

Environmental Management - Grand Junction Office



Environmental Air Monitoring Data
Quarterly Report for the Moab and
Crescent Junction, Utah, Sites
First Quarter 2009
(January through March 2009)

June 2009



U.S. Department
of Energy

Office of Environmental Management

**Moab UMTRA Project
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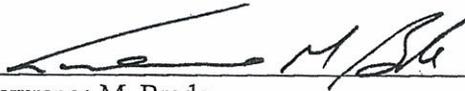
Revision 0

Review and Approval



Edward B. Baker
RAC Environmental Compliance Manager

June 25, 2009
Date



Lawrence M. Brede
RAC Project Manager

6/25/09
Date

Revision History

Revision No.	Date	Reason/Basis for Revision
0	June 2009	Initial issue.

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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	thermonuclear dosimeters
UMTRA	Uranium Mill Tailings Remedial Action

1.0 Summary of Results

1.1 Moab, Utah, Site

Sampling Period: January through March 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 gas that is applicable to the Moab Uranium Mill Tailings Remedial Action (UMTRA) Project site (Moab site). 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 first quarter of 2009 indicate that this guideline was exceeded at two on site monitoring locations and one off site location, in close proximity to the tailings pile. The DOE guideline concentration that was exceeded at the off site location was on vacant land with no public exposure. Refer to Table 1 and 2 for a review of radon-222 data for the Moab site. Sample locations for the Moab site are presented in Figure 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 the First Quarter	Sampling Locations Exceeding Standards/Guidelines During 2009 [†]
Radon-222	3.7 pCi/L	0106, 0107, 0128	0106, 0107, 0128
Direct Gamma Radiation	182 mrem/yr (45.5 mrem/qtr)	0109, 0110, 0111	0109, 0110, 0111

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

Direct Environmental Gamma Radiation

DOE O 5400.5, "Radiation Protection of the Public and Environment," 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 first quarter of 2009, three on site monitoring locations exceeded the gamma dose limit; none of the off site monitoring locations exceeded the quarterly gamma radiation dose limit. Refer to Table 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 near 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 First Quarter, Calendar Year 2009

Station Number	1 st Quarter 2009		2 nd Quarter 2009		3 rd Quarter 2009		4 th 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							2.2	127.72
0102	1.6	20.98							1.6	83.92
0103	1.8	21.24							1.8	84.96
0104	2.7	25.57							2.7	102.28
0105	3.4	41.94							3.4	167.76
0106	7.1	44.1							7.1	176.4
0107	6.7	33.08							6.7	132.32
0108	3.6	42.7							3.6	170.08
0109	1.2	52.7							1.2	210.8
0110	2.5	62.33							2.5	249.32
0111	1.2	59.96							1.2	239.84
0112	1.9	34.35							1.9	137.4
0113	2.2	25.91							2.2	103.64
Off Site Locations										
0117 ¹	0.8	20.21							0.8	80.84
0118	0.8	18.84							0.8	75.36
0119	0.9	18.27							0.9	73.08
0120	1	17.06							1	68.24
0121	0.6	18.82							0.6	75.28
0122	0.5	17.99							0.5	71.96
0123 ¹	0.4	18.49							0.4	73.96
0124	1.7	20.69							1.7	82.76
0125	2.1	24.5							2.1	98
0126	2.8	22.51							2.8	90.04
0127	1.2	21.16							1.2	84.64
0128	4	22.42							4	89.68
0129	1.8	20.95							1.8	83.8
MEI ²	1.1	18							1.1	72

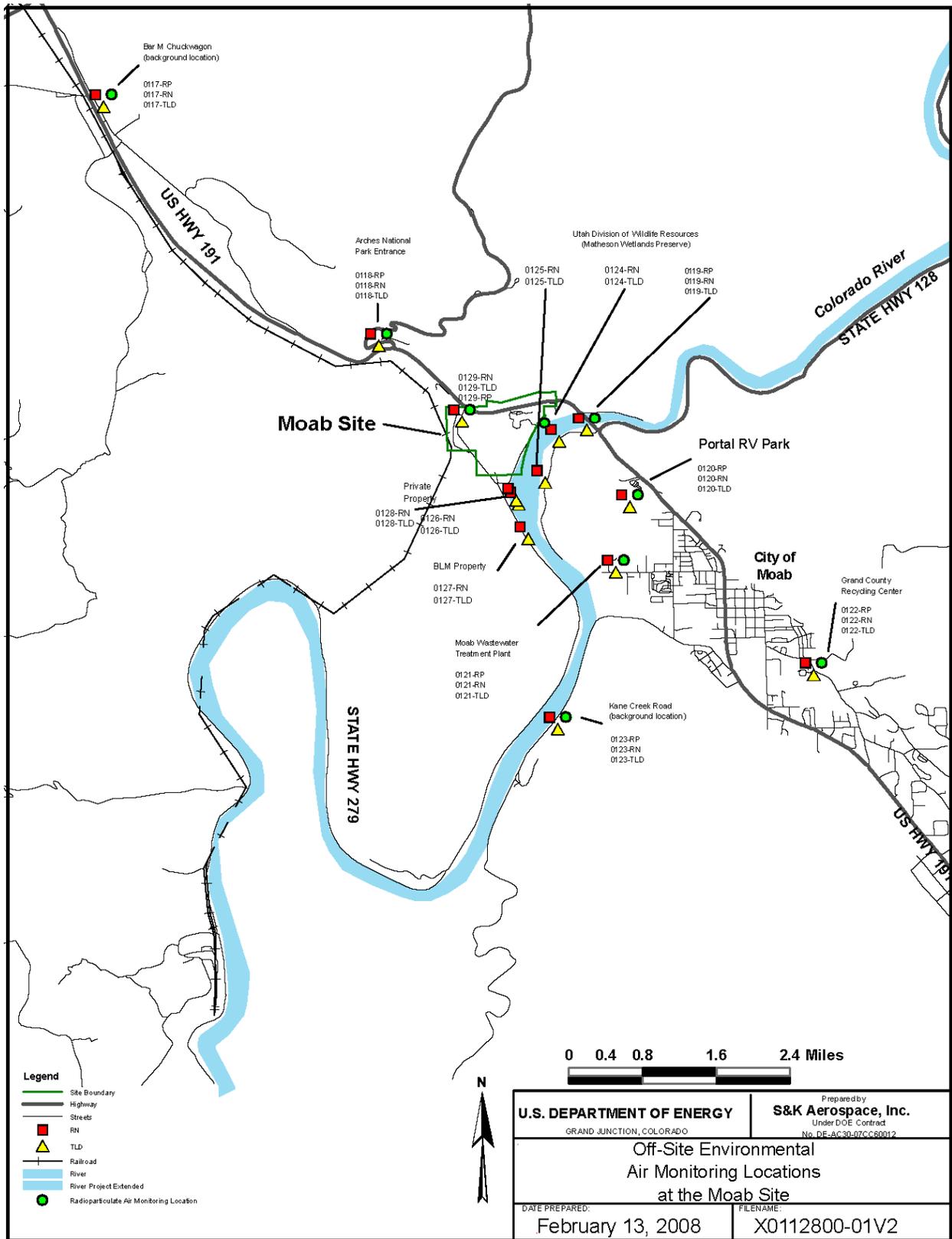
¹Designated background monitoring locations. Background locations are sufficiently distant from the millsite to be free from any effects or influences from potential site contaminants.

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.

NA = not applicable

NDA = no data available



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

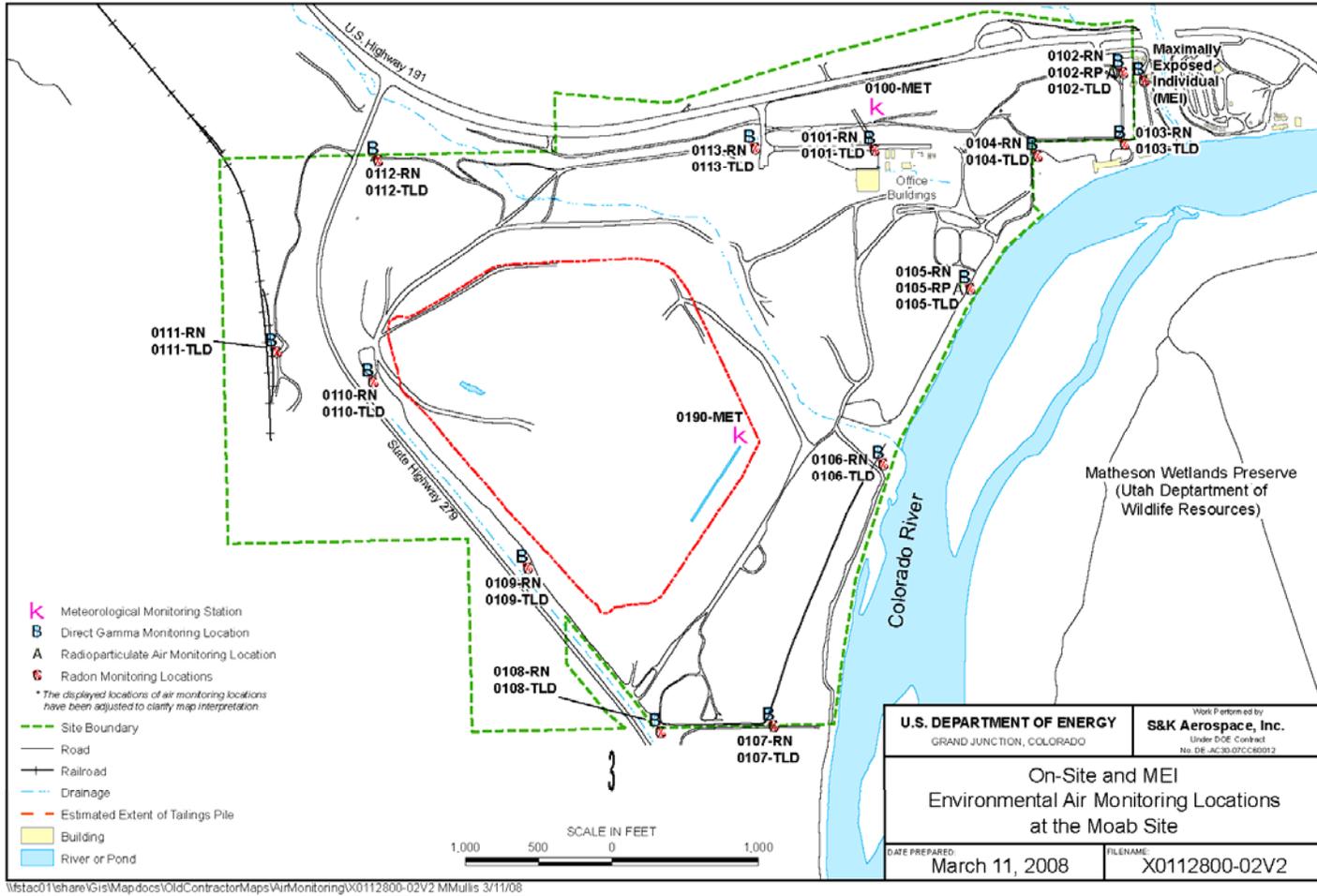


Figure 2. On Site Radon, Direct Gamma, and Radioparticulate Monitoring Locations

Radioparticulates

No standards or radiological exposure limits were exceeded at any of the 10 radioparticulate monitoring locations at the Moab site during the first 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, "Radiation Protection of the Public and Environment." 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 be less than 10 mrem/yr. All off site sampling location concentrations, when converted to dose using the relationship of (measured concentration)/(DCG concentration) x (100 mrem/yr), were significantly lower than the DOE DCG value of 10.0 mrem/yr.

During the first quarter of 2009, the on site dose resulting from airborne emissions, excluding background, was 1.29 mrem/yr at location 0102 and 1.73 mrem/yr at location 0105. Off site locations 0117 and 0129 were 1.05 mrem/yr and 1.75 mrem/yr. Refer to Table 3 for a review of radioparticulate air monitoring data for the Moab site.

1.2 Crescent Junction, Utah, Site

Sampling Period: January through March 2009

Atmospheric Radon-222

DOE O 5400.5, "Radiation Protection of the Public and Environment," establishes a guideline for atmospheric emissions of radon-222 gas that will be applicable to the Crescent Junction site (3.0 pCi/L above background). Because the uranium mill tailings have yet to be placed at the disposal site, all sampling results to date represent baseline conditions (i.e., natural background). The data collected before tailings placement begins will be used to calculate a background value and ultimately a site-specific radon standard. 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, "Radiation Protection of the Public and Environment," establishes a dose limit of 100 mrem/yr above naturally occurring gamma levels (background). Because the uranium mill tailings have yet to be placed at the disposal site, all sampling results to date represent baseline conditions (i.e., natural background conditions). The data collected before tailings placement begins will be used to calculate a background value and ultimately a site-specific gamma radiation standard. Refer to Table 5 for a review of gamma data for the Crescent Junction site.

Radioparticulates

DOE O 5400.5, "Radiation Protection of the Public and Environment," establishes DCGs for concentrations of radioparticulates in air. Because the uranium mill tailings have yet to be placed at the disposal site, all sampling data results to date represent baseline conditions (i.e., natural background conditions). The data collected before tailings placement begins will be used to calculate a background value and ultimately a site-specific radioparticulate standard. 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	1 st Quarter 2009 (μCi/mL) ⁵	2 nd Quarter 2009 (μCi/mL)	3 rd Quarter 2009 (μCi/mL)	4 th Quarter 2009 (μCi/mL)	Annual Average (μCi/mL)
On Site Locations						
0102-RP	Uranium ¹	1.4E-16				1.4E-16
	Thorium-230 ²	1.1E-16				1.1E-16
	Radium-226 ³	9.6E-17				9.6E-17
	Polonium-210 ⁴	1.0E-14				1.0E-14
0105-RP	Uranium ¹	2.6E-16				2.6E-16
	Thorium-230 ²	2.0E-16				2.0E-16
	Radium-226 ³	1.6E-16				1.6E-16
	Polonium-210 ⁴	1.2E-14				1.2E-14
Off Site Locations						
0117-RP	Uranium ¹	1.1E-16				1.1E-16
	Thorium-230 ²	8.3E-17				8.3E-17
	Radium-226 ³	5.9E-17				5.9E-17
	Polonium-210 ⁴	8.3E-15				8.3E-15
0118-RP	Uranium ¹	1.6E-16				1.6E-16
	Thorium-230 ²	1.3E-16				1.3E-16
	Radium-226 ³	4.8E-17				4.8E-17
	Polonium-210 ⁴	9.9E-15				9.9E-15
0119-RP	Uranium ¹	1.4E-16				1.4E-16
	Thorium-230 ²	1.3E-16				1.3E-16
	Radium-226 ³	5.1E-17				5.1E-17
	Polonium-210 ⁴	9.6E-15				9.6E-15
0120-RP	Uranium ¹	1.3E-16				1.3E-16
	Thorium-230 ²	1.1E-16				1.1E-16
	Radium-226 ³	7.8E-17				7.8E-17
	Polonium-210 ⁴	8.8E-15				8.8E-15
0121-RP	Uranium ¹	1.6E-16				1.6E-16
	Thorium-230 ²	4.3E-17				4.3E-17
	Radium-226 ³	5.8E-17				5.8E-17
	Polonium-210 ⁴	9.2E-15				9.2E-15
0122-RP	Uranium ¹	1.4E-16				1.4E-16
	Thorium-230 ²	1.1E-16				1.1E-16
	Radium-226 ³	3.2E-17				3.2E-17
	Polonium-210 ⁴	8.9E-15				8.9E-15
0123-RP	Uranium ¹	1.2E-16				1.2E-16
	Thorium-230 ²	1.3E-16				1.3E-16
	Radium-226 ³	9.0E-18				9.0E-18
	Polonium-210 ⁴	9.3E-15				9.3E-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) ⁵	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				3.2E-16
	Thorium-230 ²	2.5E-16				2.5E-16
	Radium-226 ³	1.2E-16				1.2E-16
	Polonium-210 ⁴	1.1E-14				1.1E-14

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

⁵μCi/mL = microCuries per milliliter

2.0 Data Assessment

2.1 Data Assessment Summary

Atmospheric Radon-222 Analyses

Radon detectors were analyzed by Landauer Inc., Glenwood, Illinois, in accordance with Landauer's *Quality Assurance Manual for Radon Monitoring Services, Revision Number 9*, March, 2004. First quarter 2009 analytical radon-222 data were received in a report dated May 8, 2009. Unlike radioparticulate analyses, radon-222 data are not reported with qualifiers from the laboratory. When detectors are either missing, damaged, or cannot be read, the laboratory noted an explanation for the effected station. No data was recorded for stations 0302 and 0303 due to a processing problem and a damaged detector. After the data report was received, the data were evaluated for consistency with other data points and with sample duplicates.

Direct Environmental Gamma Radiation Analyses

Thermoluminescent dosimeters (TLDs) are used for continuous dose measurements and are analyzed by Environmental, Inc., Midwest Laboratory, Northbrook, Illinois, in accordance with their analytical procedure *Preparation and Readout of Teledyne Isotopes TLD Card, TIML-TLD-01, Revision 7* (Teledyne Isotopes 2001). First quarter 2009 environmental gamma radiation data were received in a report dated May 12, 2009. After the laboratory results were received, the data were evaluated for consistency with other results collected previously at each monitoring location and also compared against duplicates. All of the TLD data were considered useable.

Radioparticulate Analyses

Paragon Analytics Laboratory, Fort Collins, Colorado, analyzed the radioparticulate samples for radium-226, thorium-230, polonium-210, and total uranium. Results for the first quarter 2009 sampling period are in Report Identification Number (RIN) 0904063. 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 Rev. 5. Radioparticulate analytical data for samples collected during the first quarter of 2009 were received May 1, 2009,

reviewed, validated, and summarized in the *Data Review and Validation Report for RIN 0904063* dated May 21, 2009.

Table 4. Summary of Environmental Radon-222 and Gamma Radiation Monitoring Data for the Crescent Junction Site through First 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 ¹	Radon pCi/L	Gamma mrem/yr						
0301	1.1	23.2							1.1	92.8
0302	NDA	21							NDA	84
0303	NDA	23.9							NDA	95.6
0304	0.9	26							0.9	104
0305	0.8	26.4							0.8	105.6
0306	0.8	24.9							0.8	99.6
0307	0.4	25.4							0.4	101.6
0308	0.7	16							0.7	64

¹mrem value is prorated to a 91-day exposure period.

NDA = no data available; there was a processing problem with 0302, and 0303 detector was found on ground.

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

Station Number	Isotope	1st Quarter 2009 (μCi/mL) ⁵	2nd Quarter 2009 (μCi/mL) ⁵	3rd Quarter 2009 (μCi/mL) ⁵	4th Quarter 2009 (μCi/mL)	Annual Average (μCi/mL) ⁵
0306-RP	Uranium ¹	1.1E-16				1.1E-16
	Thorium-230 ²	1.3E-16				1.3E-16
	Radium-226 ³	3.6E-17				3.6E-17
	Polonium-210 ⁴	7.8E-15				7.8E-15
0307-RP	Uranium ¹	1.3E-16				1.3E-16
	Thorium-230 ²	3.7E-17				3.7E-17
	Radium-226 ³	2.0E-17				2.0E-17
	Polonium-210 ⁴	7.5E-15				7.5E-15
0308-RP	Uranium ¹	1.4E-16				1.4E-16
	Thorium-230 ²	8.9E-17				8.9E-17
	Radium-226 ³	8.9E-17				8.9E-17
	Polonium-210 ⁴	6.5E-15				6.5E-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

⁵μCi/mL = microCuries per milliliter

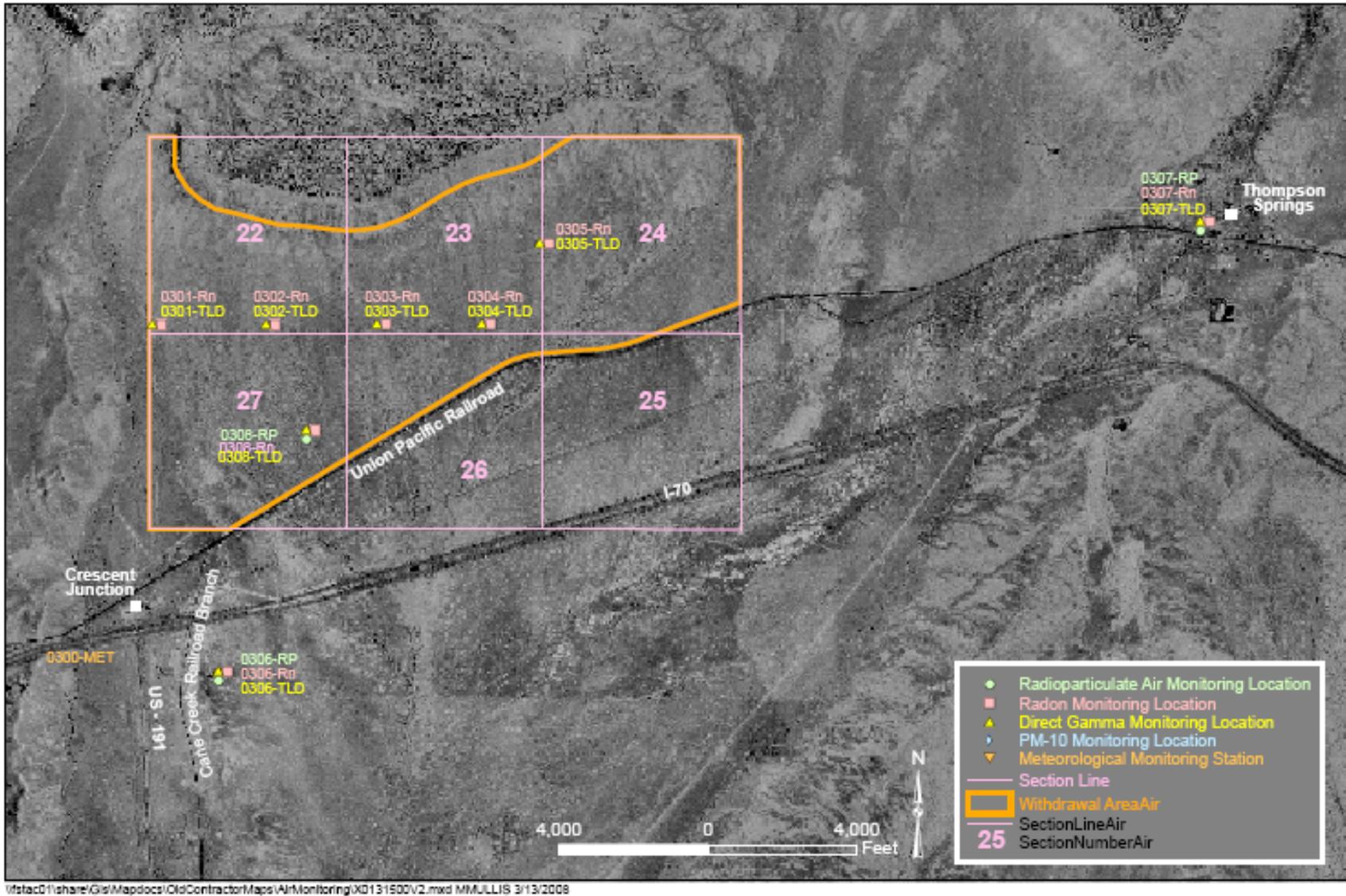


Figure 3. Sampling Location Map for the Crescent Junction Site

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, 0306, and 0308. Duplicate direct gamma measurements were made at Crescent Junction locations 0301 and 0305.

Duplicates are not being collected for radioparticulate samples per the Sampling and Analysis Plan (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 data anomalies were detected during this quarter. This 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, data validation was performed by a third party (Pro2Serve) prior to data entry (into the SeePro database).

Summary

Data collected during the first 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	January through March 2009
Date(s) of Verification	May 27, 2009	Name of Verifier	Ed Baker

	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 reset 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 in undisturbed and in operable condition upon arrival?	No	Radon cups for station 0303 were found on the ground and unusable.
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>January through March 2009</u>
Date(s) of Verification	<u>May 27, 2009</u>	Name of Verifier	<u>Ed Baker</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 Figure 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 begins, location 0306 could become the MEI location. Location 0307, approximately 5 miles east of the disposal site, will probably represent the second greatest risk, 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 (Figure 4) 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

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., Glenwood, Illinois, March, 2004.

Data Review and Validation Report for RIN 0904063, Paragon Analytics Laboratory, Fort Collins, Colorado, May 21, 2009.

Moab Radioparticulate Concentration (Po-210)



Figure 4. Moab Radioparticulate Concentration (Po-210)

Moab Radioparticulate Concentration (Th-230)

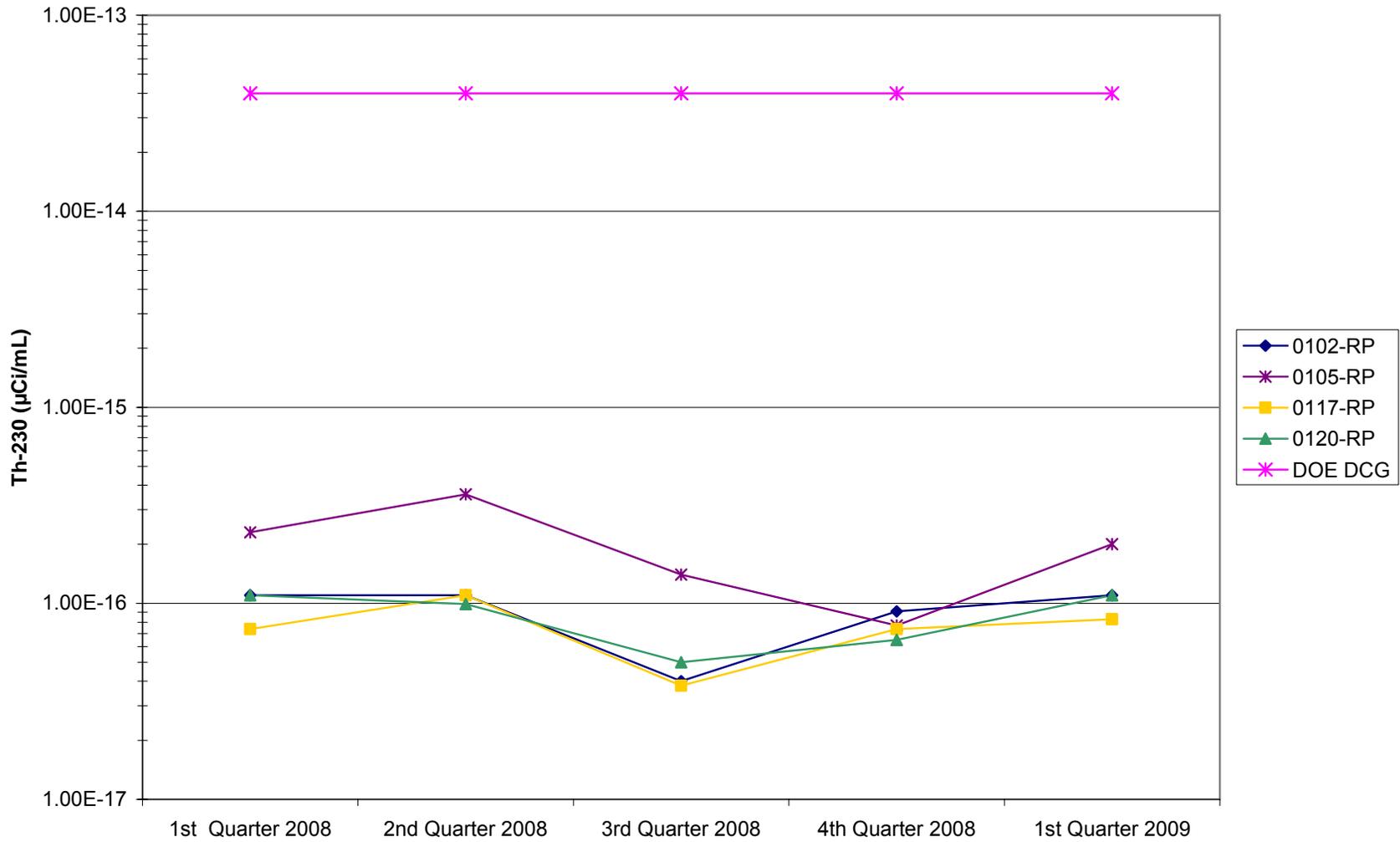


Figure 5. Moab Radioparticulate Concentration (Th-230)

Moab Radioparticulate Concentration (Ra-226)

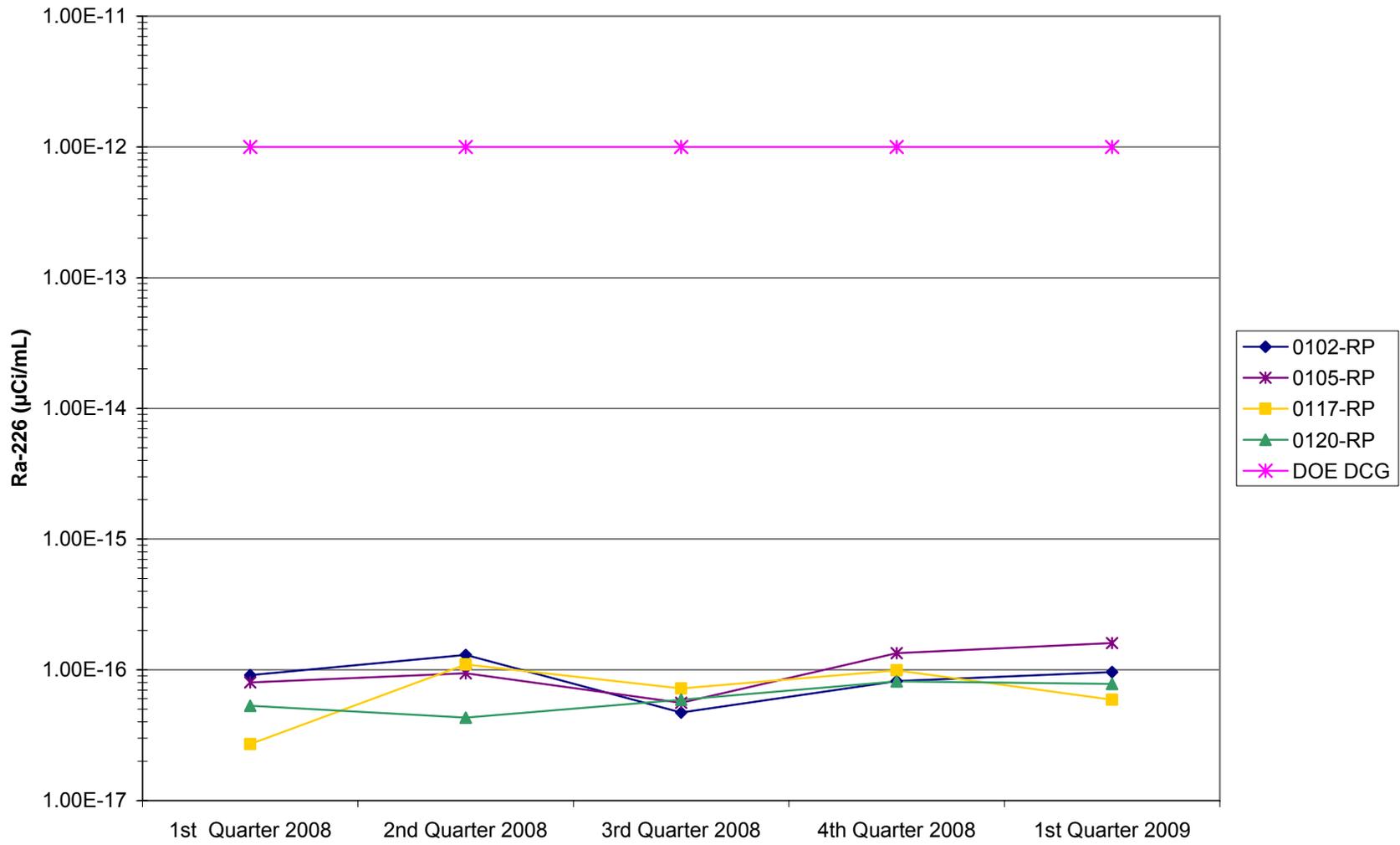


Figure 6. Moab Radioparticulate Concentration (Ra-226)

Moab Radioparticulate Concentration (Uranium)

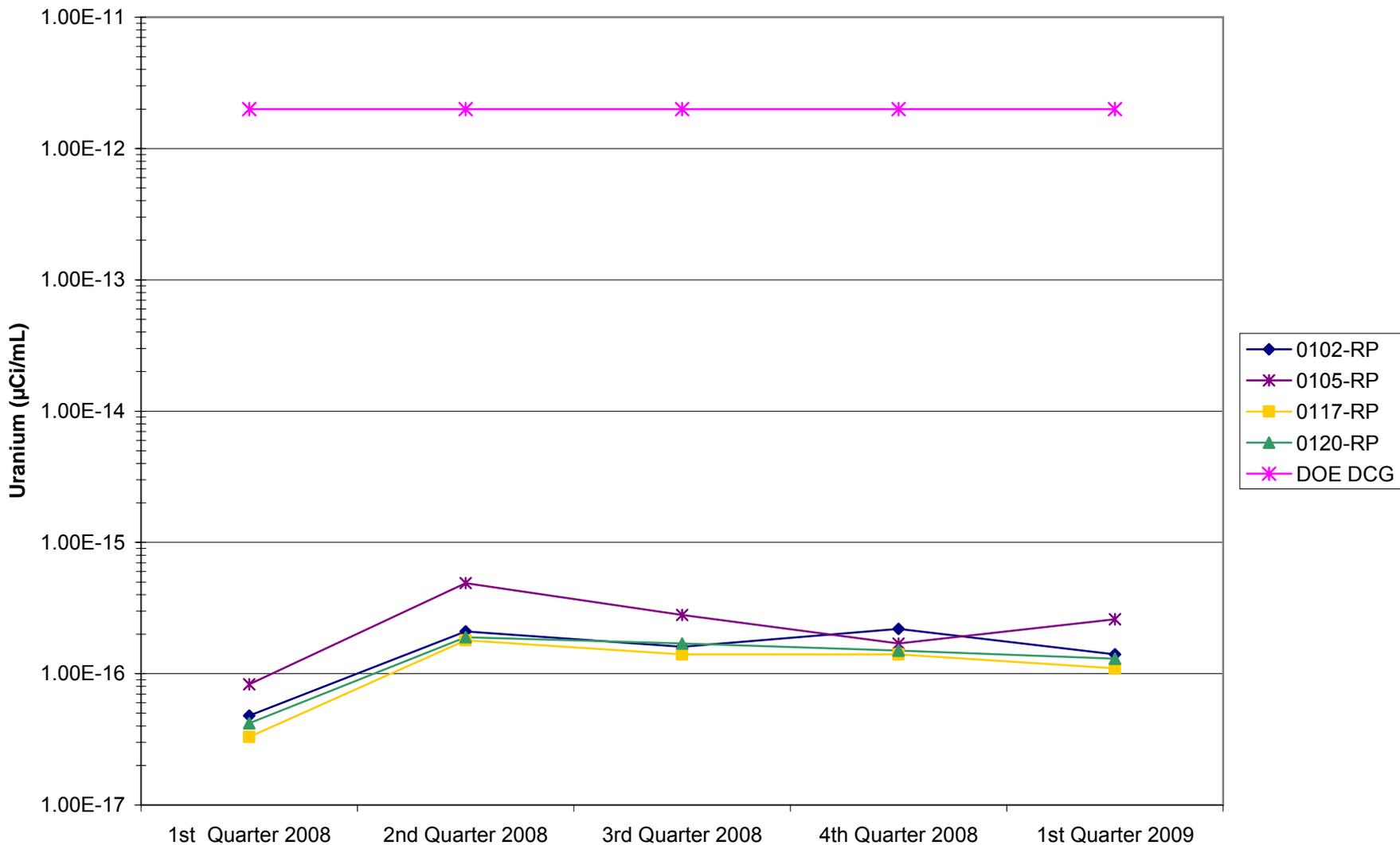


Figure 7. Moab Radioparticulate Concentration (Uranium)

Moab Atmospheric Radon-222 Concentration

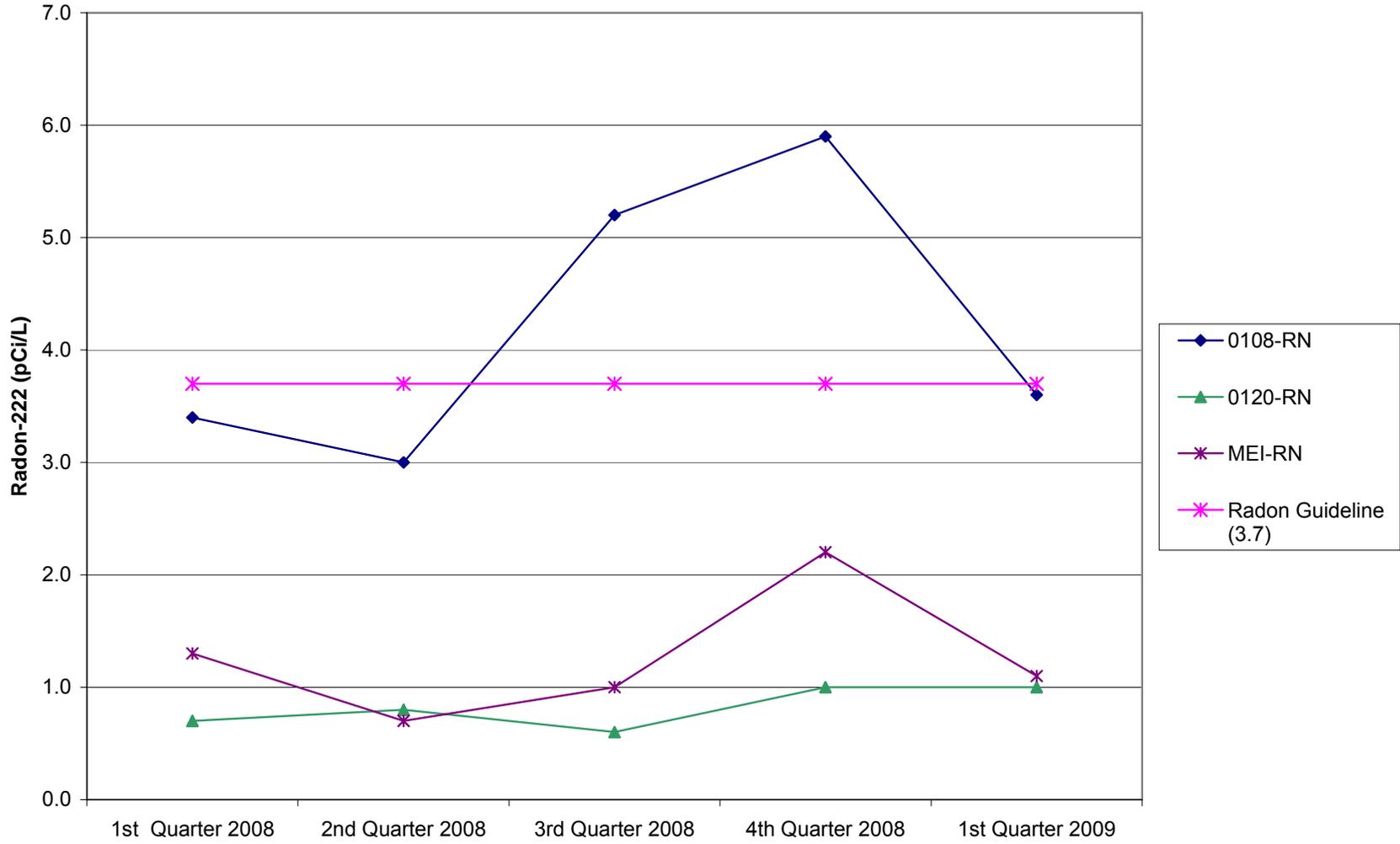


Figure 8. Moab Atmospheric Radon-222 Concentration

Moab Direct Gamma Radiation Dose



Figure 9. Moab Direct Gamma Radiation Dose

Crescent Junction Radioparticulate Concentration (Po-210)

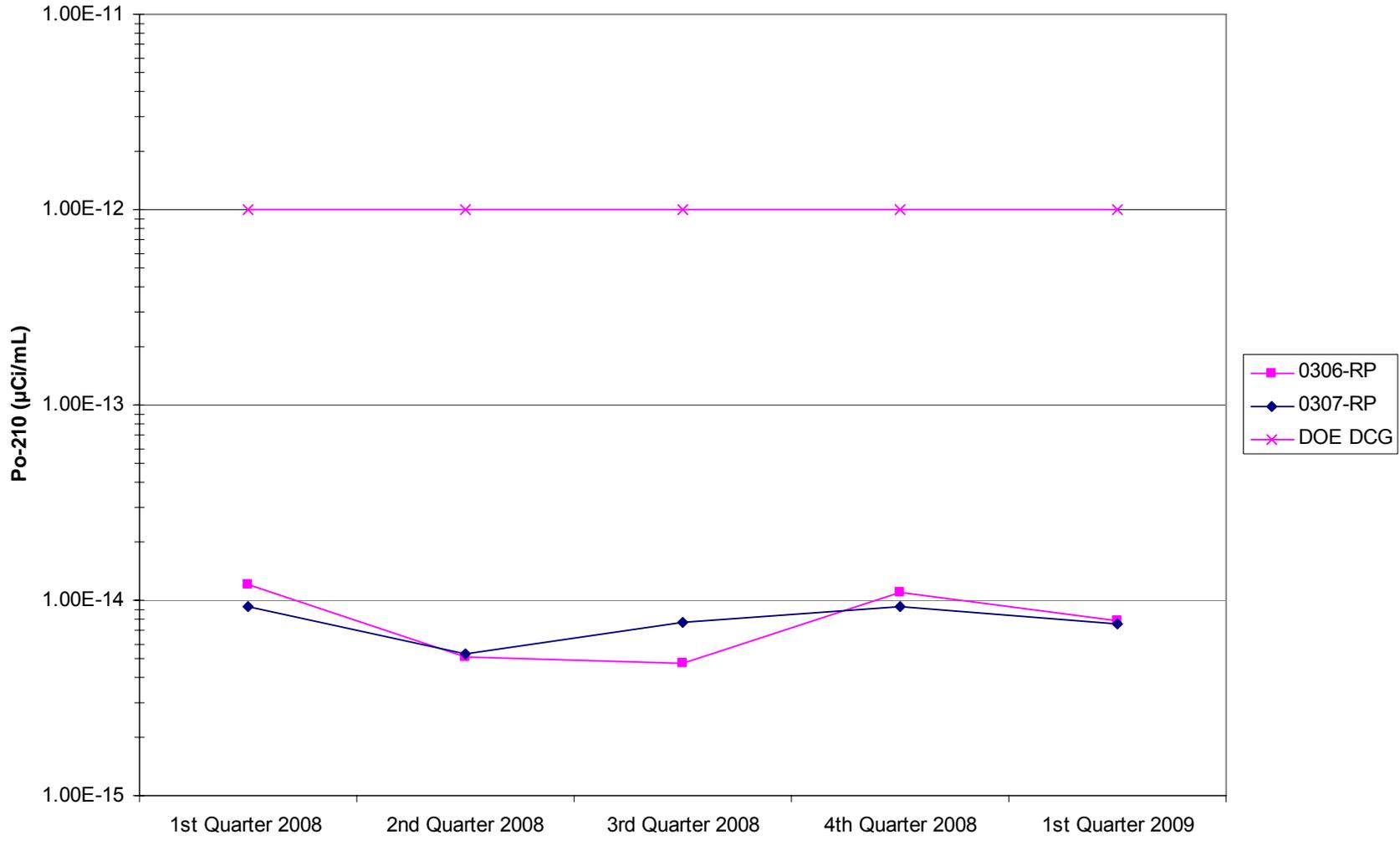


Figure 10. Crescent Junction Radioparticulate Concentration (Po-210)

Crescent Junction Radioparticulate Concentration (Th-230)

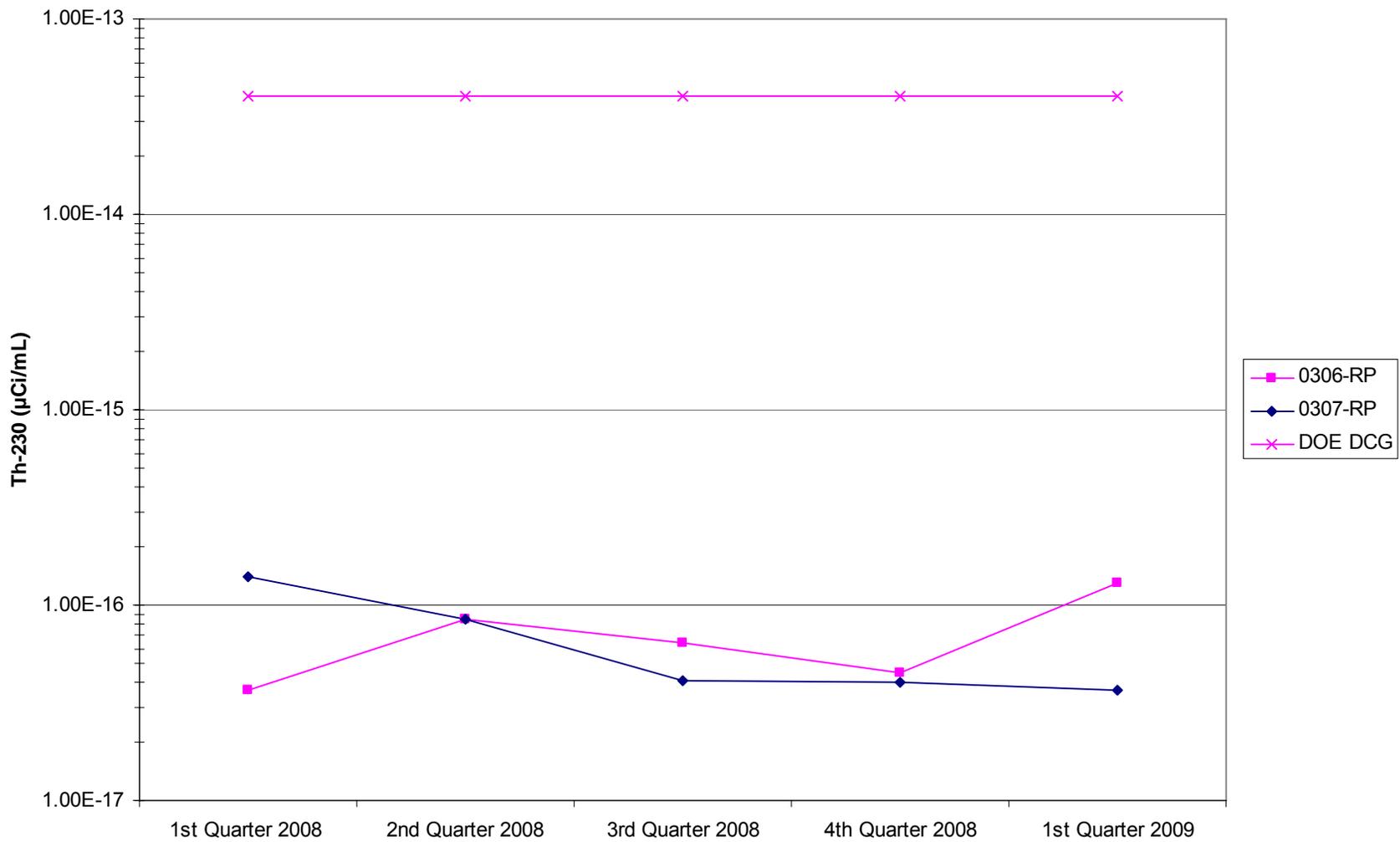


Figure 11. Crescent Junction Radioparticulate Concentration (Th-230)

Crescent Junction Radioparticulate Concentration (Ra-226)

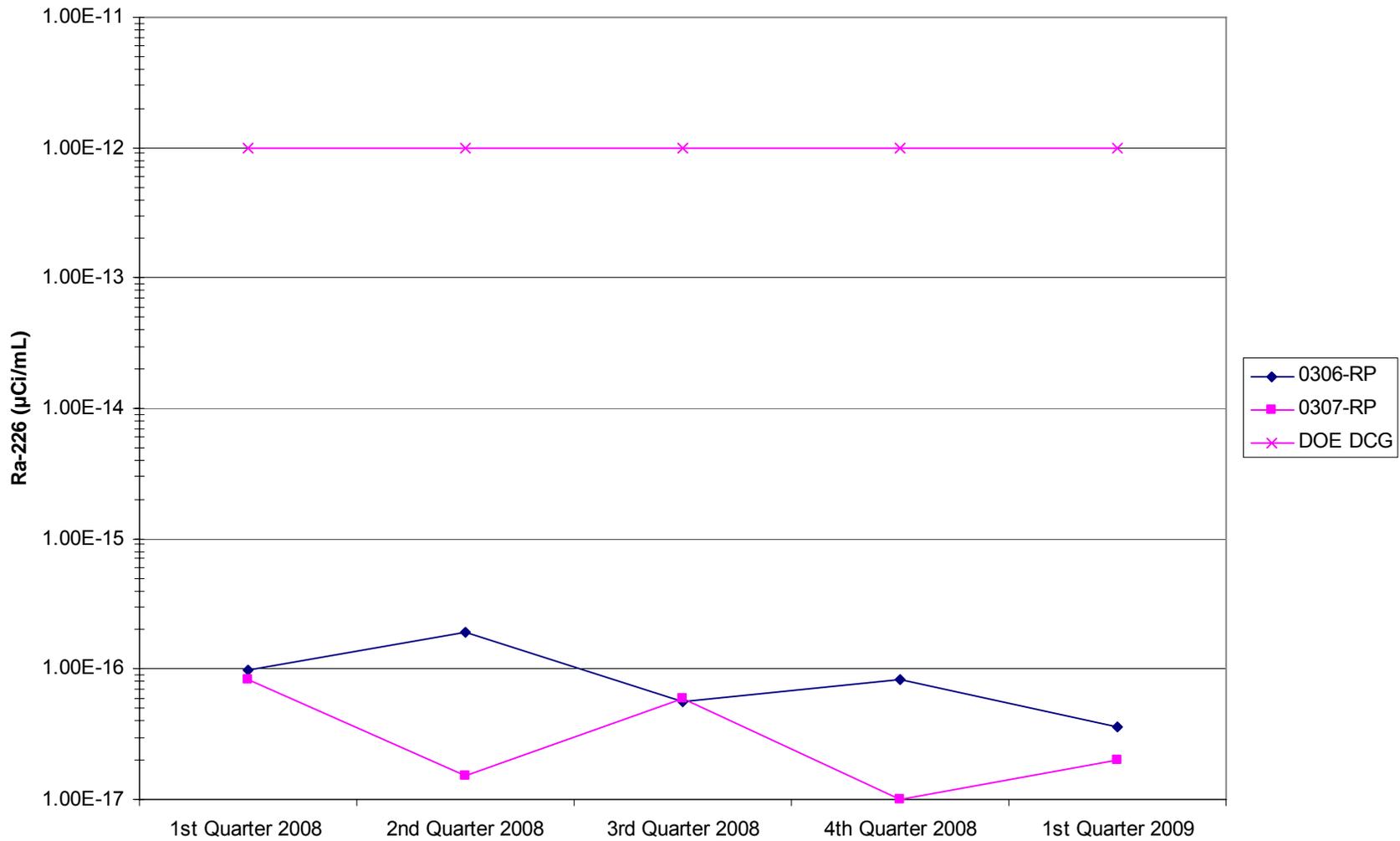


Figure 12. Crescent Junction Radioparticulate Concentration (Ra-226)

Crescent Junction Radioparticulate Concentration (Uranium)

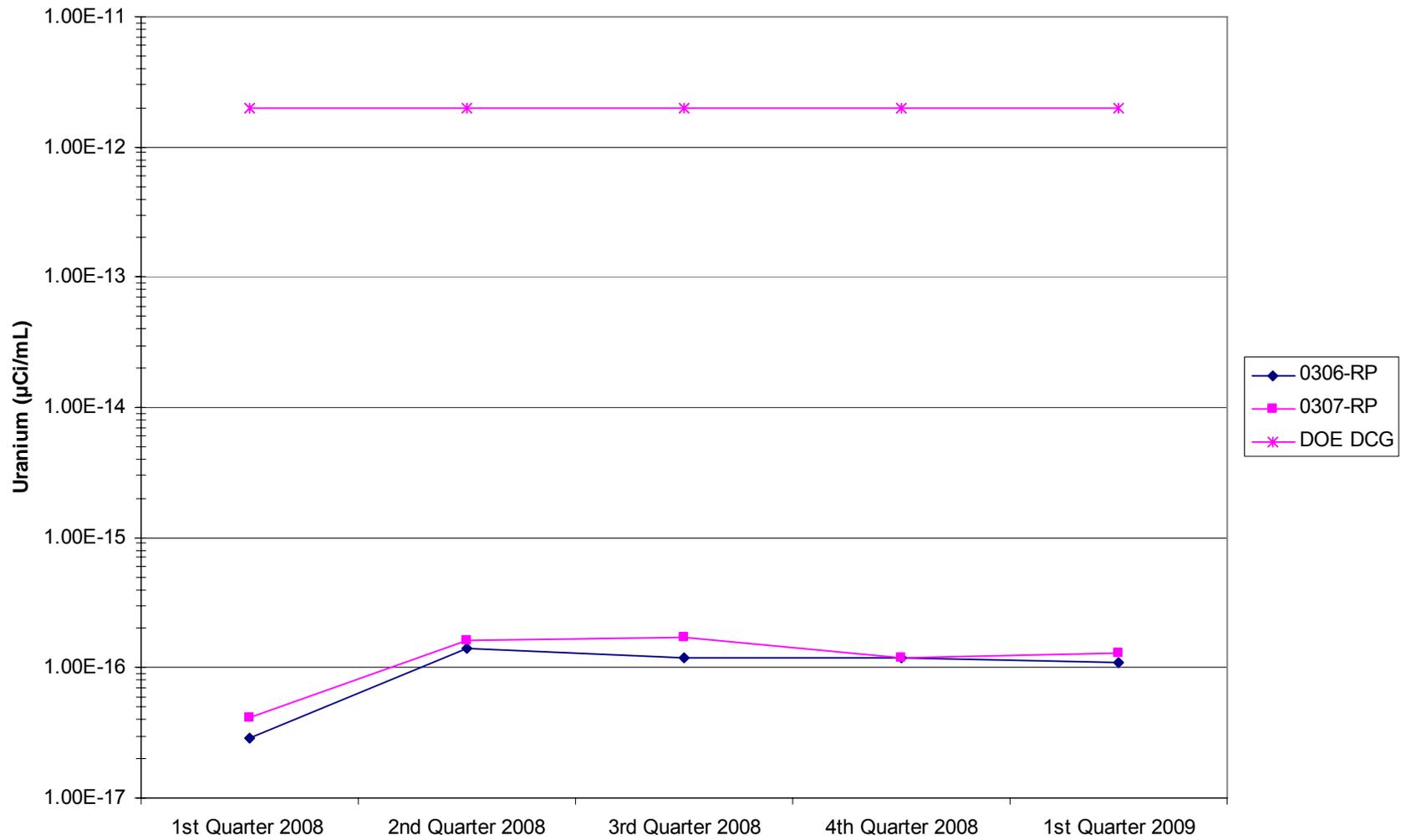


Figure 13. Crescent Junction Radioparticulate Concentration (Uranium)

Crescent Junction Atmospheric Radon-222 Concentration

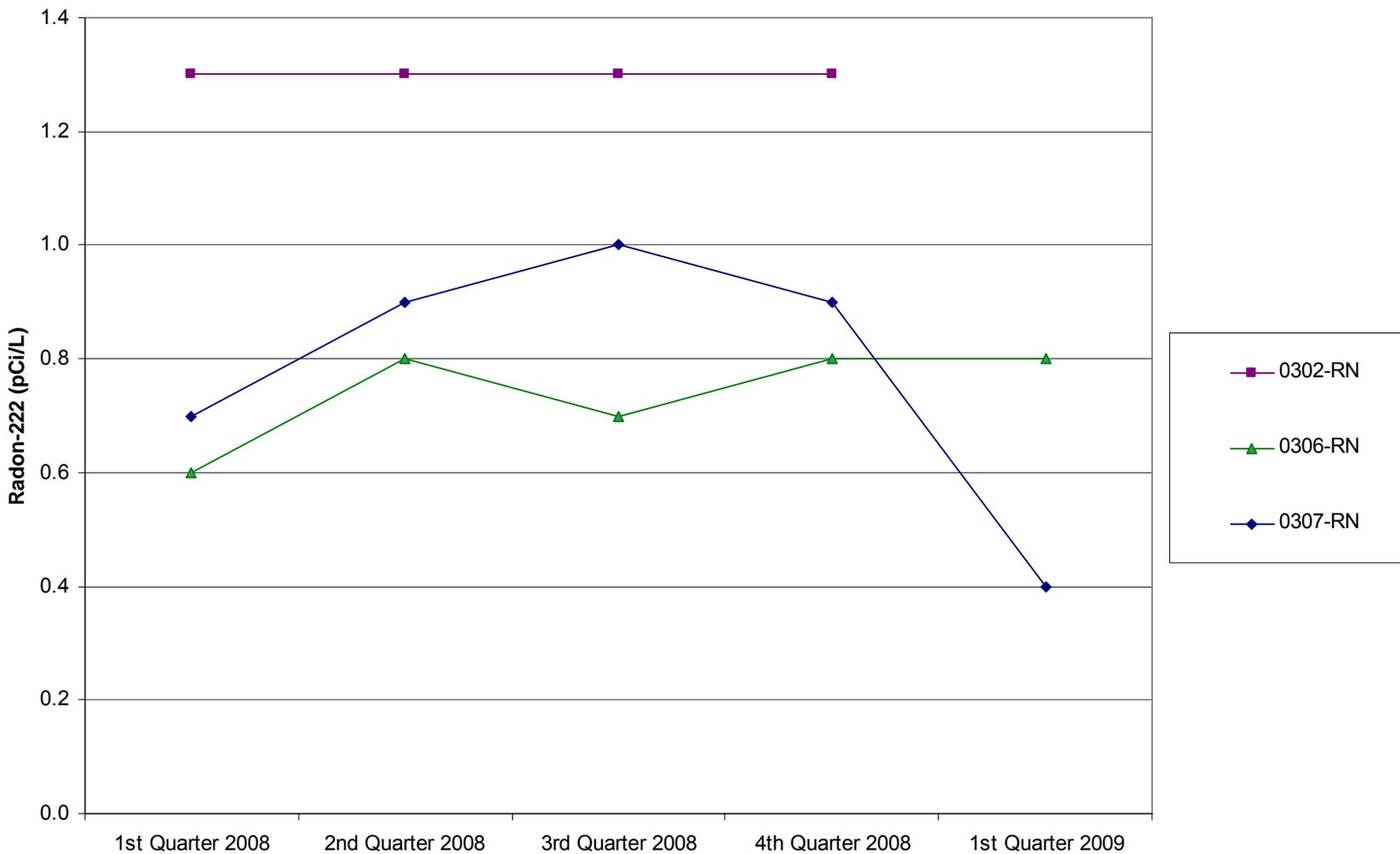


Figure 14. Crescent Junction Atmospheric Radon-222 Concentration

Crescent Junction Direct Gamma Radiation Dose

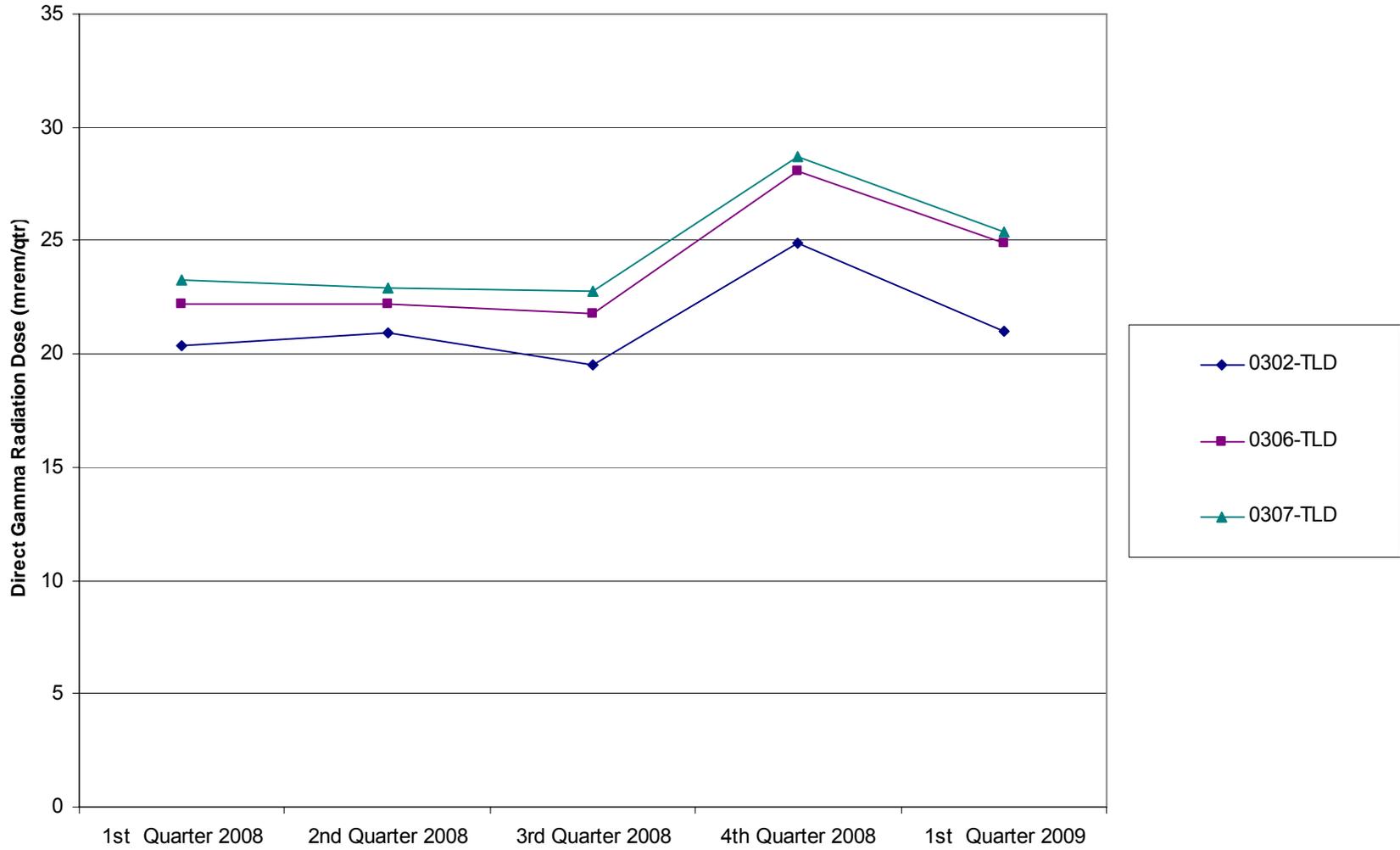


Figure 15. Crescent Junction Direct Gamma Radiation Dose