

Environmental Management - Grand Junction Office



Environmental Air Monitoring Data
Quarterly Report for the Moab and
Crescent Junction, Utah, Sites
Fourth Quarter 2009
(October through December 2009)

March 2010



U.S. Department
of Energy

Office of Environmental Management

**Moab UMTRA Project
Environmental Air Monitoring Data
Quarterly Report for the Moab and
Crescent Junction, Utah, Sites
Fourth Quarter 2009
(October through December 2009)**

March 2010

**Moab UMTRA Project
Environmental Air Monitoring Data
Quarterly Report for the Moab and
Crescent Junction, Utah, Sites
Fourth Quarter 2009**

Revision 0

Review and Approval

Edward B. Baker

Edward B. Baker
RAC Environmental Compliance Manager

March 8, 2010
Date

Lawrence M. Brede / LMB

Lawrence M. Brede
RAC Project Manager

08 MAR 10
Date

Revision History

Revision No.	Date	Reason/Basis for Revision
0	March 2010	Initial issue.

Table of Contents

Section	Page
Acronyms and Abbreviations	iv
1.0 Summary of Results.....	1
1.1 Moab, Utah, Site	1
1.2 Crescent Junction, Utah, Site	5
2.0 Data Assessment.....	7
2.1 Data Assessment Summary.....	7
2.2 Environmental Air Monitoring Field Activities Verification Checklist.....	11
3.0 Environmental Air Monitoring Data	13
3.1 Environmental Air Monitoring Data Summary	13
4.0 References.....	14

Figures

Figure 1. Off-site Radon, Direct Gamma, and Radioparticulate Monitoring Locations.....	3
Figure 2. On-site Radon, Direct Gamma, and Radioparticulate Monitoring Locations	4
Figure 3. Sampling Location Map for the Crescent Junction Site	9
Figure 4. Moab Radioparticulate Concentration (Po-210).....	15
Figure 5. Moab Radioparticulate Concentration (Th-230).....	16
Figure 6. Moab Radioparticulate Concentration (Ra-226).....	17
Figure 7. Moab Radioparticulate Concentration (Uranium)	18
Figure 8. Moab Atmospheric Radon-222 Concentration	19
Figure 9. Moab Direct Gamma Radiation Dose.....	20
Figure 10. Crescent Junction Radioparticulate Concentration (Po-210).....	21
Figure 11. Crescent Junction Radioparticulate Concentration (Th-230)	22
Figure 12. Crescent Junction Radioparticulate Concentration (Ra-226)	23
Figure 13. Crescent Junction Radioparticulate Concentration (Uranium).....	24
Figure 14. Crescent Junction Atmospheric Radon-222 Concentration.....	25
Figure 15. Crescent Junction Direct Gamma Radiation Dose.....	26

Tables

Table 1. Moab Environmental Air Monitoring Locations with Samples that Exceeded Applicable Regulatory Standards, Limits, or Guidelines During 2009	1
Table 2. Summary of Environmental Radon-222 and Gamma Radiation Monitoring Data for the Moab Site for Calendar Year 2009.....	2
Table 3. Summary of Radioparticulate Air Monitoring Data for the Moab Site for Calendar Year 2009	6
Table 4. Summary of Environmental Radon-222 and Gamma Radiation Monitoring Data for the Crescent Junction Site for Calendar Year 2009	8
Table 5. Summary of Radioparticulate Air Monitoring Data for the Crescent Junction Site for Calendar Year 2009.....	8

Acronyms and Abbreviations

DCG	Derived Concentration Guideline
DOE	U.S. Department of Energy
DOE O	U.S. Department of Energy Order
EPA	Environmental Protection Agency
MEI	maximally exposed individual
mrem/qtr	millirems per quarter
mrem/yr	millirems per year
pCi/L	picocuries per liter
RIN	report identification number
SAP	Sampling and Analysis Plan
TLD	thermoluminescent dosimeter
UMTRA	Uranium Mill Tailings Remedial Action

1.0 Summary of Results

1.1 Moab, Utah, Site

Sampling Period: October through December 2009

Atmospheric Radon-222

U.S. Department of Energy (DOE) Order (O) 5400.5, "Radiation Protection of the Public and Environment," establishes a guideline for atmospheric emissions of radon-222 that is applicable to the Moab Uranium Mill Tailings Remedial Action (UMTRA) Project. This guideline is 3.0 picocuries per liter (pCi/L) above background. Based on 5 years of data from 2003 through 2008, background concentrations of radon-222 in the Moab area have been established at 0.7 pCi/L; therefore, the guideline for radon-222 emissions at the Moab site is 3.7 pCi/L. Monitoring data collected during the fourth quarter of 2009 indicate that this guideline was exceeded at three on-site monitoring locations in close proximity to the tailings pile. The DOE guideline concentration was not exceeded at any off-site location during the fourth quarter. In general, fourth quarter results were higher than third quarter and similar to historic winter time data. Refer to Tables 1 and 2 for a review of radon-222 data for the Moab site. Sample locations for the Moab site are presented in Figures 1 and 2.

Table 1. Moab Environmental Air Monitoring Locations with Samples that Exceeded Applicable Regulatory Standards, Limits, or Guidelines During 2009

Analyte	Standard/Guideline	Sample Locations Exceeding Standards/Guidelines During Fourth Quarter 2009	Sampling Locations Exceeding Standards/Guidelines During 2009 [†]
Radon-222	3.7 pCi/L	0106, 0107, 0108	0106, 0107, 0108, 0110, 0128
Direct Gamma Radiation	182 mrem/yr (45.5 mrem/qtr)	0106, 0109, 0110	0101, 0105, 0106, 0107, 0108, 0109, 0110, 0111, 0112, 0125

[†]Annual exceedance is estimated based on calculated year of data.
mrem/yr = millirems per year; mrem/qtr = millirems per quarter

Direct Environmental Gamma Radiation

DOE O 5400.5 establishes a dose limit of 100 millirems per year (mrem/yr) above naturally occurring gamma levels (background). Background gamma radiation for the Moab area has been established at 82 mrem/yr; therefore, the gamma dose limit for the Moab site is 182 mrem/yr (45.5 mrem/quarter [qtr]). Based on the monitoring data collected during the fourth quarter of 2009, three on-site monitoring locations exceeded the gamma dose limit, and no off-site monitoring location exceeded the quarterly gamma radiation dose limit. Fourth quarter analytical results were lower than the third quarter and similar to historic data, with the exception of stations 0108, 0109, and 0110 (located near the tailings pile excavation), which indicate tailing pile influence on the DOE property. Based on third and fourth quarter results, it appears the second quarter results were an anomaly. Because all quality assurance checks indicate data was valid, the second quarter data cannot be removed from the database. Refer to Tables 1 and 2 for a review of gamma data for the Moab site.

Radon-222 and Direct Gamma Conclusion

Although the exposure rates were exceeded at several locations on the DOE site property boundary, this does not reflect elevated doses to the public. These data represent the exposure that a member of the public could receive if he or she resided at the point where the data were collected for an entire year. This is not a realistic representation of actual or expected public exposure conditions, because no member of the public permanently resides at or near these locations of elevated readings. Monitoring data observed at the maximally exposed individual (MEI) location, just east of the Moab site, represents the greatest potential exposure to a member of the public. The gamma dose limit established by DOE was not exceeded at the MEI location.

Table 2. Summary of Environmental Radon-222 and Gamma Radiation Monitoring Data for the Moab Site through Fourth Quarter, Calendar Year 2009

Station Number	1st Quarter 2009		2nd Quarter 2009		3rd Quarter 2009		4th Quarter 2009		2009 Annual Average	
	Radon pCi/L	Gamma mrem/91 d ³	Radon pCi/L	Gamma mrem/yr						
On-site Locations										
0101	2.2	31.93	1.3	47.05	2.1	31.99	2.8	27.38	2.1	138.35
0102	1.6	20.98	0.9	35	1.3	19.38	1.5	17.76	1.33	93.12
0103	1.8	21.24	1.2	38.3	1.2	19.28	1.9	16.83	1.53	95.65
0104	2.7	25.57	1.4	45.07	1.7	23.01	2.1	20.5	1.98	114.15
0105	3.4	41.94	2.1	60.42	2.2	41.56	3.7	40.81	2.85	184.73
0106	7.1	44.1	4.2	62.88	5.2	41.71	6.3	48.14	5.7	196.83
0107	6.7	33.08	3.9	60.07	4.6	34.2	5.2	33.06	5.1	160.41
0108	3.6	42.7	3.4	60.53	4.7	44.74	4.3	41.78	4	189.75
0109	1.2	52.7	2.3	79.15	2.7	67.59	2.9	78.61	2.28	278.05
0110	2.5	62.33	4	91.98	2.5	88.48	2.4	77.23	2.85	320.02
0111 ⁴	1.2	59.96	1.4	69.4	1	33.1	1	26.84	1.15	189.3
0112	1.9	34.35	NDA	53.54	2	42.59	2.6	37.67	2.2	168.15
0113	2.2	25.91	1.4	41.01	2.7	26.73	3.1	23.93	2.35	117.58
Off-site Locations										
0117 ¹	0.8	20.21	0.6	39.94	0.8	19.16	0.8	NDA	0.75	106
0118	0.8	18.84	0.5	32.09	0.6	18.15	0.7	17.12	0.65	86.2
0119 ²	0.9	18.27	NDA	41.3	0.7	17.66	0.8	18.77	0.8	96
0120	1	17.06	0.6	33.61	0.6	15.92	0.7	16.67	0.073	83.26
0121	0.6	18.82	0.7	36.41	0.8	17.59	0.6	16.02	0.068	88.84
0122	0.5	17.99	1	35.69	0.3	16.35	0.5	13.92	0.058	83.95
0123 ¹	0.4	18.49	0.5	35.28	0.3	17.58	0.4	12.96	0.4	84.31
0124	1.7	20.69	0.6	40.59	1	20.14	1.1	20.88	1.1	102.3
0125	2.1	24.5	2	47.08	1.7	23.63	1.9	26.5	1.93	121.71
0126	2.8	22.51	1.1	35.05	1.7	20.99	2.4	19.99	2	98.54
0127	1.2	21.16	1	40.51	0.7	20.18	0.8	20.45	0.093	102.3
0128	4	22.42	2.2	39.16	2.5	22.24	2.9	21.03	2.9	104.85
0129	1.8	20.95	1.5	40.15	2	21.88	1.9	21.7	1.8	104.68
MEI ²	1.1	18	0.8	32.52	0.9	17.34	1.4	14.24	1.05	82.1

¹Designated background monitoring locations. Background locations are sufficiently distant from the millsite to be free of any influences from potential site contaminants.

²The MEI is the continually occupied residential property that is closest to the DOE property boundary.

³mrem value is prorated to a 91-day exposure period.

⁴Station was temporary relocated during the 1st and 2nd quarters of 2009 due to construction on the bench. During the 3rd quarter of 2009, it was back on the bench.

NDA= No Data available

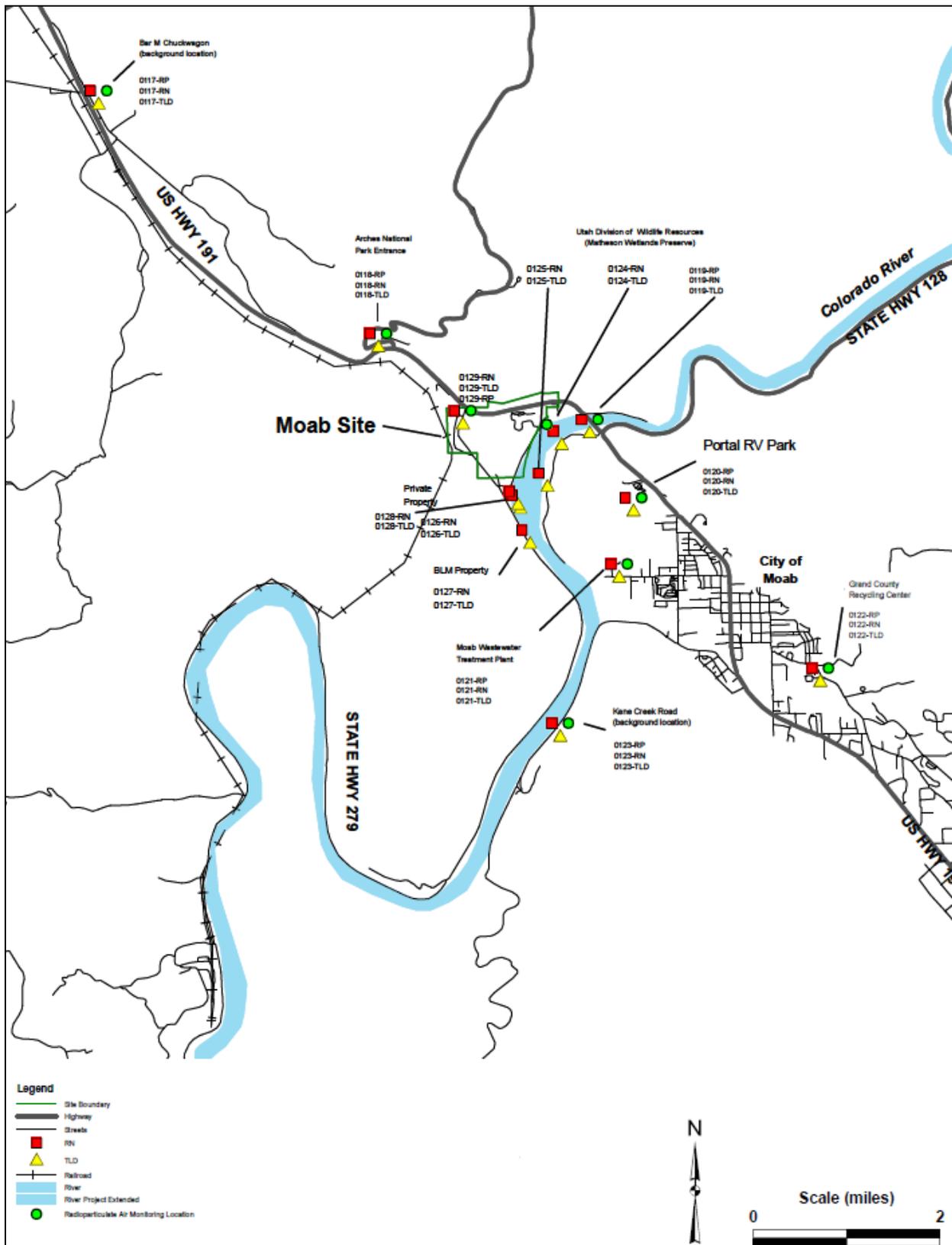


Figure 1. Off-site Radon, Direct Gamma, and Radioparticulate Monitoring Locations

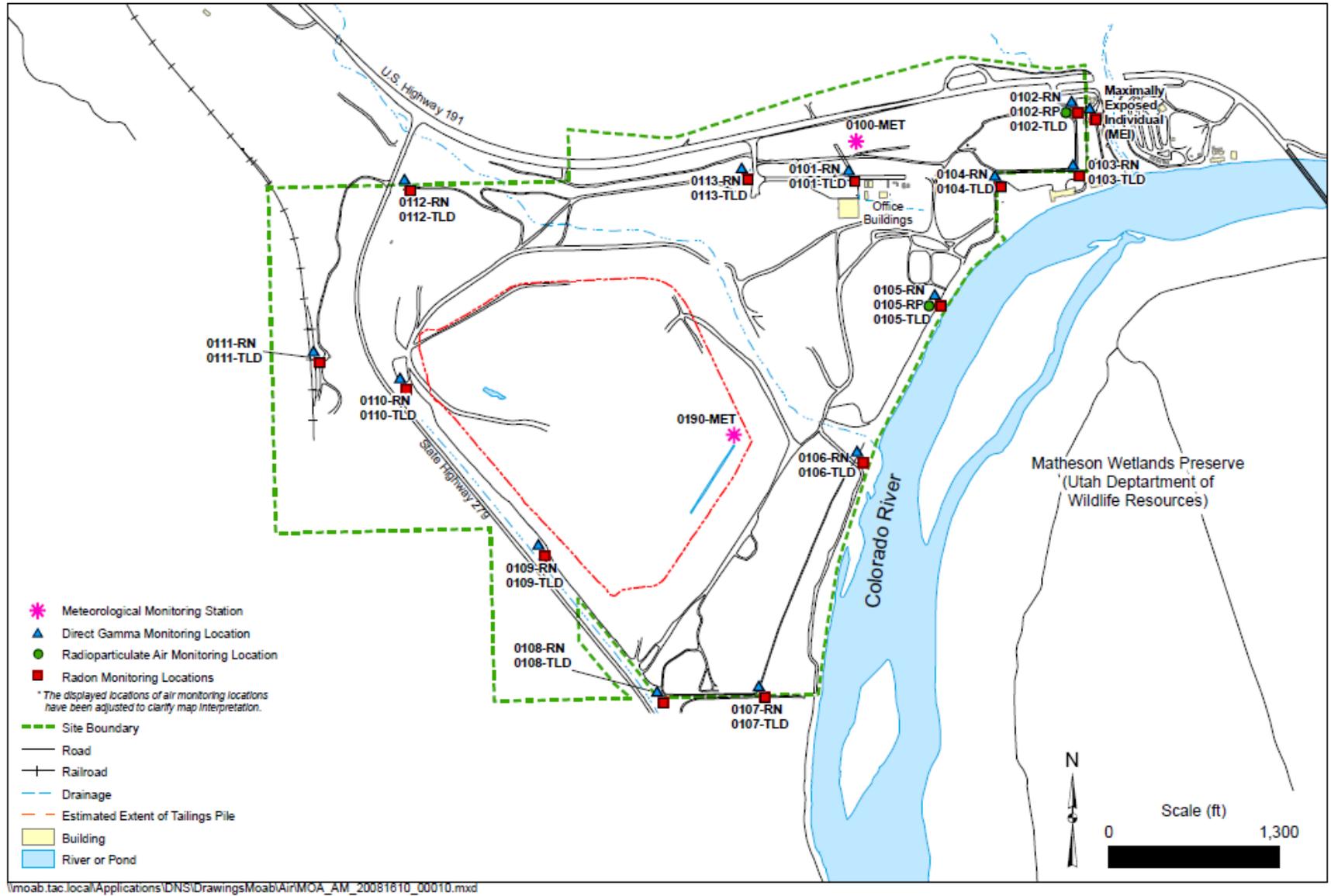


Figure 2. On-site Radon, Direct Gamma, and Radioparticulate Monitoring Locations

Radioparticulates

No standards or radiological exposure limits were exceeded at any of the 10 radioparticulate monitoring locations at the Moab site during the fourth quarter of 2009. Analytical data for all analytes (radium-226, thorium-230, polonium-210, and total uranium) were below their respective Derived Concentration Guidelines (DCGs), as found in DOE O 5400.5. Concentrations of the radioparticulates have been consistently below DCGs since DOE assumed ownership of the site in 2001. DOE O 5400.5 also requires that the radiological dose resulting from airborne emissions is less than 10 mrem/yr. All off-site sampling results, when converted to dose using the relationship of measured concentration divided by DCG concentration times 100 mrem/yr, were significantly lower than the DOE DCG value of 10.0 mrem/yr.

During the fourth quarter of 2009, the on-site dose resulting from airborne emissions, excluding background, was 1.43 mrem/yr at location 0102 and 3.13 mrem/yr at location 0105. Off-site locations 0117 and 0129 were 0.98 mrem/yr and 3.16 mrem/yr, respectively. Although results are well below the guideline, stations closer to the operations (0105 and 0129) indicate higher results than more remote stations (0102 and 0117). Refer to Table 3 for a review of radioparticulate air monitoring data for the Moab site.

1.2 Crescent Junction, Utah, Site

Sampling Period: October through December 2009

Atmospheric Radon-222

DOE O 5400.5 establishes a guideline for atmospheric emissions of radon-222 that will be applicable to the Crescent Junction site (3.0 pCi/L above background). Shipment of uranium mill tailings to the Crescent Junction disposal cell commenced in the second quarter of 2009. Based on 3 years of data from 2006 through 2009, background concentrations of radon-222 in the Crescent Junction area have been established at 0.9 pCi/L; therefore, the guideline for radon-222 emissions at the Crescent Junction site is 3.9 pCi/L. During the fourth quarter of 2009, none of the on-site or off-site stations exceeded the guideline. Sample locations for the Crescent Junction site are presented in Figure 3. Radon-222 and direct gamma radiation for the Crescent Junction site are summarized in Table 4, and radioparticulate data for the Crescent Junction site are summarized in Table 5.

Direct Environmental Gamma Radiation

DOE O 5400.5 establishes a dose limit of 100 mrem/yr above naturally occurring gamma levels (background). The gamma dose limit for the Crescent Junction site is 192.5 mrem/yr (48.1 mrem/qtr) based on background data from all stations for 2006 to 2009. During the fourth quarter of 2009, none of the on-site or off-site stations exceeded the annual or quarterly gamma radiation dose limit. Refer to Table 5 for a review of gamma data for the Crescent Junction site.

Radioparticulates

DOE O 5400.5 establishes DCGs for concentrations of radioparticulates in air. Concentrations of the radioparticulates have been consistently below DCGs since DOE assumed ownership of the site in 2006. During the fourth quarter of 2009, the on-site dose resulting from airborne emissions, excluding background, was 1.14 mrem/yr at location 0308 and 0.98 mrem/yr at off-site location 0306. Refer to Table 5 for a review of radioparticulate air monitoring data for the Crescent Junction site.

Table 3. Summary of Radioparticulate Air Monitoring Data for the Moab Site for Calendar Year 2009

Station Number	Isotope	1st Quarter 2009 (µCi/mL)	2nd Quarter 2009 (µCi/mL)	3rd Quarter 2009 (µCi/mL)	4th Quarter 2009 (µCi/mL)	Annual Average (µCi/mL)
On-site Locations						
0102-RP	Uranium ¹	1.4E-16	1.9E-16	2.6E-16	1.70E-16	1.9E-16
	Thorium-230 ²	1.1E-16	1.8E-16	2.2E-16	2.0E-16	1.8E-16
	Radium-226 ³	9.6E-17	9.7E-17	1.3E-16	1.6E-16	1.2E-16
	Polonium-210 ⁴	1.0E-14	4.6E-15	6.7E-15	9.1E-15	7.7E-15
0105-RP	Uranium ¹	2.6E-16	4.1E-16	6.6E-16	3.8E-16	4.3E-16
	Thorium-230 ²	2.0E-16	3.5E-16	6.4E-16	6.6E-16	4.6E-16
	Radium-226 ³	1.6E-16	7.6E-17	3.0E-16	5.8E-16	2.8E-16
	Polonium-210 ⁴	1.2E-14	5.6E-15	6.7E-15	1.4E-14	9.5E-15
Off-site Locations						
0117-RP	Uranium ¹	1.1E-16	1.5E-16	1.6E-16	1.3E-16	1.4E-16
	Thorium-230 ²	8.3E-17	1.7E-16	7.8E-17	8.3E-17	1.0E-16
	Radium-226 ³	5.9E-17	3.3E-18	5.2E-17	8.8E-17	5.1E-17
	Polonium-210 ⁴	8.3E-15	3.9E-15	5.6E-15	7.6E-15	6.3E-15
0118-RP	Uranium ¹	1.6E-16	2.0E-16	2.5E-16	1.5E-16	1.9E-16
	Thorium-230 ²	1.3E-16	2.9E-16	4.4E-16	2.0E-16	2.7E-16
	Radium-226 ³	4.8E-17	-2.4E-17	4.5E-16	1.6E-16	1.6E-16
	Polonium-210 ⁴	9.9E-15	3.8E-15	5.8E-15	9.1E-15	7.1E-15
0119-RP	Uranium ¹	1.4E-16	3.1E-16	2.7E-16	1.8E-16	2.2E-16
	Thorium-230 ²	1.3E-16	2.4E-16	2.0E-16	1.4E-16	1.8E-16
	Radium-226 ³	5.1E-17	1.9E-16	9.4E-17	9.1E-17	1.1E-16
	Polonium-210 ⁴	9.6E-15	4.2E-15	5.6E-15	8.2E-15	6.9E-15
0120-RP	Uranium ¹	1.3E-16	1.8E-16	1.9E-16	1.6E-16	1.7E-16
	Thorium-230 ²	1.1E-16	1.7E-16	1.1E-16	1.5E-16	1.3E-16
	Radium-226 ³	7.8E-17	1.1E-16	8.6E-17	2.1E-17	7.4E-17
	Polonium-210 ⁴	8.8E-15	3.6E-15	6.1E-15	8.4E-15	6.7E-15
0121-RP	Uranium ¹	1.6E-16	1.6E-16	1.8E-16	1.3E-16	1.6E-16
	Thorium-230 ²	4.3E-17	1.1E-16	1.3E-16	1.1E-16	9.7E-17
	Radium-226 ³	5.8E-17	4.2E-17	9.3E-17	1.3E-16	8.1E-17
	Polonium-210 ⁴	9.2E-15	4.3E-15	5.4E-15	7.6E-15	6.6E-15
0122-RP	Uranium ¹	1.4E-16	1.7E-16	1.6E-16	1.6E-16	1.6E-16
	Thorium-230 ²	1.1E-16	9.5E-17	1.1E-16	1.4E-16	1.1E-16
	Radium-226 ³	3.2E-17	8.3E-17	1.0E-16	1.3E-16	8.7E-17
	Polonium-210 ⁴	8.9E-15	3.4E-15	5.1E-15	7.9E-15	6.3E-15
0123-RP	Uranium ¹	1.2E-16	1.7E-16	1.6E-16	1.4E-16	1.5E-16
	Thorium-230 ²	1.3E-16	1.3E-16	1.3E-16	1.2E-16	1.3E-16
	Radium-226 ³	9.0E-18	5.5E-17	1.3E-16	1.0E-16	7.4E-17
	Polonium-210 ⁴	9.3E-15	3.9E-15	5.6E-15	8.5E-15	6.8E-15

Table 3. Summary of Radioparticulate Air Monitoring Data for the Moab Site for Calendar Year 2009 (continued)

Station Number	Isotope	1st Quarter 2009 (μCi/mL)	2nd Quarter 2009 (μCi/mL)	3rd Quarter 2009 (μCi/mL)	4th Quarter 2009 (μCi/mL)	Annual Average (μCi/mL)
Off-site Locations (continued)						
0129-RP	Uranium ¹	3.2E-16	2.8E-16	6.7E-16	4.4E-16	4.3E-16
	Thorium-230 ²	2.5E-16	3.8E-16	2.0E-15	8.0E-16	8.6E-16
	Radium-226 ³	1.2E-16	2.3E-16	1.1E-15	4.0E-16	4.7E-16
	Polonium-210 ⁴	1.1E-14	4.2E-15	7.5E-15	1.1E-14	8.2E-15

¹DOE DCG for total uranium = 2.E-12

²DOE DCG for thorium-230 = 4.E-14

³DOE DCG for radium-226 = 1.E-12

⁴DOE DCG for polonium-210 = 1.E-12

μCi/mL = microcuries per milliliter

2.0 Data Assessment

2.1 Data Assessment Summary

Atmospheric Radon-222 Analyses

Radon detectors were analyzed by Landauer Inc., in accordance with Landauer's *Quality Assurance Manual for Radon Monitoring Services* (March, 2004). Fourth quarter 2009 analytical radon-222 data were received in a report dated January 25, 2010. Unlike radioparticulate analyses, radon-222 data are not reported with qualifiers from the laboratory. When detectors were either missing, damaged, or could not be read, the laboratory noted an explanation for the stations. After the data report was received, the data were evaluated for consistency with other data points and sample duplicates. Data was determined to be valid and was entered into the data base.

Direct Environmental Gamma Radiation Analyses

Thermoluminescent dosimeters (TLDs) are used for continuous dose measurements and are analyzed by Environmental, Inc., Midwest Laboratory in accordance with their analytical procedure *Preparation and Readout of Teledyne Isotopes TLD Card, TIML-TLD-01* (Teledyne Isotopes, 2001). Fourth quarter 2009 environmental gamma radiation data were received in a report dated January 20, 2010. After the laboratory results were received, the data were evaluated for consistency, and compared to historic data and duplicates. TLDs from two stations were lost after collection and data were noted as "No Data Available". Remaining data were valid and entered into the data base.

Radioparticulate Analyses

ALS Laboratory Group in Fort Collins, Colorado, analyzed the radioparticulate samples for radium-226, thorium-230, polonium-210, and total uranium. Results for the fourth quarter 2009 sampling period are in Report Identification Number (RIN) 1001001. Polonium-210 and isotopic thorium (includes thorium-230) were analyzed by alpha spectroscopy, method PA-SOP714R10. Radium-226 was analyzed by radon emanation methods, Environmental Protection Agency (EPA) method 903.1(m). Total uranium was analyzed by inductively coupled plasma-mass spectrometry, EPA method SW-846 6020A, procedure PA SOP827 Revision 5. Radioparticulate

analytical data for samples collected during the fourth quarter of 2009 were received January 4, 2010, and were reviewed, validated, and summarized in the *Data Review and Validation Report for RIN 1001001* dated February 17, 2010.

Table 4. Summary of Environmental Radon-222 and Gamma Radiation Monitoring Data for the Crescent Junction Site through Fourth Quarter, Calendar Year 2009

Station Number	1st Quarter 2009		2nd Quarter 2009		3rd Quarter 2009		4th Quarter 2009		2009 Annual Average	
	Radon pCi/L	Gamma mrem	Radon pCi/L	Gamma mrem/yr						
0301	1.1	23.2	0.9	37.9	1	21.73	0.8	14.8	0.95	97.63
0302	NDA	21	0.9	38.2	NDA	20.28	0.6	14.2	0.75	93.68
0303	NDA ¹	23.9	1.3	41.1	0.7	23.71	1	17.5	1	106.21
0304	0.9	26	1.4	35.6	0.9	24.51	1.1	14.8	1.08	100.91
0305	0.8	26.4	0.9	38.6	1	26.5	0.8	NDA	0.88	122
0306	0.8	24.9	0.6	39.3	0.7	23.4	0.5	16.6	0.65	104.2
0307	0.4	25.4	0.8	41.9	0.6	25.09	0.7	18	0.63	110.39
0308	0.7	16	0.6	32.3	0.5	15	0.7	11.1	0.63	74.4

NDA= No Data Available

¹Radon cup found on ground

Table 5. Summary of Radioparticulate Air Monitoring Data for the Crescent Junction Site through Fourth Quarter Calendar Year 2009

Station Number	Isotope	1st Quarter 2009 (µCi/mL)	2nd Quarter 2009 (µCi/mL)	3rd Quarter 2009 (µCi/mL)	4th Quarter 2009 (µCi/mL)	Annual Average (µCi/mL)
0306-RP	Uranium ¹	1.1E-16	1.3E-16	1.4E-16	1.2E-16	1.2E-16
	Thorium-230 ²	1.3E-16	9.9E-17	8.5E-17	9.1E-17	1.0E-16
	Radium-226 ³	3.6E-17	4.8E-17	5.6E-17	9.3E-17	5.8E-17
	Polonium-210 ⁴	7.8E-15	3.9E-15	6.5E-15	7.4E-15	6.4E-15
0307-RP	Uranium ¹	1.3E-16	1.2E-16	2.6E-16	1.7E-16	1.7E-16
	Thorium-230 ²	3.7E-17	1.2E-16	1.5E-16	1.3E-16	1.1E-16
	Radium-226 ³	2.0E-17	2.3E-17	9.7E-17	6.8E-17	5.2E-17
	Polonium-210 ⁴	7.5E-15	3.4E-15	5.5E-15	7.1E-15	5.9E-15
0308-RP	Uranium ¹	1.4E-16	2.1E-16	3.9E-16	1.9E-16	1.8E-16
	Thorium-230 ²	8.9E-17	1.9E-16	5.9E-16	1.5E-16	1.2E-16
	Radium-226 ³	8.9E-17	1.7E-16	2.6E-16	1.2E-16	8.0E-17
	Polonium-210 ⁴	6.5E-15	4.6E-15	6.2E-15	7.4E-15	7.4E-15

¹DOE DCG for Total Uranium = 2.E-12

²DOE DCG for Thorium-230 = 4.E-14

³DOE DCG for Radium-226 = 1.E-12

⁴DOE DCG for Polonium-210 = 1.E-12

µCi/mL = microCuries per milliliter

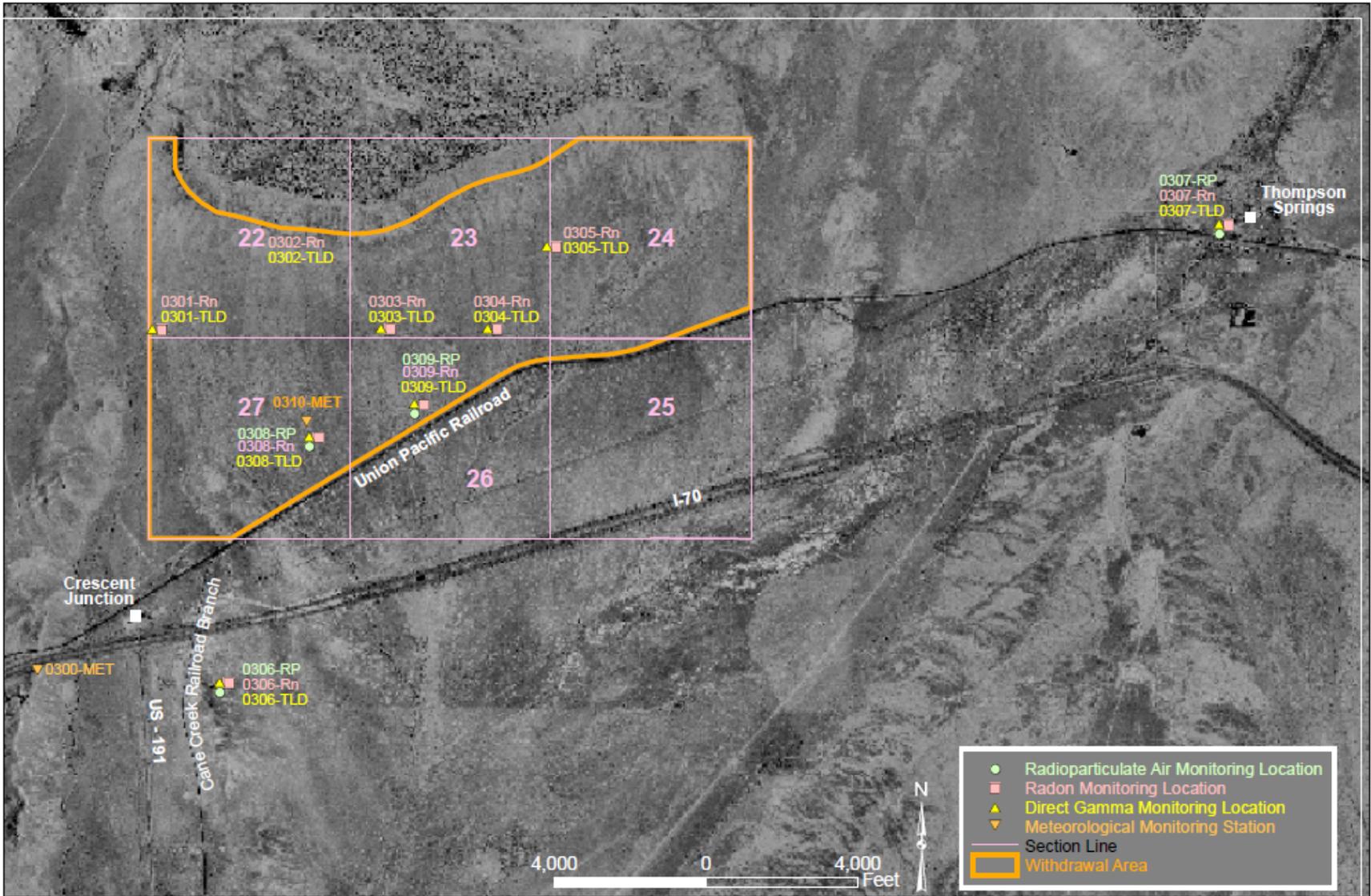


Figure 3. Sampling Location Map for the Crescent Junction Site

Field Activities

Duplicate samples for radon-222 monitoring were collected at three locations: (1) 0108, an on-site location at the southern property line of the Moab site; (2) 0111, an on-site location at the western property line near the rail load-out location; and (3) 0121, a background monitoring location approximately 2 miles southeast of the Moab site. Duplicate measurements of direct gamma were made at two Moab locations: (1) 0108, an on-site location with consistently elevated readings; and (2) 0129, an off-site location near the property boundary. Duplicate radon-222 measurements were made at Crescent Junction locations 0303 and 0308. A duplicate of radon-222 for 0306 was used as 0309 location. Duplicate direct gamma measurements were made at Crescent Junction locations 0301. A duplicate of direct gamma for 0305 location was moved to 0309 location.

Duplicates are not being collected for radioparticulate samples per the *Environmental Air Monitoring Sampling and Analysis Plan for the Moab Project Site and Crescent Junction Disposal Site, Utah* (DOE-EM/GJRAC1434) (SAP). All of the radioparticulate isotopes collected to date are significantly below their respective DCGs. Consequently, the costs associated with purchasing a duplicate sampler, providing additional electrical power, and incurring additional analytical expenses are not justified.

Suspected Anomalies

All analytical data are reviewed for anomalous or outlying data points. No anomalous data was noted for the fourth quarter. Direct gamma data was similar to historic data and indicate second quarter data was an anomaly. The only significant data change for the fourth quarter was elevated gamma readings for stations 0109 and 0110, which are close to the tailing pile excavation activity. Also, it should be noted that station 0111 was relocated during first and second quarter construction and returned to the railroad bench for the third quarter, resulting in lower gamma reading. The quarterly review consists of evaluating monitoring data against historical and minimum/maximum values to determine if the reported data are within reasonable expected ranges.

In addition, radioparticulate validation was performed by a third party (Pro2Serve) prior to data entry (into the SeePro database).

Summary

Data collected during the fourth quarter of 2009 met the applicable laboratory control criteria for their respective analyses, and all data were reviewed by qualified personnel. The results were found to be within the acceptable limits associated with each matrix. Data reported in this environmental air monitoring report are considered validated and may be treated as final results.

2.2 Environmental Air Monitoring Field Activities Verification Checklist

Project	Moab/Crescent Junction, Utah	Date(s) of Air Sampling	October through December 2009
Date(s) of Verification	February 17, 2010	Name of Verifier	Ed Baker/Melvin Capitan

	Response (Yes, No, NA)	Comments
1. Is the SAP the primary document directing field procedures?	Yes	
2. Were the sampling locations specified in the SAP?	Yes	
3. Were low-volume air samplers operating at or near 60 liters/minute \pm 10%?	Yes	
4. Did any of the samplers require airflow adjustment?	No	All pumps were recalibrated to 60 liters/minute both at the beginning and the end of the sampling period.
5. Were detectors (radon cups, TLDs) and monitoring equipment found to be undisturbed and in operable condition upon arrival?	Yes	After collection, TLDs from 0117 and 0305 were lost.
6. Were the hourly clocks on the low-volume air samplers operational upon arrival?	Yes	
7. Were the run times recorded for each radioparticulate monitoring location?	Yes	
8. Were duplicates (for radon-222 and gamma radiation) taken at a frequency of one per 20 samples?	Yes	
9. Were filter blanks (for radioparticulates) taken at a frequency of one per 20 samples?	No	Not required per SAP.
10. Were trip blanks (for radon-222 and gamma radiation) included with each shipment?	No	A trip blank is not used for the radon-222 monitoring; however, a trip blank was used for the direct gamma radiation monitoring.
11. Was the identity of the quality-control sample locations protected?	Yes	

2.2 Environmental Air Monitoring Field Activities Verification Checklist (continued)

Project	<u>Moab/Crescent Junction, Utah</u>	Date(s) of Air Sampling	<u>October through December 2009</u>
Date(s) of Verification	<u>February 17, 2010</u>	Name of Verifier	<u>Ed Baker/Melvin Capitan</u>
		Response (Yes, No, NA)	Comments
12. Were the true locations of the quality-control samples recorded in the Field Log Book?		<u>Yes</u>	
13. Were all samples collected as specified in the SAP?		<u>Yes</u>	
14. Were chain of custody records completed, and was sample custody maintained?		<u>Yes</u>	
15. Are field data sheets signed and dated by sampling personnel?		<u>Yes</u>	
16. Was all other pertinent information documented on the field data sheets?		<u>Yes</u>	

3.0 Environmental Air Monitoring Data

3.1 Environmental Air Monitoring Data Summary

Radon-222 and direct gamma radiation for the Moab site are summarized in Table 2 (Section 1), and radioparticulate data for the Moab site are summarized in Table 3 (Section 1). Radon-222 and direct gamma radiation for the Crescent Junction site are summarized in Table 4 (Section 2), and radioparticulate data for the Crescent Junction site are summarized in Table 5 (Section 2).

Time-concentration graphs for each analyte sampled at the Moab site are presented in Figures 4 through 9. Time-concentration graphs for each analyte sampled at the Crescent Junction site are presented in Figures 10 through 15. After mill tailings disposal began, location 0306 became the MEI location. Location 0307, approximately 5 miles east of the disposal site, will probably represent the second greatest risk (second to the MEI location), and locations 0301 through 0305 will provide property line data for the disposal site. Time-concentration graphs have been plotted only for selected locations for each matrix. The rationale used for selecting each location is summarized below.

Radon-222 and Direct Gamma Radiation

Radon-222 and gamma radiation data have been graphed (Figures 8 and 9, respectively) for the following Moab site locations: (1) location MEI, which is considered to represent the greatest potential exposure scenario to a member of the public; (2) location 0108, which is on the southern property boundary of the Moab site and occasionally has high radon levels; (3) location 0106, which is along the southeastern property boundary and has recorded high direct gamma radiation; (4) location 0117, which is approximately 5 miles northwest of the Moab site property and is a background monitoring location; and (5) location 0120, which is near the Portal RV Park, approximately 1 mile southeast of the Moab site, and represents a second potential exposure to the public.

Radioparticulates

Radioparticulate monitoring data have been graphed (Figures 4 through 7) for the following Moab site locations: (1) location 0102, one of two on-site radioparticulate monitoring locations, is the radioparticulate sampling location closest to the MEI; (2) location 0105, which is closest to the emissions source (i.e., the mill tailings pile) and is at the site boundary adjacent to the Colorado River and the Matheson Wetlands Preserve; (3) location 0117 (near the Bar-M Chuckwagon), which is a background monitoring location approximately 5 miles northwest of the Moab site property and represents ambient or naturally occurring conditions; and (4) location 0120 (near the Portal RV Park), which is approximately 1 mile southeast of the Moab site and represents the second greatest risk (second to the MEI location) for off-site exposure to a member of the public.

4.0 References

Data Review and Validation Report for RIN 1001001, ALS Laboratory Group, Fort Collins, Colorado, February, 2010.

DOE (U.S. Department of Energy). *Environmental Air Monitoring Sampling and Analysis Plan for the Moab Project Site and Crescent Junction Disposal Site, Utah* (DOE-EM/GJ1434-2009), November, 2009.

DOE (U.S. Department of Energy) Order 5400.5, "Radiation Protection of the Public and Environment."

Preparation and Readout of Teledyne Isotopes TLD Card, TIML-TLD-01, Revision 7
Environmental, Inc., Midwest Laboratory, Teledyne Isotopes, 2001.

Quality Assurance Manual for Radon Monitoring Services, Revision Number 9, Landauer, Inc., March, 2004.

Moab Radioparticulate Concentration (Po-210)

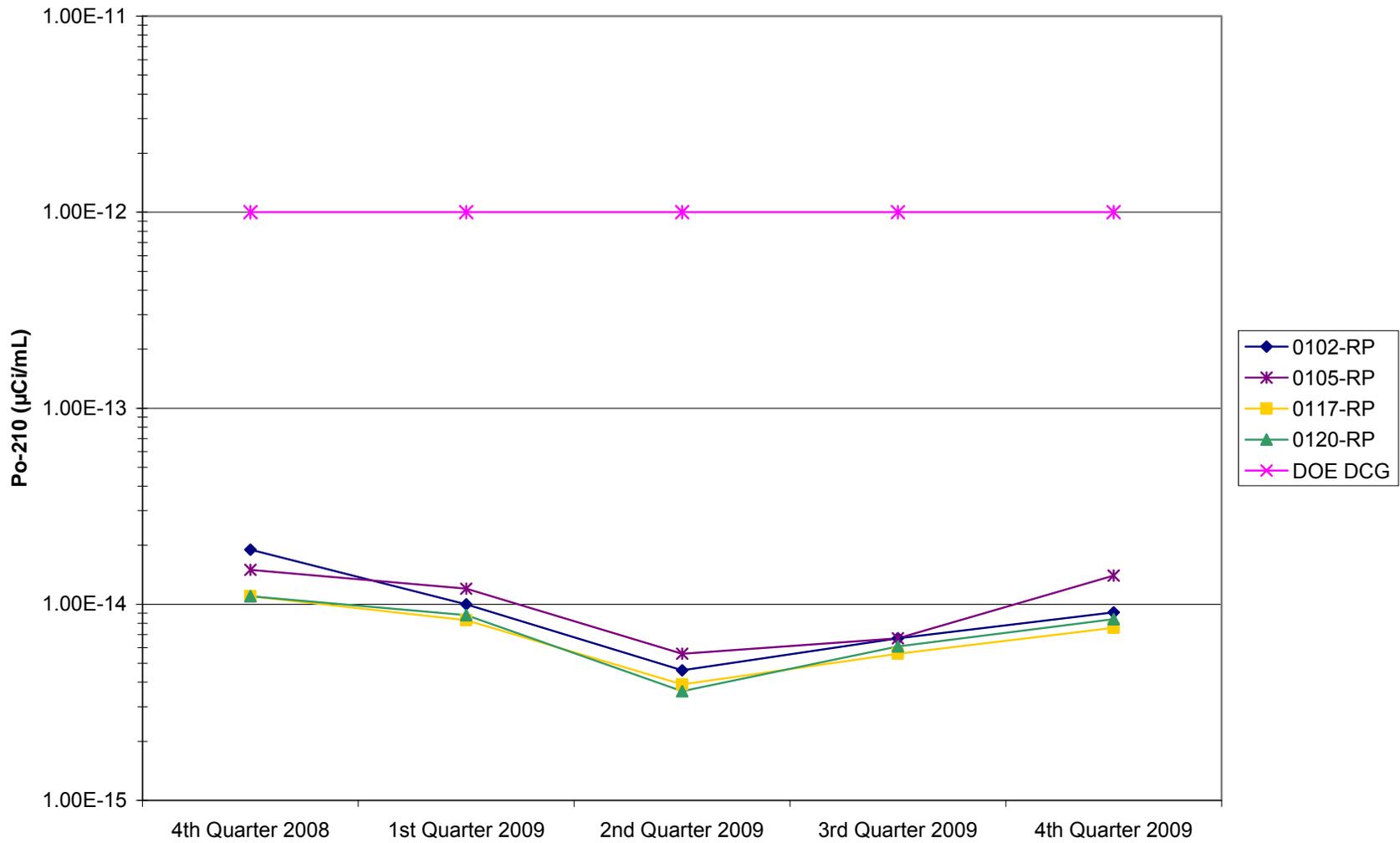


Figure 4. Moab Radioparticulate Concentration (Po-210)

Moab Radioparticulate Concentration (Po-210)

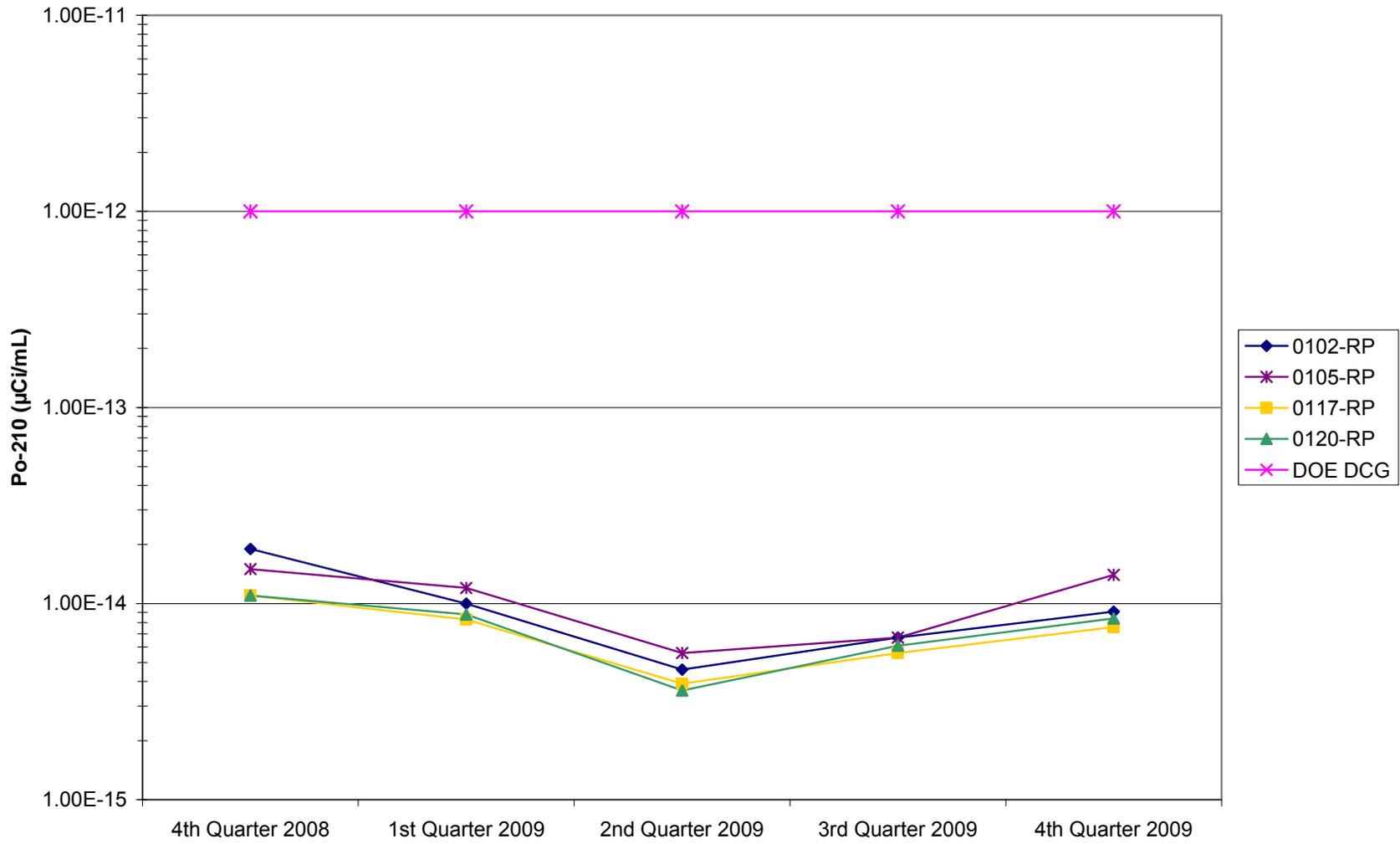


Figure 5. Moab Radioparticulate Concentration (Th-230)

Moab Radioparticulate Concentration (Ra-226)

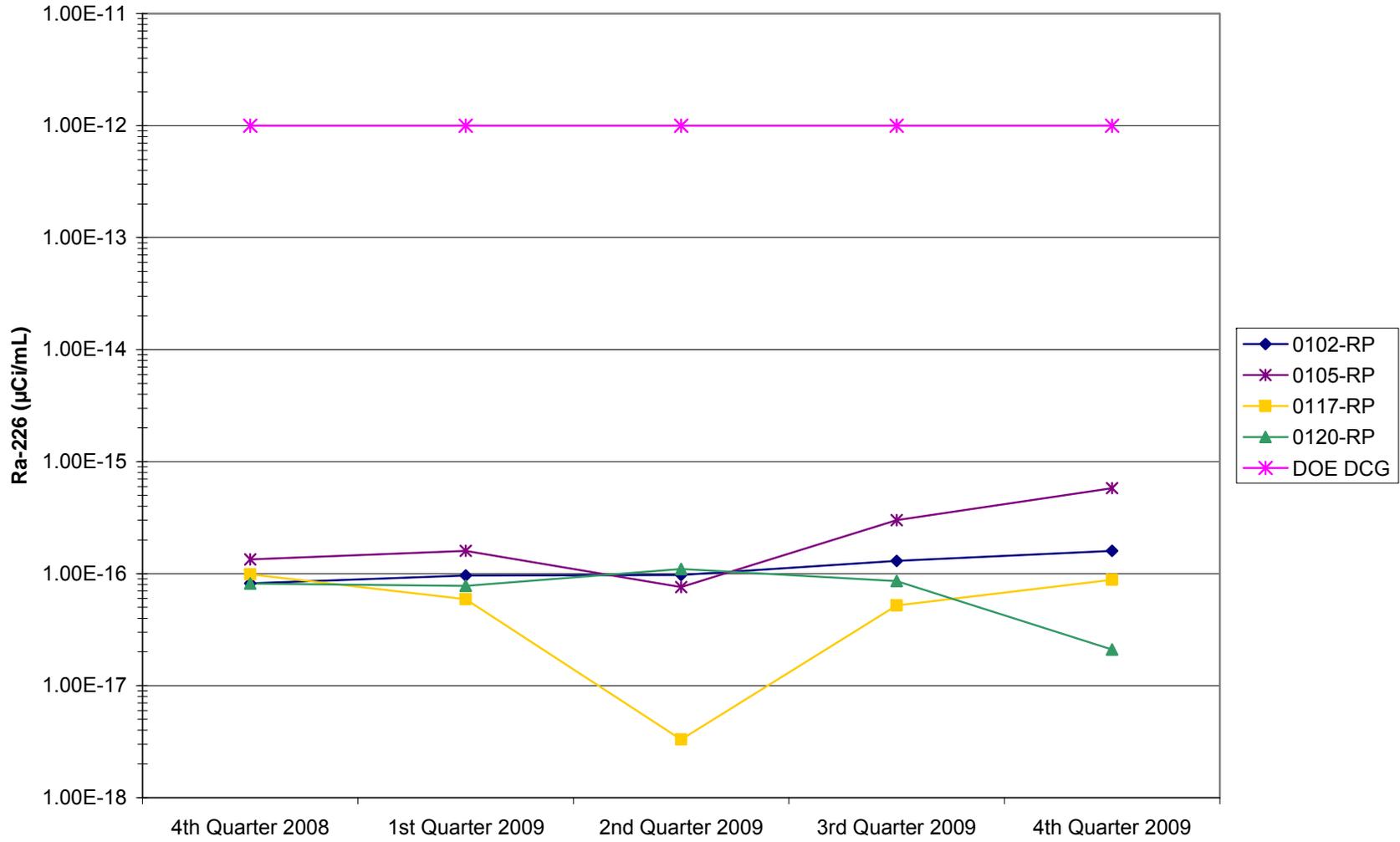


Figure 6. Moab Radioparticulate Concentration (Ra-226)

Moab Radioparticulate Concentration (Uranium)

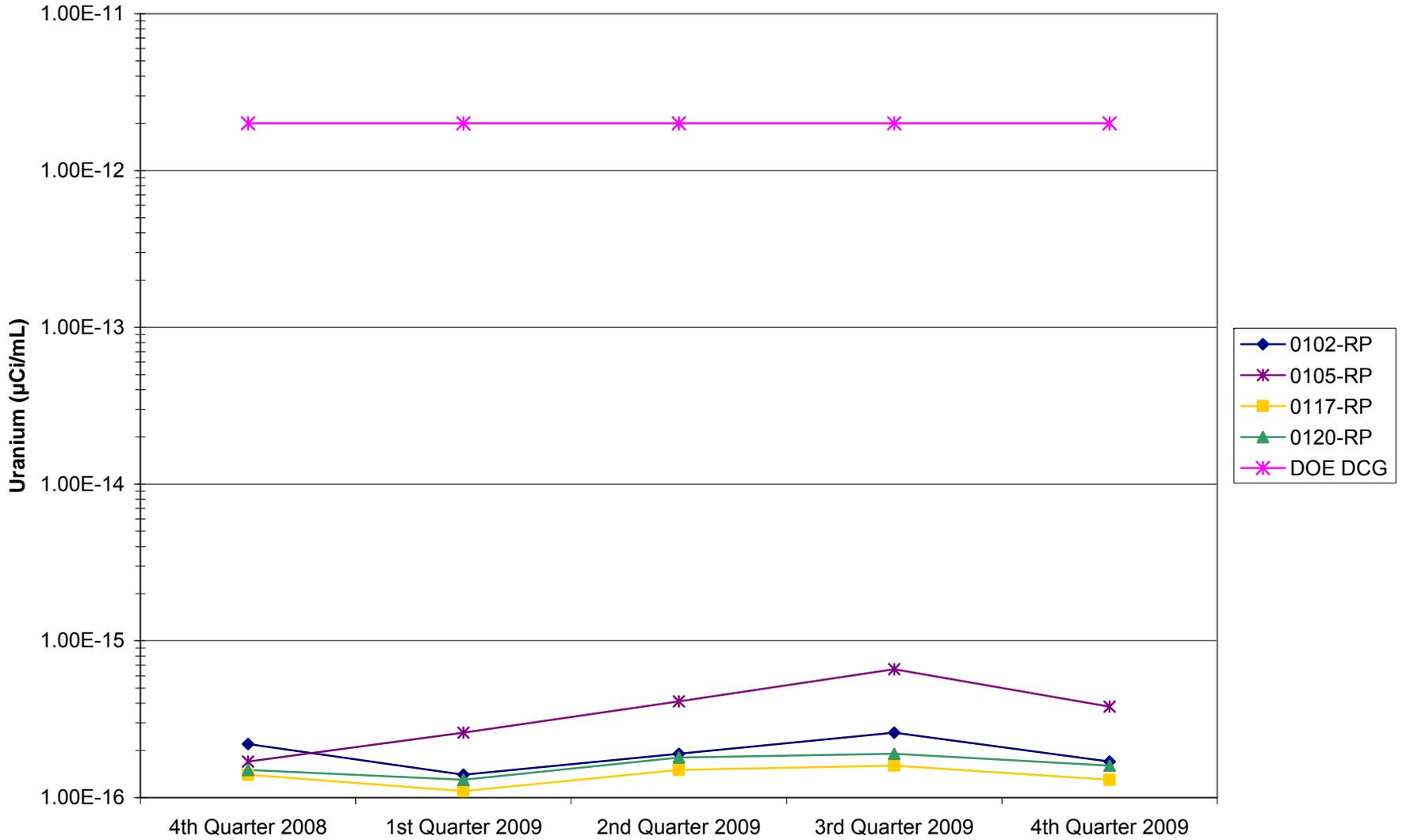


Figure 7. Moab Radioparticulate Concentration (Uranium)

Moab Atmospheric Radon-222 Concentration

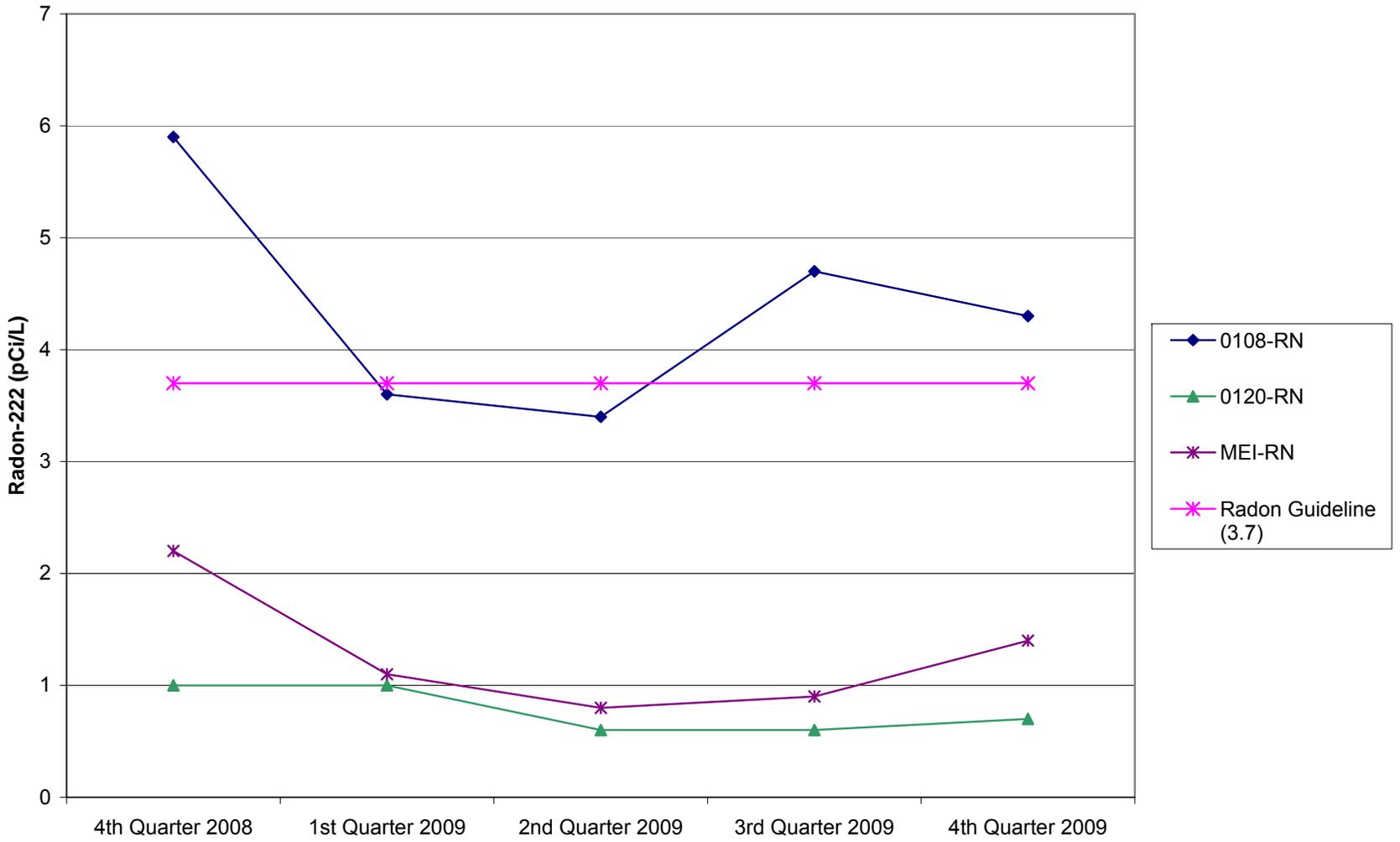


Figure 8. Moab Atmospheric Radon-222 Concentration

Moab Direct Gamma Radiation Dose

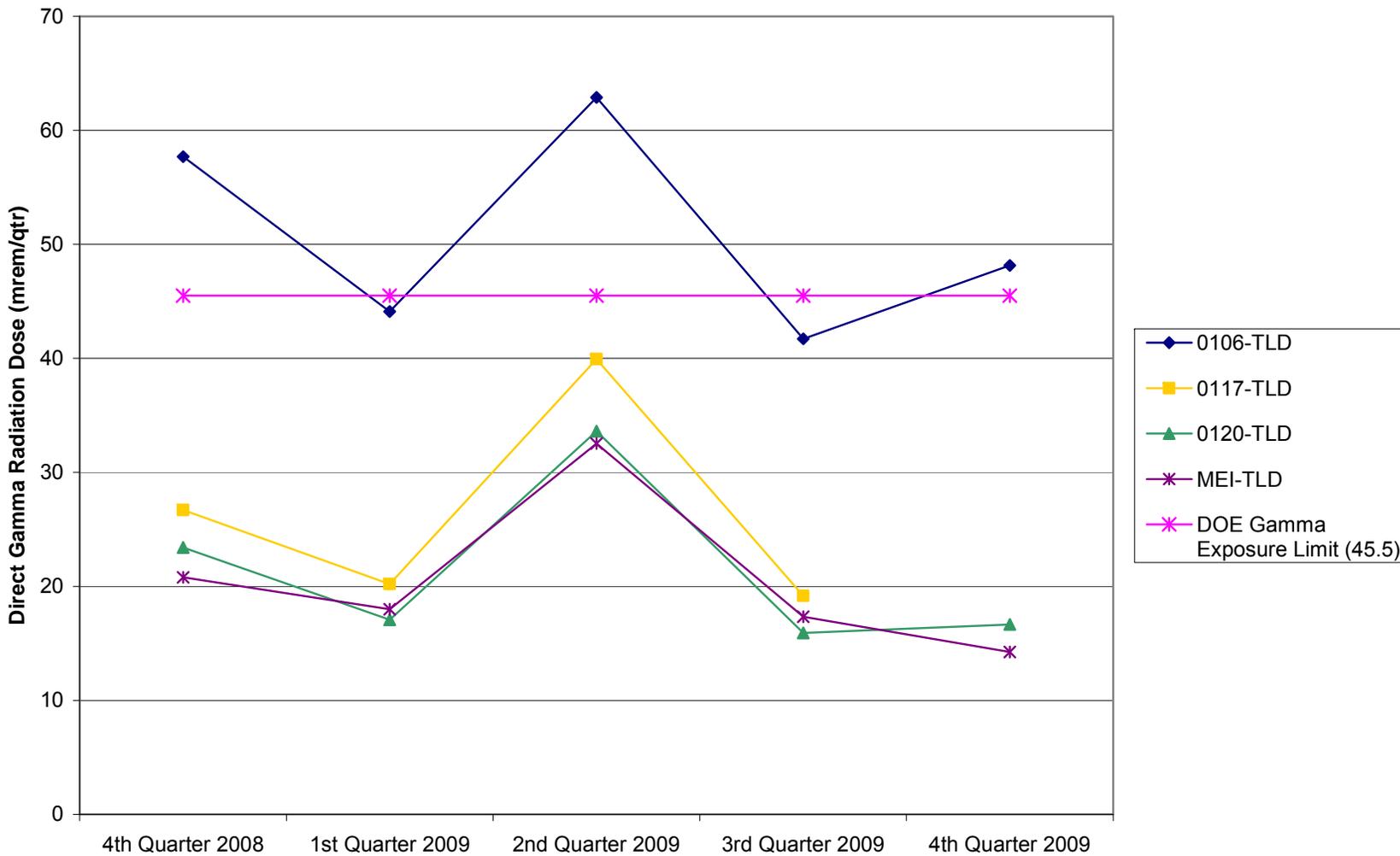


Figure 9. Moab Direct Gamma Radiation Dose

Crescent Junction Radioparticulate Concentration (Po-210)

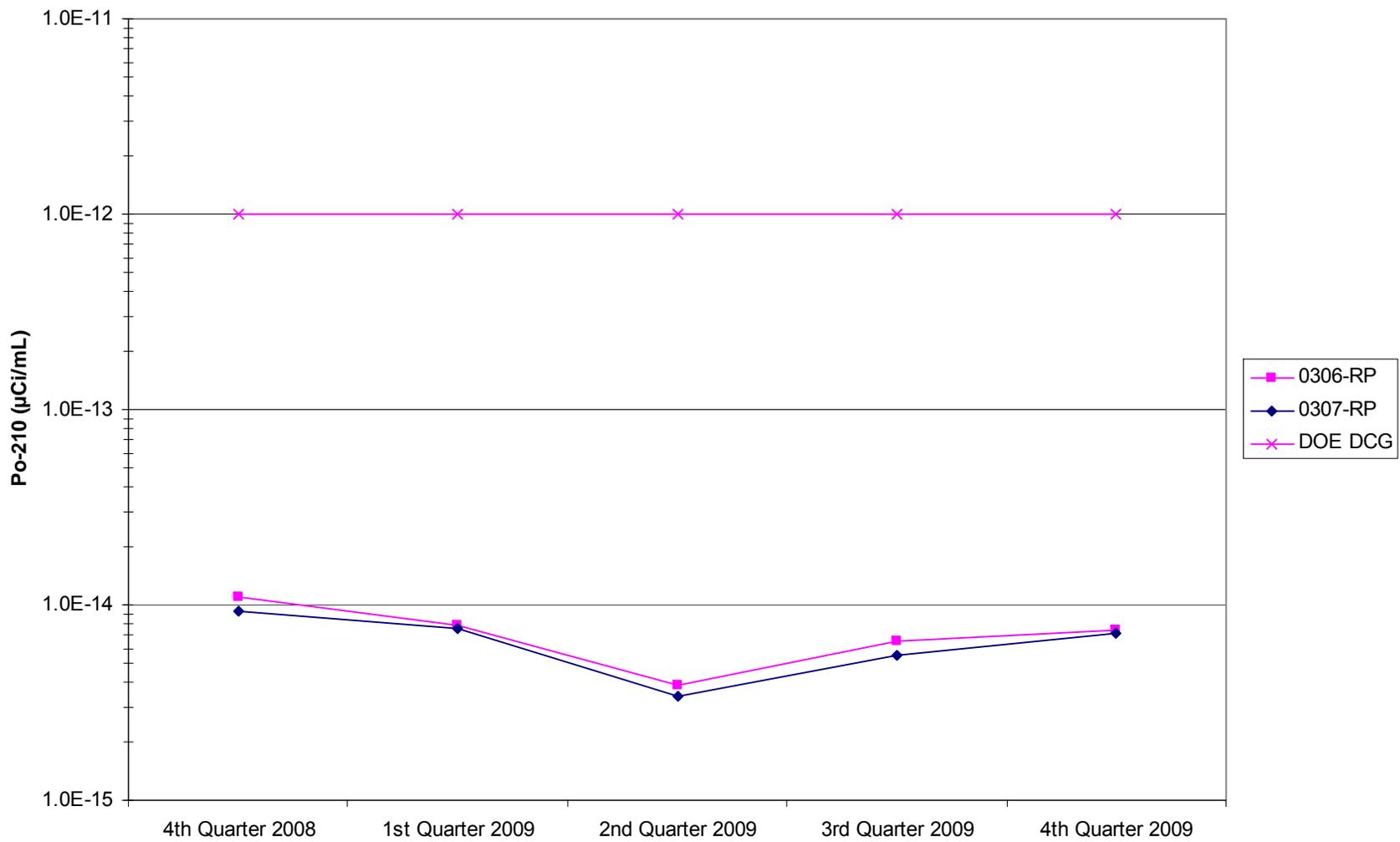


Figure 10. Crescent Junction Radioparticulate Concentration (Po-210)

Crescent Junction Radioparticulate Concentration (Th-230)

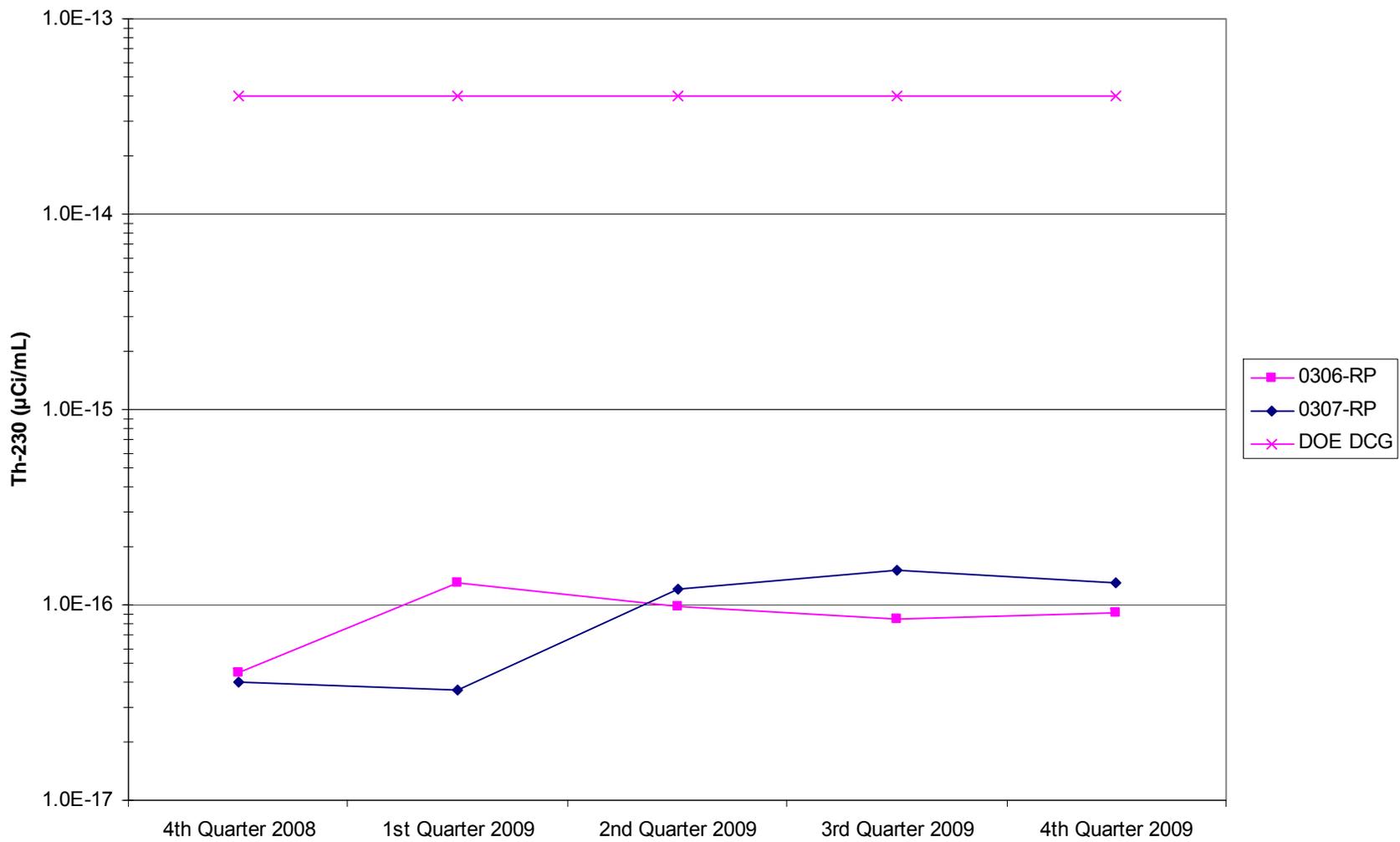


Figure 11. Crescent Junction Radioparticulate Concentration (Th-230)

Crescent Junction Radioparticulate Concentration (Ra-226)

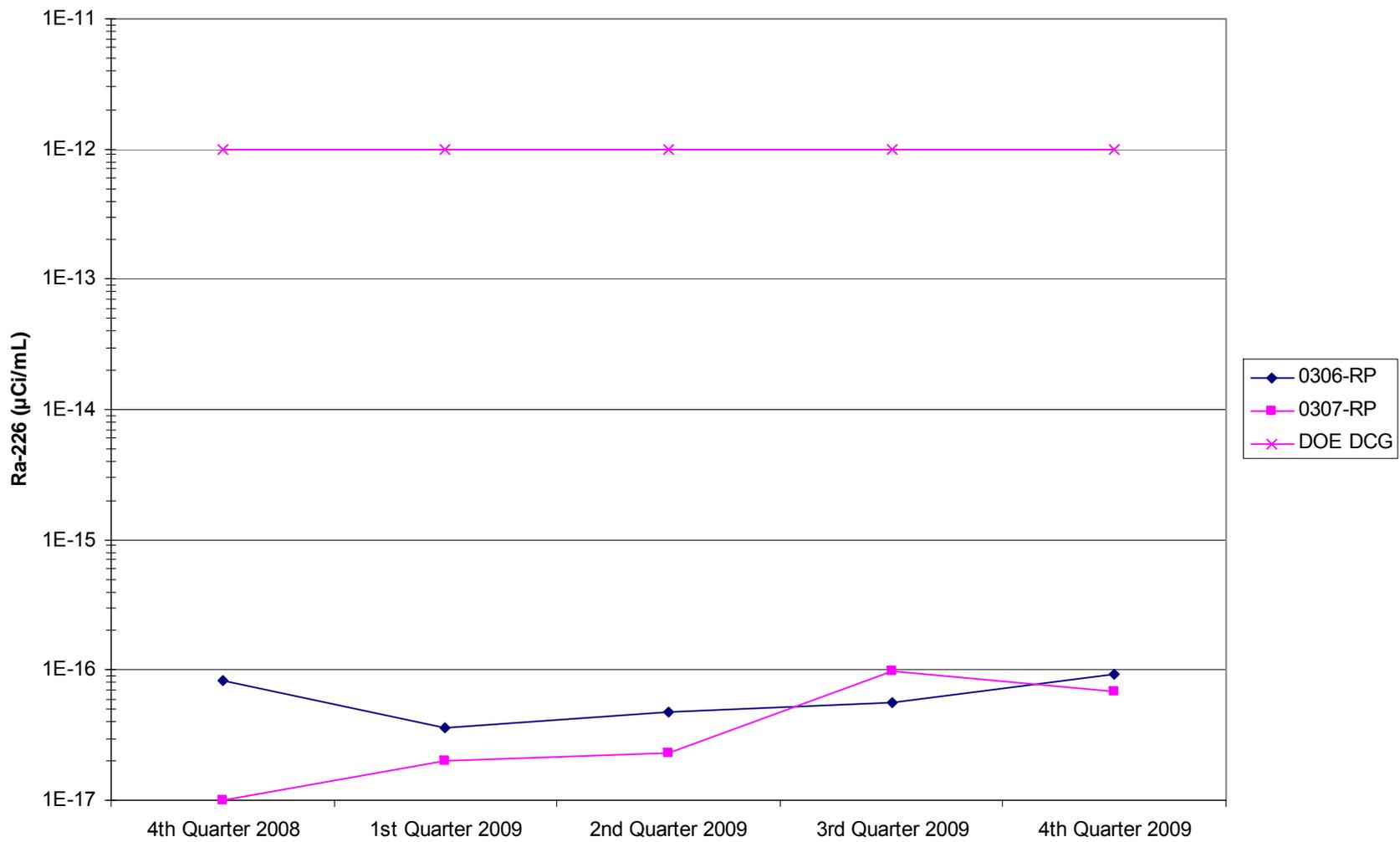


Figure 12. Crescent Junction Radioparticulate Concentration (Ra-226)

Crescent Junction Radioparticulate Concentration (Uranium)

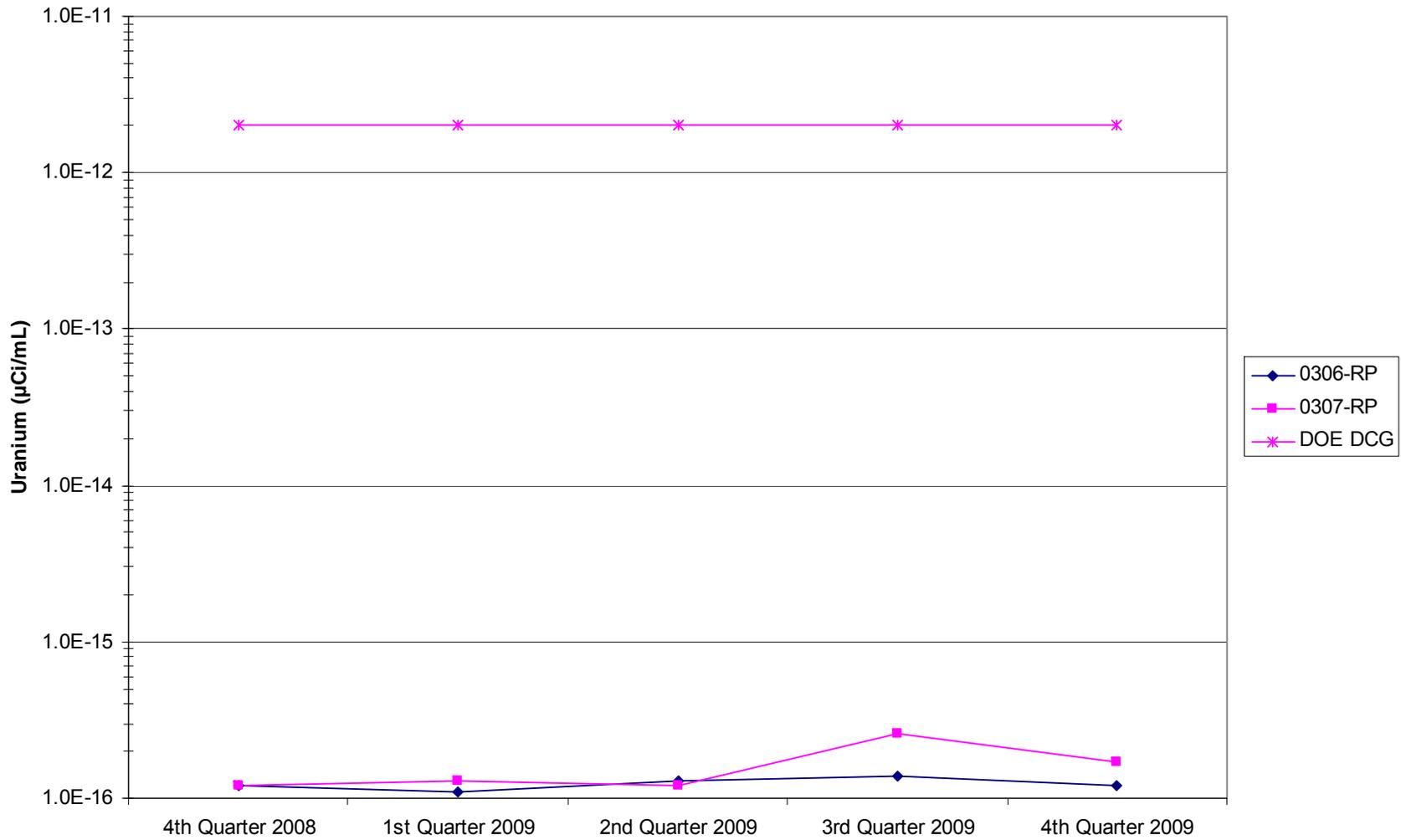


Figure 13. Crescent Junction Radioparticulate Concentration (Uranium)

Crescent Junction Atmospheric Radon-222 Concentration

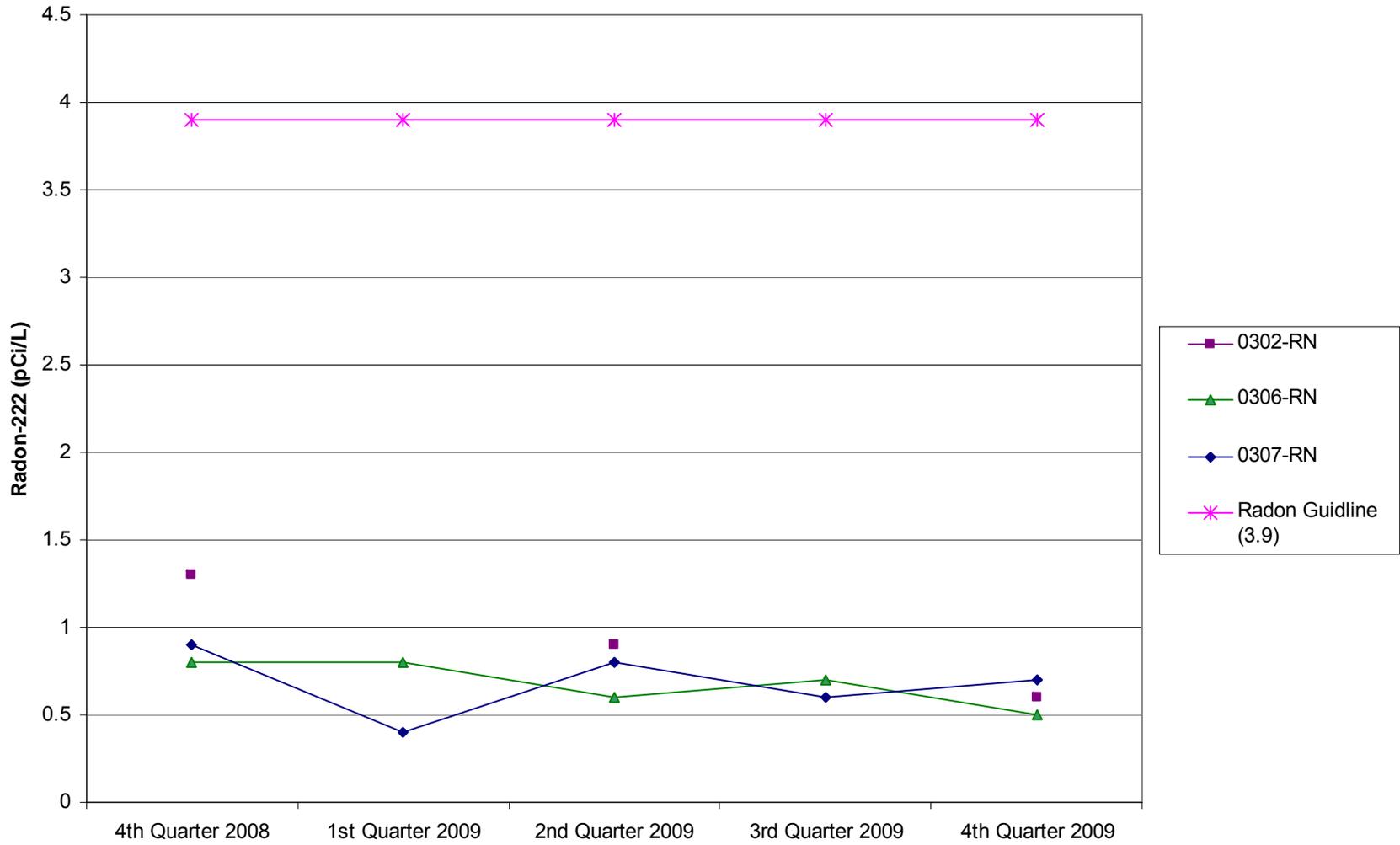


Figure 14. Crescent Junction Atmospheric Radon-222 Concentration

Crescent Junction Direct Gamma Radiation Dose

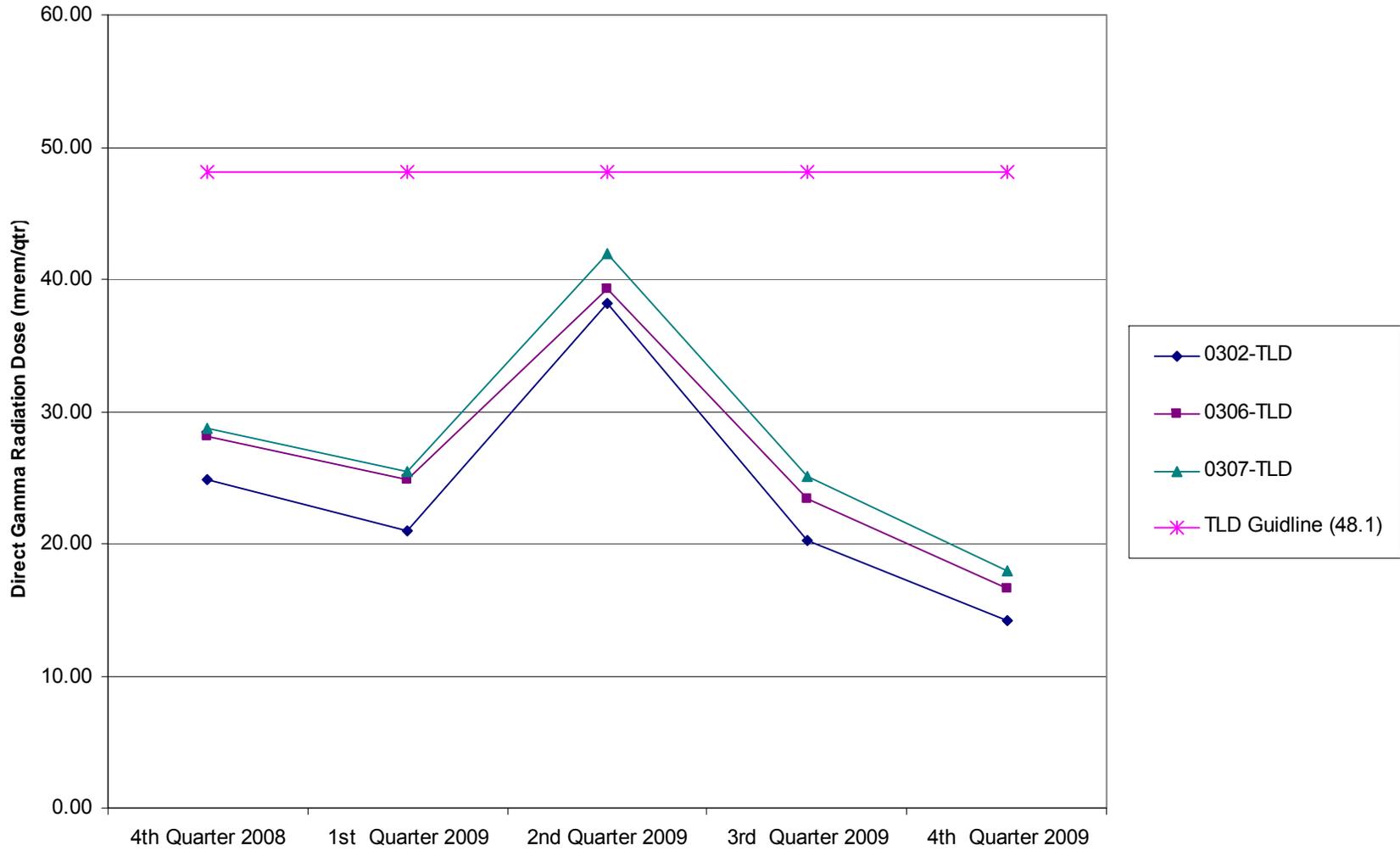


Figure 15. Crescent Junction Direct Gamma Radiation Dose