text{Ci}/\text{mL}$, Th-230=1.0E-16 $\mu\text{Ci}/\text{mL}$, Ra-226=1.0E-15 $\mu\text{Ci}/\text{mL}$, Pb-210=2.0E-15 $\mu\text{Ci}/\text{mL}$)

Conclusions

Five air particulate monitoring stations were installed and began operations in January 2010. On a weekly schedule, exposed filters were collected and exchanged at each location. Weekly filters were composited into quarterly sample sets (12 or 13 filters per quarter per location) and analyzed for Pb-210, Ra-226, Th-230 and total uranium.

Results for the four quarters of data are consistent for all sites with no unusual anomalies or unexpected results. Most results, with exception of Pb-210, were at or below lower limits of detection. No site appeared to demonstrate higher or lower concentrations than any others. There is no evidence from this data of seasonal variation, although the Q4 Pb-210 results may be greater at most locations relative to the other three quarters. Further statistical analysis would be required to verify this.

Overall, results indicate Pb-210 concentrations were consistently higher at all locations and in all quarters in comparison to other radionuclides. These results are typical and likely attributed to Pb-210 being a radon (gas) progeny making it more available and mobile in the atmosphere than the other particulate radionuclides which result from re-suspension of soil particles.

2.9.2.5-D: Supplement to Results and Conclusions - Radon in Air

Results

The data provided in Tables 2 through 6 below provide results for the quarterly radon concentration in air study completed with Landauer Trak-Etch Radon Detectors for the purpose of characterizing the average radon-222 concentrations across the site. These results are provided as an addendum to Section 2.9.2.5 of the Technical Report. Note that results for all quarters have been included in this addendum for ease of comparison; however, the results provided here for the first three quarters do not differ from the previously reported results in Table 2.9-9. Lab results for the 4th quarter Radon in Air Sampling Program are included in Appendix A.

Table 2. First Quarter 2010 Results for Radon in Air

Location #	Location ID	Exposure Dates	Average Radon Concentration (pCi/L)	Reported Error ¹ (pCi/L)
1	Oshoto Field Office	1/12-4/22	1.7	±0.12
2	Met Station	1/12-4/22	2.0	±0.13
3	SW Station	1/12-4/22	1.9	±0.13
4	E Station	1/12-4/22	1.7	±0.12
5	S Station	1/12-4/22	0.5	±0.05
6	Wesley Residence	1/12-4/22	0.9	±0.08
7	Wood Residence	1/12-4/22	1.1	±0.09
8	Strong Residence	1/12-4/22	0.8	±0.07
9	E. Evap Pond	1/15-4/22	0.3	±0.04
10	E CPP	1/15-4/22	0.4	±0.04
11	W Evap Pond	1/15-4/22	0.6	±0.06
12	W CPP	1/15-4/22	0.5	±0.05
13	Former R&D	1/12-4/22	1.7	±0.12
14	N Mineralized	1/12-4/22	0.8	±0.07
15	S Mineralized	1/12-4/22	0.7	±0.07
	AVERAGE		1.0	

¹ One standard deviation

Table 3. Second Quarter 2010 Results for Radon in Air

Location #	Location ID	Exposure Dates	Reported Average Radon Concentration (pCi/L)	Reported Error ¹ (pCi/L)
1	Oshoto Field Office	4/22-7/19	0.7	±0.05
2	Met Station	4/22-7/19	0.6	±0.05
3	SW Station	4/22-7/19	1.1	±0.07
4	E Station	4/22-7/19	0.7	±0.05
5	S Station	4/22-7/19	0.8	±0.06
6	Wesley Residence	4/22-7/19	1.0	±0.07
7	Wood Residence	4/22-7/19	0.9	±0.06
8	Strong Residence	4/22-7/19	0.7	±0.05
9	E. Evap Pond	4/22-7/19	0.9	±0.06
10	E CPP	4/22-7/19	0.8	±0.06
11	W Evap Pond	4/22-7/19	0.6	±0.04
12	W CPP	4/22-7/19	0.8	±0.06
13	Former R&D	4/22-7/19	0.8	±0.06
14	N Mineralized	4/22-7/19	0.6	±0.04
15	S Mineralized	4/22-7/19	0.8	±0.06
16	N CPP	5/20-7/19	1.4	±0.10
17	N Evap Pond	5/20-7/19	1.4	±0.10
	AVERAGE		0.86	

¹ One standard deviation

Table 4. Third Quarter 2010 Results for Radon in Air

Location #	Location ID	Exposure Dates	Reported Average Radon Concentration (pCi/L)	Reported Error ¹ (pCi/L)
1	Oshoto Field Office	7/19-10/15	0.8	±0.06
2	Met Station	7/19-10/15	0.4	±0.04
3	SW Station	7/19-10/15	1.0	±0.07
4	E Station	7/19-10/15	0.6	±0.05
5	S Station	7/19-10/15	0.8	±0.06
6	Welsey Residence	7/19-10/15	0.9	±0.06
7	Wood Residence	7/19-10/15	1.3	±0.08
8	Strong Residence	7/19-10/15	0.9	±0.06
9	E. Evap Pond	7/19-10/15	0.8	±0.06
10	E CPP	7/19-10/15	1.2	±0.05
11	W Evap Pond	7/19-10/15	0.6	±0.05
12	W CPP	7/19-10/15	0.7	±0.05
13	Former R&D	7/19-10/15	1.2	±0.08
14	N Mineralized	7/19-10/15	0.8	±0.06
15	S Mineralized	7/19-10/15	0.7	±0.05
16	N CPP	7/19-10/15	0.8	±0.06
17	N Evap Pond	7/19-10/15	0.8	±0.06
	AVERAGE		0.84	

¹ One standard deviation**Table 5. Fourth Quarter 2010 Results for Radon in Air**

Location #	Location ID	Exposure Dates	Reported Average Radon Concentration (pCi/L)	Reported Error ¹ (pCi/L)
1	Oshoto Field Office	10/15-1/12	0.5	±0.04
2	Met Station	10/15-1/12	0.2	±0.02
3	SW Station	10/15-1/12	0.5	±0.05
4	E Station	10/15-1/14	0.6	±0.05
5	S Station	10/15-1/14	0.6	±0.04
6	Welsey Residence	10/15-1/12	0.5	±0.04
7	Wood Residence	10/15-1/12	0.5	±0.04
8	Strong Residence	10/15-1/12	0.5	±0.04
9	E. Evap Pond	10/15-1/14	0.9	±0.06
10	E CPP	10/15-1/14	0.7	±0.05
11	W Evap Pond	10/15-1/14	0.5	±0.04
12	W CPP	10/15-1/14	0.4	±0.03
13	Former R&D	10/15-1/12	0.7	±0.05
14	N Mineralized	10/15-1/12	0.6	±0.04
15	S Mineralized	10/15-1/12	0.5	±0.04
16	N CPP	10/15-1/12	0.6	±0.05
17	N Evap Pond	10/15-1/12	0.5	±0.04
	AVERAGE		0.55	

¹ One standard deviation

Table 6. Summary of Radon in Air Results for Four Quarters

#	Location ID	Average ¹ Rn Conc Q1 (pCi/L)	Average ¹ Rn Conc Q2 (pCi/L)	Average ¹ Rn Conc Q3 (pCi/L)	Average ¹ Rn Conc Q4 (pCi/L)	Location Average ² for ALL Quarters (pCi/L)
1	Oshoto Office	1.7	0.7	0.8	0.5	0.9
2	Met Station	2.0	0.6	0.4	0.2	0.8
3	SW station	1.9	1.1	1.0	0.5	1.1
4	E Station	1.7	0.7	0.6	0.6	0.9
5	S Station	0.5	0.8	0.8	0.6	0.7
6	Wesley	0.9	1.0	0.9	0.5	0.8
7	Wood	1.1	0.9	1.3	0.5	1.0
8	Strong	0.8	0.7	0.9	0.5	0.7
9	E Evap Pond	0.3	0.9	0.8	0.9	0.7
10	E CPP	0.4	0.9	0.6	0.7	0.8
11	W Evap Pond	0.6	0.6	0.6	0.5	0.6
12	W CPP	0.5	0.8	0.7	0.4	0.6
13	Former R&D	1.7	0.8	1.2	0.7	1.1
14	N mineralized	0.8	0.6	0.8	0.6	0.7
15	S Mineralized	0.7	0.8	0.7	0.5	0.7
16	N CPP	NA	1.4	0.8	0.6	0.9
17	N Evap Pond	NA	1.4	0.8	0.5	0.9
	Average of all locations by Quarter	1.0	0.9	0.8	0.6	0.8 ³
	Standard Deviation	0.6	0.2	0.2	0.1	0.2
	Approximate Range	0.3 – 2.0	0.6 – 1.4	0.4 – 1.3	0.2 – 0.9	N/A

¹ Average based on total Radon exposure reported over entire exposure period

² Values represent the average of all 4 quarters of data received at each location

³ Value represents the average from all locations for all quarters

Conclusions

The radon in air sampling program commenced on January 12, 2010. Initially fifteen measurement locations were established. The program was expanded to include two additional locations during the second quarter to add coverage in the northern portion of the permit area where an additional CPP location was considered. Although it was subsequently determined that this location would not be pursued, it was nonetheless decided to maintain these sampling locations as part of the baseline study.

Landauer high sensitivity environmental radon Trak-Etch detectors were exchanged on a quarterly basis. After approximately a 90 day exposure period in the field, the dosimeters were replaced with “unexposed” units. The exposed units were returned to the vendor for analysis.

In general, results were indicative of expected regional background for radon in air in mineralized environments in the range of 0.5 – 2.0 pCi/l. Table 6 summarizes the radon in air program results by quarter. All data in this table are in units of pCi/liter in air. Detailed results by quarter and location including quarterly time periods were presented in Tables 2 through 5.

No specific location appeared to be consistently high or low across all four quarters. The data suggests that in general, lower radon concentrations were evident during the fourth quarter of the study (10/22/10 – 1/12/11) as reflected by the lowest average result for the 17 locations as compared to the averages for the other three quarters.

However, to confirm this, a more rigorous statistical analysis, including considerations of reported uncertainty values would need to be performed. It is of interest to note that this same effect was noted in regards to the direct radiation long-term studies in that TLD results also appeared to be lowest during this same quarter (See Addendum for Section 2.9.2.8). This could be a reflection of greater air pressure, cloud and snow cover and/or soil moisture during this period.

It is also noted that greater variability of results occurred across the site during the first quarter since the standard deviation of the mean values was considerably higher than in the other three quarters.

2.9.2.8-D: Supplement to Results and Conclusions – Direct Radiation - Long Term Studies

Results

The data presented below in Tables 7 through 11 provide quarterly results for the long-term gamma exposure rate study completed with Thermoluminescent Dosimeters (TLDs) for the purpose of characterizing the average exposure rates across the site. These results are provided as an addendum to Section 2.9.2.8 of the Technical Report. Note that results for all quarters have been included in this Addendum for ease of comparison; however the results for the first three quarters do not differ from those previously reported in Tables 2.9–13 thru 2.9–15. Lab reports for the 4th quarter of the direct radiation study are included in Appendix A of this addendum.

Table 7. First Quarter 2010 Long Term Gamma Study (TLD) Results

Location	Location #	Exposure Dates	Reported Exposure (mrem)	Environmental Exposure (mrem) ¹	Average Exposure Rate (μR/hr)
Deploy Control	Control	1/12-4/22	29.4	24.5	11.2
Oshoto Office	1	1/12-4/22	35.5	30.6	14.0
Met Station	2	1/12-4/22	32.1	27.2	12.5
SW station	3	1/12-4/22	31.3	26.4	12.1
E Station	4	1/12-4/22	29.6	24.7	11.3
S Station	5	1/12-4/22	32.3	27.4	12.5
Wesley	6	1/12-4/22	35.0	30.1	13.8
Wood	7	1/12-4/22	33.6	28.7	13.1
Strong	8	1/12-4/22	33.8	28.9	13.2
E Evap Pond	9	1/15-4/22	32.7	27.8	13.2
E CPP	10	1/15-4/22	34.8	29.9	14.2
W Evap Pond	11	1/15-4/22	33.7	28.8	13.6
W CPP	12	1/15-4/22	34.4	29.5	14.0
Former R&D	13	1/12-4/22	34.2	29.3	13.4
N mineralized	14	1/12-4/22	34.9	30.0	13.7
S Mineralized	15	1/12-4/22	32.8	27.9	12.8

¹ Environmental Exposure= Reported Exposure - Transit Control Exposure; Transit Control Exposure= 4.9 mrem

Table 8. Second Quarter 2010 Long Term Gamma Study (TLD) Results

Location	Location #	Exposure Dates	Reported Exposure (mrem)	Environmental Exposure (mrem)²	Average Exposure Rate (μR/hr)
Deploy Control 1	Control	4/22-7/19	24.3	21.5	10.1
Deploy Control 2	Control	5/20-7/19	17.2	14.4	9.8
Oshoto Office	1	4/22-7/19	30	27.2	12.7
Met Station	2	4/22-7/19	30.2	27.4	12.8
SW station	3	4/22-7/19	29.2	26.4	12.4
E Station	4	4/22-7/19	32.7	29.9	14.0
S Station	5	4/22-7/19	26.3	23.5	11.0
Wesley	6	4/22-7/19	32.1	29.3	13.7
Wood	7	4/22-7/19	30.4	27.6	12.9
Strong	8	4/22-7/19	29.6	26.8	12.5
E Evap Pond	9	4/22-7/19	23.2	20.4	9.6
E CPP	10	4/22-7/19	21.9	19.1	8.9
W Evap Pond	11	4/22-7/19	31.1	28.3	13.2
W CPP	12	4/22-7/19	32.4	29.6	13.9
Former R&D	13	4/22-7/19	28.4	25.6	12.0
N mineralized	14	4/22-7/19	31.2	28.4	13.3
S Mineralized	15	4/22-7/19	31.1	28.3	13.2
N Evap Pond	16	5/20-7/19	23.2	18.6	12.7
N CPP	17	5/20-7/19	21.9	17.3	11.8

¹ Transit control 1 is applied to badges 1-15, Transit control 2 is applied to badges 16-17

² Environmental Exposure= Reported Exposure - Transit Control Exposure; Transit Control 1 = 2.8 mrem,
Transit Control 2 = 4.6 mrem

Table 9. Third Quarter 2010 Long Term Gamma Study (TLD) Results

Location	Location #	Exposure Dates	Reported Exposure (mrem)	Environmental Exposure (mrem)²	Average Exposure Rate (μR/hr)
Deploy Control 1	Control	7/19-10/15	30.5	21.3	10.1
Deploy Control 2	Control	7/19-10/15	21.7	19.3	9.1
Oshoto Office	1	7/19-10/15	35.7	26.5	12.5
Met Station	2	7/19-10/15	38.7	29.5	14.0
SW station	3	7/19-10/15	36.2	27	12.8
E Station	4	7/19-10/15	34.3	25.1	11.9
S Station	5	7/19-10/15	31	21.8	10.3
Wesley	6	7/19-10/15	37.0	27.8	13.2
Wood	7	7/19-10/15	38.2	29	13.7
Strong	8	7/19-10/15	36.1	26.9	12.7
E Evap Pond	9	7/19-10/15	38.7	29.5	14.0
E CPP	10	7/19-10/15	36.2	27	12.8
W Evap Pond	11	7/19-10/15	27.2	24.8	11.7
W CPP	12	7/19-10/15	28.4	26.0	12.3
Former R&D	13	7/19-10/15	28.7	26.3	12.5
N mineralized	14	7/19-10/15	29	26.6	12.6
S Mineralized	15	7/19-10/15	29.9	27.5	13.0
N Evap Pond	16	7/19-10/15	28.7	26.3	12.5
N CPP	17	7/19-10/15	30.1	27.7	13.1

¹ Transit control 1 is applied to badges 1-10, transit control 2 is applied to badges 10-17

² Environmental Exposure= Reported Exposure – Transit Control Exposure; Transit Control 1 = 9.2 mrem, Transit Control 2 = 2.4 mrem

Table 10. Fourth Quarter 2010 Long Term Gamma Study (TLD) Results

Location	Location #	Exposure Dates	Reported Exposure (mrem)	Environmental Exposure (mrem)²	Average Exposure Rate (μR/hr)
Deploy Control 1	Control	10/15-1/12	28.7	20.5	9.6
Deploy Control 2	Control	10/15-1/12	25.1	19.4	9.1
Deploy Control 3	Control	10/15-1/12	21.3	17.7	8.3
Oshoto Office	1	10/15-1/12	32.2	24	11.2
Met Station	2	10/15-1/12	31.5	23.3	10.9
SW station	3	10/15-1/12	29	20.8	9.7
E Station	4	10/15-1/14	30.7	22.5	10.3
S Station	5	10/15-1/14	29.1	20.9	9.6
Wesley	6	10/15-1/12	30.5	22.3	10.4
Wood	7	10/15-1/12	31.7	23.5	11.0
Strong	8	10/15-1/12	27.7	19.5	9.1
E Evap Pond	9	10/15-1/14	30.2	30.2	13.8
E CPP	10	10/15-1/14	29.2	29.2	13.4
W Evap Pond	11	10/15-1/14	28.5	22.8	10.4
W CPP	12	10/15-1/14	28.1	22.4	10.3
Former R&D	13	10/15-1/12	29.8	24.1	11.3
N mineralized	14	10/15-1/12	28.2	22.5	10.5
S Mineralized	15	10/15-1/12	26.9	21.2	9.9
N Evap Pond	16	10/15-1/12	28.4	24.8	11.6
N CPP	17	10/15-1/12	26.8	23.2	10.9

¹ Transit control 1 is applied to badges 1-8, transit control 2 is applied to badges 9-15, and transit control 3 is applied to badges 16-17

² Environmental Exposure = Reported Exposure – Transit Control Exposure; Transit Control 1 = 8.2 mrem, Transit Control 2 = 5.7 mrem, Transit Control 3 = 3.6 mrem

Table 11. Summary of Results for All Four Quarters

#	Location ID	Average Exposure Rate (μR/hr) 1Q2010	Average Exposure Rate (μR/hr) 2Q2010	Average Exposure Rate (μR/hr) 3Q2010	Average Exposure Rate (μR/hr) 4Q2010	Location Average ¹ for ALL Quarters (μR/hr)
1	Oshoto Office	14.0	12.7	12.5	11.2	12.6
2	Met Station	12.5	12.8	14.0	10.9	12.5
3	SW station	12.1	12.4	12.8	9.7	11.7
4	E Station	11.3	14.0	11.9	10.3	11.9
5	S Station	12.5	11.0	10.3	9.6	10.9
6	Wesley	13.8	13.7	13.2	10.4	12.8
7	Wood	13.1	12.9	13.7	11.0	12.7
8	Strong	13.2	12.5	12.7	9.1	11.9
9	E Evap Pond	13.2	9.6	14.0	13.8	12.6
10	E CPP	14.2	8.9	12.8	13.4	12.3
11	W Evap Pond	13.6	13.2	11.7	10.4	12.3
12	W CPP	14.0	13.9	12.3	10.3	12.6
13	Former R&D	13.4	12.0	12.5	11.3	12.3
14	N mineralized	13.7	13.3	12.6	10.5	12.5
15	S Mineralized	12.8	13.2	13.0	9.9	12.2
16	N CPP	n/a	12.7	12.5	11.6	12.3
17	N Evap Pond	n/a	11.8	13.1	10.9	11.9
	Average² of all locations by Quarter	13.2	12.4	12.7	10.8	12.3 ³
	Standard Deviation	0.80	1.41	0.87	1.22	0.47
	Approximate Range	11.3 – 14.2	8.9 – 14.0	10.3 - 14	9.1 – 13.8	N/A

¹ Values represent the average of all 4 quarters of data for each location; all exposure rates are based on “environmental exposure” as previously defined

² Values represent the average from all locations during that quarter

³ Average exposure rate for all locations over the 12 month study period

Conclusions

The long-term gamma radiation monitoring program commenced on January 12, 2010. Although initially, fifteen measurement locations were established, the program was expanded to include two additional locations during the second quarter to add coverage in the northern portion of the proposed project area when an additional Central Processing Plant (CPP) location was being considered. While this CPP location has not pursued it was decided to maintain these locations in the baseline TLD monitoring program.

Landauer environmental low level TLDs were exchanged on a quarterly basis. After approximately a 90 day exposure period in the field, the dosimeters were replaced with “unexposed” units. The exposed units were returned to the vendor for analysis.

In general, results were indicative of expected regional background for cosmic and terrestrial exposure rates in the range of approximately 9 -14 $\mu\text{R/hr}$ and a mean of about 12 $\mu\text{R/hr}$ (e.g., see the Environmental Report section 3.11). These results were consistent with the results from the direct gamma exposure rate field surveys results reported in Section 2.9.2.7. Table 11 summarizes the TLD program results by quarter. All data in this table are in units of $\mu\text{R/hr}$.

No specific location appeared to be consistently high or low across the four quarters of data. The data suggests however that lower exposure rates were indicated during the fourth quarter of the study (10/22/10 – 1/12/11) as reflected by the lowest result when averaged for the 17 locations as compared to the average values for the other three quarters. However, if uncertainty parameters (standard deviations) are taken into account, this tentative conclusion may not be confirmable by a more rigorous statistical analysis.

APPENDIX A

Radionuclides in Air Particulates,
Radon in Air and Direct Radiation Lab Reports



Sample Analysis Report

CLIENT: Western Water Consultants
1849 Terra
Sheridan, WY 82801

Date Reported: 2/4/2011
Report ID: S1101148001

Project: Strata
Lab ID: S1101148-001
Client Sample ID: Office Filter 4th Qtr Composite

Work Order: S1101148
Collection Date: 1/14/2011
Date Received: 1/17/2011
Sampler:
Matrix: Filter

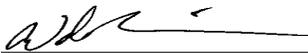
Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
Radiochemistry - Filter						
Lead 210	105 ± 6.1	2		pCi/Filter	01/25/2011 1040 SH	OTW01
Radium 226	0.2 ± 0.2	0.1		pCi/Filter	01/21/2011 1431 SH	SM 7500RAB
Thorium-230	0.2 ± 0.2	0.1		pCi/Filter	01/24/2011 845 WL	ACW10
Uranium	0.1	0.1		pCi/Filter	01/18/2011 1931 MS	EPA 200.8

These results apply only to the samples tested.

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
 - E Value above quantitation range
 - J Analyte detected below quantitation limits
 - M Value exceeds Monthly Ave or MCL
 - O Outside the Range of Dilutions

RL - Reporting Limit

- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

Reviewed by: 
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

CLIENT: Western Water Consultants
1849 Terra
Sheridan, WY 82801

Date Reported: 2/4/2011
Report ID: S1101148001

Project: Strata
Lab ID: S1101148-002
Client Sample ID: East Filter 4th Qtr Composite

Work Order: S1101148
Collection Date: 1/14/2011
Date Received: 1/17/2011
Sampler:
Matrix: Filter

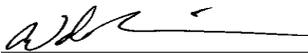
Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
Radiochemistry - Filter						
Lead 210	53.6 ± 4.6	2		pCi/Filter	01/25/2011 1040 SH	OTW01
Radium 226	ND	0.1		pCi/Filter	01/21/2011 1431 SH	SM 7500RAB
Thorium-230	0.3 ± 0.3	0.1		pCi/Filter	01/24/2011 845 WL	ACW10
Uranium	ND	0.1		pCi/Filter	01/18/2011 1934 MS	EPA 200.8

These results apply only to the samples tested.

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
 - E Value above quantitation range
 - J Analyte detected below quantitation limits
 - M Value exceeds Monthly Ave or MCL
 - O Outside the Range of Dilutions

RL - Reporting Limit

- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

Reviewed by: 
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

CLIENT: Western Water Consultants
1849 Terra
Sheridan, WY 82801

Date Reported: 2/4/2011
Report ID: S1101148001

Project: Strata
Lab ID: S1101148-003
Client Sample ID: South Filter 4th Qtr Composite

Work Order: S1101148
Collection Date: 1/14/2011
Date Received: 1/17/2011
Sampler:
Matrix: Filter

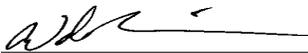
Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
Radiochemistry - Filter						
Lead 210	39.0 ± 4.2	2		pCi/Filter	01/25/2011 1040 SH	OTW01
Radium 226	ND	0.1		pCi/Filter	01/21/2011 1431 SH	SM 7500RAB
Thorium-230	0.5 ± 0.3	0.1		pCi/Filter	01/24/2011 845 WL	ACW10
Uranium	ND	0.1		pCi/Filter	01/18/2011 1945 MS	EPA 200.8

These results apply only to the samples tested.

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
 - E Value above quantitation range
 - J Analyte detected below quantitation limits
 - M Value exceeds Monthly Ave or MCL
 - O Outside the Range of Dilutions

RL - Reporting Limit

- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

Reviewed by: 
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

CLIENT: Western Water Consultants
1849 Terra
Sheridan, WY 82801

Date Reported: 2/4/2011
Report ID: S1101148001

Project: Strata
Lab ID: S1101148-004
Client Sample ID: Met Filter 4th Qtr Composite

Work Order: S1101148
Collection Date: 1/14/2011
Date Received: 1/17/2011
Sampler:
Matrix: Filter

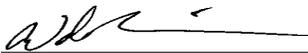
Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
Radiochemistry - Filter						
Lead 210	71.2 ± 5.2	2		pCi/Filter	01/25/2011 1040 SH	OTW01
Radium 226	ND	0.1		pCi/Filter	01/21/2011 1431 SH	SM 7500RAB
Thorium-230	0.1 ± 0.2	0.1		pCi/Filter	02/03/2011 1403 WL	ACW10
Uranium	ND	0.1		pCi/Filter	01/18/2011 1948 MS	EPA 200.8

These results apply only to the samples tested.

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
 - E Value above quantitation range
 - J Analyte detected below quantitation limits
 - M Value exceeds Monthly Ave or MCL
 - O Outside the Range of Dilutions

RL - Reporting Limit

- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

Reviewed by: 
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

CLIENT: Western Water Consultants
1849 Terra
Sheridan, WY 82801

Date Reported: 2/4/2011
Report ID: S1101148001

Project: Strata
Lab ID: S1101148-005
Client Sample ID: Southwest Filter 4th Qtr Composite

Work Order: S1101148
Collection Date: 1/14/2011
Date Received: 1/17/2011
Sampler:
Matrix: Filter

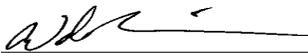
Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
Radiochemistry - Filter						
Lead 210	61.0 ± 4.9	2		pCi/Filter	01/25/2011 1040 SH	OTW01
Radium 226	ND	0.1		pCi/Filter	01/21/2011 1431 SH	SM 7500RAB
Thorium-230	0.2 ± 0.2	0.1		pCi/Filter	01/24/2011 845 WL	ACW10
Uranium	ND	0.1		pCi/Filter	01/18/2011 1952 MS	EPA 200.8

These results apply only to the samples tested.

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
 - E Value above quantitation range
 - J Analyte detected below quantitation limits
 - M Value exceeds Monthly Ave or MCL
 - O Outside the Range of Dilutions

RL - Reporting Limit

- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

Reviewed by: 
Wade Nieuwsma, Assistant Laboratory Manager

Radon Monitoring Report

LANDAUER

SENES CONSULTANTS LTD
 ATTN: STEVE BROWN
 8310 S VALLEY HWY, #3016
 ENGLEWOOD, CO 80112

Landauer, Inc. 2 Science Road Glenwood, Illinois 60425-1586
 Telephone: (800) 528-8327 Facsimile: (708) 755-7048

Acct. No. 0410356

Detector Number	Detector Type	Starting Date	Ending Date	Field Data / Comments	Exposure pCi/-days	Avg. Radon Conc. pCi/l	
4801490	DRNF	15-OCT-10	12-JAN-11	OFFICE	44.3 ±3.23	0.5 ±0.04	
4801491	DRNF	15-OCT-10	12-JAN-11	MET STATION	16.8 ±1.41	0.2 ±0.02	
4801492	DRNF	15-OCT-10	12-JAN-11	SOUTHWEST	42.1 ±4.05	0.5 ±0.05	
4801493	DRNF	15-OCT-10	14-JAN-11	EAST	50.1 ±4.65	0.6 ±0.05	
4801636	DRNF	15-OCT-10	14-JAN-11	SOUTH	58.4 ±4.00	0.6 ±0.04	
4804689	DRNF	15-OCT-10	12-JAN-11	WESLEY	44.1 ±3.45	0.5 ±0.04	
4804690	DRNF	15-OCT-10	12-JAN-11	WOOD	48.2 ±3.68	0.5 ±0.04	
4804691	DRNF	15-OCT-10	12-JAN-11	STRONG	41.3 ±3.27	0.5 ±0.04	
4804692	DRNF	15-OCT-10	14-JAN-11	9	81.0 ±5.37	0.9 ±0.06	
4804693	DRNF	15-OCT-10	14-JAN-11	10	62.6 ±4.47	0.7 ±0.05	

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

RESULTS RELATED ONLY TO MONITORS
 AS RECEIVED BY LANDAUER.

Q.C. Release	Process No.	Report Date	Date Received
LMR	A22106	01-FEB-11	18-JAN-11

PAGE 1 OF 2

Radon Monitoring Report

SENES CONSULTANTS LTD
 ATTN: STEVE BROWN
 8310 S VALLEY HWY, #3016
 ENGLEWOOD, CO 80112

LANDAUER

Landauer, Inc. 2 Science Road Glenwood, Illinois 60425-1586
 Telephone: (800) 528-8327 Facsimile: (708) 755-7048

Acct. No. 0410356

Detector Number	Detector Type	Starting Date	Ending Date	Field Data / Comments	Exposure pCi/d-days	Avg. Radon Conc. pCi/l
4804694	DRNF	15-OCT-10	14-JAN-11	11	48.2 ±3.68	0.5 ±0.04
4804695	DRNF	15-OCT-10	14-JAN-11	12	34.9 ±2.87	0.4 ±0.03
4804696	DRNF	15-OCT-10	12-JAN-11	13	64.9 ±4.59	0.7 ±0.05
4804697	DRNF	15-OCT-10	12-JAN-11	14	51.0 ±3.85	0.6 ±0.04
4804698	DRNF	15-OCT-10	12-JAN-11	15	44.7 ±3.48	0.5 ±0.04
4804699	DRNF	15-OCT-10	12-JAN-11	16	55.6 ±4.10	0.6 ±0.05
4804700	DRNF	15-OCT-10	12-JAN-11	17	43.6 ±3.41	0.5 ±0.04

① RESULTS RELATED ONLY TO MONITORS
 AS RECEIVED BY LANDAUER.

⑤ Q.C. Release LMR	Process No. A22106	Report Date 01-FEB-11	Date Received 18-JAN-11
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⑦ PAGE 2 OF 2

LANDAUER

Landauer, Inc. 2 Science Road Glenwood, Illinois 60425-1586 Telephone: (708) 755-7000 Facsimile: (708) 755-7016

ENVIRONMENTAL / LOW LEVEL DOSIMETRY REPORT

Ross ISR Project

ADDRESS ACCOUNT NO. SERIES CODE
 291488
 ATTN : STEVE BROWN
 SUITE 3016
 8310 SOUTH VALLEY HWY
 ENGLEWOOD, CO 80112

FOR EXPOSURE PERIOD 10/01/2010

NET CUMULATIVE TOTALS (MILLIREMS)

LOCATION ID NUMBER	IDENTIFIER (CLIENT SUPPLIED)	NOTE CODE	EXPOSURE OF DOSIMETER (MILLIREMS AMBIENT DOSE EQUIVALENT)	CALENDAR QUARTER	YEAR TO DATE	PERMANENT	ADJUST-MENTS	NUMBER OF DOSIMETERS REPORTED	INCEPTION DATE OF PERM. TOTAL
			GROSS NET						
000X9	DEPLOY CONTROL	9600183R	28.7						
000X9	DEPLOY CONTROL	9715640R	25.1						
000X9	DEPLOY CONTROL	9727623R	21.3						
00011			32.2	3.5	0.2	0.2		3	/ /
00012			31.5	2.7	0.6	0.6		3	/ /
00013			29.0	0.3	-1.5	-1.5		3	/ /
00014			30.7	1.9	0.4	0.4		3	/ /
00015			29.1	0.3	-0.3	-0.3		3	/ /
00016			30.5	1.8	0.0	0.0		3	/ /
00017			31.7	2.9	2.5	2.5		3	/ /
00018			27.7	-1.0	-1.0	-1.0		1	/ /
00019			30.2	1.5	1.5	1.5		1	/ /
00020			29.2	0.4	0.4	0.4		1	/ /
00021			28.5	-0.2	-0.2	-0.2		1	/ /
00022			28.1	-0.7	-0.7	-0.7		1	/ /
00023			29.8	1.1	1.1	1.1		1	/ /
00024			28.2	-0.5	-0.5	-0.5		1	/ /
00025			26.9	-1.9	-1.9	-1.9		1	/ /
00026			28.4	-0.4	-0.4	-0.4		1	/ /

23

Addendum 2.9-D

Q.C. Release	Process No.	Reported Date	Date Processed	Date Received	Minimum Detectable Dose In This Process, Millirems Ambient Dose Equivalent	PAGE
sb	B36007	01/24/2011	01/22/2011	01/17/2011	0.10	1

LANDAUER

Landauer, Inc. 2 Science Road Glenwood, Illinois 60425-1586 Telephone: (708) 755-7000 Facsimile: (708) 755-7016

ENVIRONMENTAL / LOW LEVEL DOSIMETRY REPORT

Ross ISR Project

ADDRESS ACCOUNT NO. SERIES CODE
291488
ATTN : STEVE BROWN
SUITE 3016
8310 SOUTH VALLEY HWY
ENGLEWOOD, CO 80112

FOR EXPOSURE PERIOD 10/01/2010

NET CUMULATIVE TOTALS (MILLIREMS)

LOCATION ID NUMBER	IDENTIFIER (CLIENT SUPPLIED)	NOTE CODE	EXPOSURE OF DOSIMETER (MILLIREMS AMBIENT DOSE EQUIVALENT)		CALENDAR QUARTER	YEAR TO DATE	PERMANENT	ADJUST-MENTS	NUMBER OF DOSIMETERS REPORTED	INCEPTION DATE OF PERM. TOTAL
			GROSS	NET						
00027			26.8	-1.9	-1.9	-1.9	-1.9	1	/ /	

24

Q.C. Release	Process No.	Reported Date	Date Processed	Date Received	Minimum Detectable Dose In This Process, Millirems Ambient Dose Equivalent	LAST PAGE
sb	B36007	01/24/2011	01/22/2011	01/17/2011	0.10	2

Addendum 2.9-D

291488 291488 X9 QUARTERLY 100110
X9

IML AIR SCIENCE
ATTN RONN SMITH
555 ABSARAKA ST
SHERIDAN WY 82801

IML AIR SCIENCE
ATTN RONN SMITH
555 ABSARAKA ST
SHERIDAN WY 82801

291488 X9 QUARTERLY 100110

IML AIR SCIENCE
ATTN RONN SMITH
555 ABSARAKA ST
SHERIDAN WY 82801

9600183R	000X9 X9	DEPLOY CONTROL	X9	000X9 X9	DEPLOY CONTROL
9600184R	00011 X9		X9	00011 X9	
9600185R	00012 X9		X9	00012 X9	
9600186R	00013 X9		X9	00013 X9	
9600187R	00014 X9		X9	00014 X9	
9600188R	00015 X9		X9	00015 X9	
9600189R	00016 X9		X9	00016 X9	
9600190R	00017 X9		X9	00017 X9	

TOTAL BADGE FOR SERIES X9

8

12/04/2010

RUNNING TOTAL - 825
SHIP GROUP NBR 1025000148

Ross ISR Project

25

Addendum 2.9-D

291488 291488 X9 QUARTERLY 100110
X9

IML AIR SCIENCE
ATTN RONN SMITH
555 ABSARAKA ST
SHERIDAN WY 82801

IML AIR SCIENCE
ATTN RONN SMITH
555 ABSARAKA ST
SHERIDAN WY 82801

291488 X9 QUARTERLY 100110

IML AIR SCIENCE
ATTN RONN SMITH
555 ABSARAKA ST
SHERIDAN WY 82801

9715640R 000X9 X9 DEPLOY CONTROL
9715641R 00018 X9
9715642R 00019 X9
9715643R 00020 X9
9715644R 00021 X9
9715645R 00022 X9
9715646R 00023 X9
9715647R 00024 X9
9715648R 00025 X9

X9 000X9 X9DEPLOY CONTROL
X9 00018 X9
X9 00019 X9
X9 00020 X9
X9 00021 X9
X9 00022 X9
X9 00023 X9
X9 00024 X9
X9 00025 X9

TOTAL BADGE FOR SERIES X9
9

12/04/2010

RUNNING TOTAL - 10
SHIP GROUP NBR 1027100002P

Ross ISR Project

26

Addendum 2.9-D

291488 291488 X9 QUARTERLY 100110
X9

291488 X9 QUARTERLY 100110

IML AIR SCIENCE
ATTN RONN SMITH
555 ABSARAKA ST
SHERIDAN WY 82801

IML AIR SCIENCE
ATTN RONN SMITH
555 ABSARAKA ST
SHERIDAN WY 82801

IML AIR SCIENCE
ATTN RONN SMITH
555 ABSARAKA ST
SHERIDAN WY 82801

9727623R 000X9 X9 DEPLOY CONTROL
9727624R 00026 X9
9727625R 00027 X9

X9 000X9 X9DEPLOY CONTROL
X9 00026 X9
X9 00027 X9

TOTAL BADGE FOR SERIES X9
3

12/04/2010

RUNNING TOTAL - 4
SHIP GROUP NBR 1027400002P

Ross ISR Project

27

Addendum 2.9-D