

*Office of Environmental Management – Grand Junction*



# Environmental Air Monitoring Data Quarterly Report for the Moab and Crescent Junction, Utah, Sites

## First Quarter 2006 (January through March 2006)



U.S. Department  
of Energy

## **Office of Environmental Management**

**Moab/Crescent Junction, Utah**  
Environmental Air Monitoring Results  
January – March 2006

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## Summary of Results

**Site:** Moab, Utah

**Sampling Period:** January through March 2006

**Atmospheric Radon-222:** U.S. Department of Energy (DOE) Order 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. Background concentrations of radon-222 in the Moab area have been measured at 0.7 pCi/L; based on 3 years of data from 2003 through 2005, therefore, the guideline for radon-222 emissions at the Moab Site is 3.7 pCi/L. Monitoring data collected during the first quarter of 2006 indicate that this guideline was equaled or exceeded at four on-site monitoring locations and no off-site locations. Please refer to [Table 1](#) and [Table 2](#) for a review of radon data for the Moab Site.

**Direct Environmental Gamma Radiation:** DOE Order 5400.5, *Radiation Protection of the Public and Environment*, establishes a dose limit of 100 millirem per year (mrem/yr) above naturally occurring gamma levels (background). Background gamma radiation for the Moab area has been measured at 82 mrem/yr; therefore, the gamma dose limit for the Moab Site is 182 mrem/yr. Although radiation doses are summed at the end of a calendar year to determine the actual annual dose, the annual dose may be *estimated* from the quarterly monitoring results. Based on the monitoring data collected from the first quarter of 2006, seven on-site monitoring locations exceeded the gamma dose limit, while none of the off-site monitoring locations exceeded the gamma radiation dose limit. Please refer to [Table 1](#) and [Table 2](#) for a review of gamma data for the Moab Site.

It should be noted that, although the exposure rates may be exceeded at several locations along the DOE site property boundary, this does not reflect expected doses to the public. These data represent the dose that a member of the public could receive if that person 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 maximum exposed individual (MEI) location, just east of the Moab Site, represents the greatest potential exposure to a member of the public. The gamma radiation dose measured at the MEI was 70 mrem/yr.

**Radioparticulates:** No standards or radiological exposure limits were exceeded at any of the nine radioparticulate monitoring locations during the current monitoring period. Analytical data for all analytes (radium-226, thorium-230, polonium-210, and uranium-total) were below their respective Derived Concentration Guidelines (DCGs), as found in DOE Order 5400.5, *Radiation Protection of the Public and Environment* ([Table 3](#)). Concentrations of the radioparticulates have been consistently below DCGs since DOE took ownership of the site in 2001. DOE Order 5400.5 also requires that the individual dose resulting from airborne emissions be less than 10 mrem/yr. All off-site sampling location concentrations, when converted to dose, were indistinguishable from the average background value of 0.7 mrem/yr. The on-site dose resulting from airborne emissions, including background, was 1.2 mrem/yr at both locations (stations 0102 and 0105). Please refer to [Table 3](#) for a review of radioparticulate air monitoring data for the Moab Site.

Table 1. Moab Environmental Air Monitoring Locations with Samples that Exceeded Applicable Regulatory Standards, Limits, or Guidelines During the First Quarter, 2006.

Analyte	Standard / Guideline	Sampling Locations Exceeding Standards/Guidelines
Radon-222	3.7 pCi/L	0105, 0106, 0107, 0108
Direct Gamma Radiation	182 mrem/yr	0101, 0105, 0107, 0108, 0109, 0110, 0111

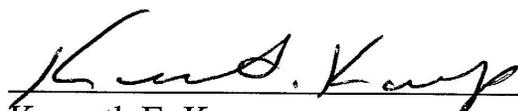
**Site:** Crescent Junction, Utah

**Sampling Period:** July 2005 through March 2006

**Atmospheric Radon-222:** U.S. Department of Energy (DOE) Order 5400.5, *Radiation Protection of the Public and Environment*, establishes a guideline for atmospheric emissions of radon-222 gas that is applicable to the Crescent Junction disposal site (3.0 pCi/L above background). 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). This data set (all data collected until tailing placement begins) will be used to calculate a background value and ultimately a site-specific radon standard. Please refer to [Table 4](#) for a review of radon data for the Crescent Junction Site.

**Direct Environmental Gamma Radiation:** DOE Order 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 data results to date represent baseline conditions (i.e., natural background conditions). This data set (all data collected until tailing placement begins) will be used to calculate a background value and ultimately a site-specific gamma radiation standard. Please refer to [Table 4](#) for a review of gamma data for the Crescent Junction Site.

**Radioparticulates:** DOE Order 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). This data set (all data collected until tailing placement begins) will be used to calculate a background value and ultimately a site-specific radioparticulate standard. Sampling for radioparticulates began during September 2005. Please refer to [Table 5](#) for a review of radioparticulate air monitoring data for the Crescent Junction Site.

  
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 Kenneth E. Karp  
 Moab Project Manager

8-2-06  
 \_\_\_\_\_  
 Date

# **Data Assessment**

## Environmental Air Monitoring Field Activities Verification Checklist

<b>Project</b>	<u>Moab/Crescent Junction, Utah</u>	<b>Date(s) of Air Sampling</b>	<u>January – March 2006</u>
<b>Date(s) of Verification</b>	<u>July 7, 2006</u>	<b>Name of Verifier</b>	<u>Jeff Price</u>

	<b>Response (Yes, No, NA)</b>	<b>Comments</b>
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?	Yes	
4. Did any of the samplers require air flow adjustment?	Yes	
5. Were detectors (radon cups, TLDs) and monitoring equipment found to be in undisturbed and operable condition upon arrival?	No	Range cattle had knocked TLDs (302 & 305) and radon cup (301) to the ground at the Crescent Junction site.
6. Were the hourly clocks on the low-volume air samplers operational upon arrival?	No	Some of the clocks failed; they have been replaced.
7. Were the run times recorded for each radioparticulate monitoring location?	Yes	
8. Were duplicates (for radon and gamma radiation) taken at a frequency of one per 20 samples?	Yes	
9. Were equipment blanks (for radioparticulates) taken at a frequency of one per 20 samples?	No	Not required. Concentration of uranium slightly above detection; contribution of uranium in filter matrix will be negated when subtracting background concentrations.
10. Were trip blanks (for radon and gamma radiation) included with each shipment?	Yes	
11. Was the identity of the QC sample locations protected?	Yes	
12. Were the true locations of the QC samples recorded in the Field Log Book?	Yes	
13. Were all samples collected as specified in the SAP?	Yes	
14. Were chain of custody records completed and was sample custody maintained?	Yes	
15. Are field data sheets signed and dated by sampling personnel?	Yes	
16. Was all other pertinent information documented on the field data sheets?	Yes	

# Data Assessment Summary

## Atmospheric Radon-222 Analyses

Radon cups were analyzed by Landauer Inc. in accordance with Landauer's *Quality Assurance Manual for Radon Monitoring Services, Revision Number 9, October 17, 2002*. First quarter 2006 analytical radon data were received in a report dated April 27, 2006 (Crescent Junction data from 2005 were received in separate reports). Unlike radioparticulate analyses, radon-222 data are not reported with qualifiers. The laboratory will make a special note/comment in the event that the detectors are missing, damaged, or the detectors cannot be read. Once the data report is received, sampling personnel review all data to insure that the results are consistent with other data points as well as with previous data collected for each monitoring location. Data reports are checked to verify that the reported concentrations/results are correct.

## Direct Environmental Gamma Radiation Analyses

Thermoluminescent dosimeters (TLDs) 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, Revision 6* (Teledyne Isotopes 1995). First quarter 2006 environmental gamma radiation data were received in a report dated April 20, 2006 (Crescent Junction data from 2005 were received in separate reports). All data are reported at the 95% confidence level (2 sigma). Once the data report is received, sampling personnel review all data to ensure that the results are consistent with other data points as well as with previous data collected for each monitoring location. Data reports are checked to verify that the reported concentrations/results are correct.

## Radioparticulate Analyses

All radioparticulate samples were analyzed by Severn Trent Laboratories (STL)-St. Louis, Missouri. Radioparticulate samples for the first quarter of 2006 were sent to STL for analysis on April 13, 2006. STL analyzed the glass fiber (47 mm) air filters for radioparticulates (radium-226, thorium-230, polonium-210, and uranium-total). Analytical results for the first quarter 2006 sampling period are reported by STL in Report Identification Number (RIN) 06030340 (Crescent Junction data from 2005 were received in separate reports). Polonium-210 and thorium-230 were analyzed by alpha spectrometry, STL methods STL-RC-0210 and EML A-01-R MOD, respectively. Radium-226 was analyzed by gas proportional counting, STL method EML RA-06-RC MO. Total uranium was analyzed by inductively coupled plasma-mass spectrometry, EPA method SW-846 6020. Radioparticulate analytical data for samples collected during the first quarter of 2006 were reviewed, validated, and summarized in the *Data Review and Validation Report for RIN 06030340* (June 5, 2006), which was prepared and issued by the Grand Junction Site laboratory and sample coordinator.

## Field Activities

Duplicate samples are collected for direct gamma environmental radiation at three Moab locations: (1) 0123, an off-site, background monitoring site with consistently low readings; (2) 0108, an on-site location with consistently elevated readings; and (3) MEI, an off-site location. Duplicate samples for radon-222 monitoring are collected only at the MEI location. The MEI is located immediately east of the Moab Site property boundary and represents the worst-case exposure scenario to a member of the public. Three duplicate TLD measurements were made at Crescent Junction: (1) 0306 and 0307 are sampling locations near private residences; and (2) 0305 was a randomly chosen location on site.

Duplicate samples are not collected for radioparticulate samples. Because the radioparticulate sample data collected to date indicate that all of the isotopes are several orders of magnitude below their respective DCGs, the costs associated with purchasing a duplicate sampler, providing additional electrical power, and incurring additional analytical expenses were not justified.

## Suspected Anomalies

All analytical data are reviewed for anomalous or outlying data points. This review consists of evaluating monitoring data against historical and minimum/maximum values to determine if the reported data are within reasonable expected ranges. Because there are relatively few sample locations (i.e., data points), and the historical data set is relatively short, this review is currently conducted manually. An automated review of reported analytical data against historical and minimum/maximum values may be initiated at some point in the future once it is determined that the data set has become too large or cumbersome for an accurate manual review. Based upon a review of the monitoring data collected during the first quarter of 2006, there were no anomalous data identified.

## Summary

Data collected during the first quarter of 2006 for both sites and the 2005 data for Crescent Junction met the applicable laboratory control criteria for their respective analyses, and all data were reviewed by qualified personnel and found to be within the acceptable limits of counting error associated with each matrix. Data reported in this environmental air monitoring report are considered validated and may be treated as final results.

  
\_\_\_\_\_  
Jeff Price  
Environmental Scientist

  
\_\_\_\_\_  
Date

# **Environmental Air Monitoring Data**

# Environmental Air Monitoring Data Summary

This section contains data summary tables for each of the environmental air monitoring matrixes. Radon and direct gamma radiation for the Moab Site are summarized in Table 2; radioparticulate data for the Moab Site are summarized in Table 3. Radon and direct gamma radiation for the Crescent Junction Site are summarized in Table 4; radioparticulate data for the Crescent Junction Site are summarized in Table 5.

Time versus concentration graphs have also been prepared for each matrix sampled at the Moab Site, see [Figure 1](#) through [Figure 6](#). Time versus concentration graphs for the Crescent Junction Site will not be prepared until mill tailing placement begins. When mill tailings disposal begins, location 0306 will likely be the MEI location, location 0307 (approximately 5 miles east of the disposal site) will represent second greatest risk, and locations 0301 through 0305 will provide background data for disposal site. Concentrations over time have been plotted only for selected locations for each matrix. The rationale used for selecting each location is summarized below.

## Radon-222

Radon-222 monitoring data have been graphed ([Figure 5](#)) for the following locations.

(1) Location MEI is considered to represent the worst-case exposure scenario to a member of the public. (2) Location 0107 is located on the southern property boundary of the Moab Site and has historically recorded some of the highest radon exposure readings. (3) Location 0117 (near the Bar-M Chuckwagon) is a background monitoring location located approximately five miles north of the Moab Site property and represents background conditions. (4) Location 0120 (near the Portal RV Park) is approximately one mile southeast of the Moab Site and represents the second greatest risk (second to the MEI location) for off-site exposure.

## Direct Gamma Radiation

Gamma radiation data have been graphed ([Figure 6](#)) for the following locations. (1) Location MEI is considered to represent the worst-case exposure scenario to a member of the public. (2) Location 0107 is on the southern property boundary of the Moab Site and has historically recorded some of the highest gamma radiation exposure readings. (3) Location 0117 (near the Bar-M Chuckwagon) is a background monitoring location approximately five miles north of the Moab Site property. (4) Location 0120 (near the Portal RV Park) is approximately one mile southeast of the Moab Site and represents the second greatest risk (second to the MEI location) for off-site exposure.

## Radioparticulates

Radioparticulate monitoring data have been graphed ([Figure 1](#) through [Figure 4](#)) for the following locations. (1) Location 0102, one of two on-site radioparticulate monitoring locations, is the radioparticulate sampling location closest to the MEI, and provides useful information regarding the MEI's exposure to radioparticulate matter. (2) Location 0105, the other on-site continuous radioparticulate sampler located on the bank of the Colorado River, is the location closest to the emissions source (i.e., the mill tailings pile). Location 0105 is at the site boundary adjacent to the Colorado River and the Matheson Wetlands Preserve. (3) Location 0117 (near the Bar-M Chuckwagon) is a background monitoring location approximately 5 miles north of the

Moab Site property and represents ambient or naturally occurring conditions. (4) Location 0120 (near the Portal RV Park) is approximately one mile southeast of the Moab Site and represents the second greatest risk (second to the MEI location) for off-site exposure.

Table 2. Summary of Environmental Radon and Gamma Radiation Monitoring Data for the Moab Site for Calendar Year 2006

Station Number	1st Quarter 2006 (01/04/06 - 04/04/06)		2nd Quarter 2006 ( )		3rd Quarter 2006 ( )		4th Quarter 2006 ( )		2006 Annual Average	
	Radon pCi/L	Gamma mrem/91 d <sup>3</sup>	Radon pCi/L	Gamma mrem/91 d <sup>3</sup>	Radon pCi/L	Gamma mrem/91 d <sup>3</sup>	Radon pCi/L	Gamma mrem/91 d <sup>3</sup>	Radon pCi/L	Gamma mrem/yr
On-Site Locations										
0101	2.5	54.8								
0102	1.9	23.7								
0103	1.9	25.1								
0104	2.4	26.2								
0105	4.1	46.9								
0106	9.2	39.7								
0107	7.9	52.9								
0108	4.8	112.5								
0109	1.7	51.3								
0110	2.4	80.7								
0111	0.9	63.8								
0112	1.7	38.6								
0113	2.7	Lost								
Off-Site Locations										
0117 <sup>1</sup>	0.6	22								
0118	0.8	20.2								
0119	1	21.4								
0120	0.6	17.8								
0121	0.8	20.1								
0122	0.6	18.5								
0123 <sup>1</sup>	0.4	18.1								
0124	1.6	20.5								
0125	2.2	23.7								
0126	2.7	22								
0127	0.9	19.7								
MEI <sup>2</sup>	2	17.4								

<sup>1</sup>Designated background monitoring locations. Background locations are located at sufficient distances away from the millsite to be free from any affects or influences from potential site contaminants.

<sup>2</sup>The maximally exposed individual (MEI) is the continually occupied residential property that is closest to the DOE property boundary.

<sup>3</sup>mrem value is prorated to a 91-day exposure period.

NA = Not Applicable.

NDA = No Data Available.

Table 3. Summary of Radioparticulate Air Monitoring Data for the Moab Site for Calendar Year 2006

Station Number	Isotope	First Quarter 2006 (μCi/mL) <sup>5</sup>	Second Quarter 2006 (μCi/mL)	Third Quarter 2006 (μCi/mL)	Fourth Quarter 2006 (μCi/mL)	Annual Average (μCi/mL)
<b>On-Site Locations</b>						
0102-RP	Uranium <sup>1</sup>	8.1E-17				8.1E-17
	Thorium-230 <sup>2</sup>	9.6E-17				9.6E-17
	Radium-226 <sup>3</sup>	1.5E-16				1.5E-16
	Polonium-210 <sup>4</sup>	8.1E-15				8.1E-15
0105-RP	Uranium <sup>1</sup>	2.2E-16				2.2E-16
	Thorium-230 <sup>2</sup>	1.7E-16				1.7E-16
	Radium-226 <sup>3</sup>	2.0E-16				2.0E-16
	Polonium-210 <sup>4</sup>	7.8E-15				7.8E-15
<b>Off-Site Locations</b>						
0117-RP	Uranium <sup>1</sup>	1.4E-17				1.4E-17
	Thorium-230 <sup>2</sup>	9.1E-17				9.1E-17
	Radium-226 <sup>3</sup>	1.8E-16				1.8E-16
	Polonium-210 <sup>4</sup>	4.2E-15				4.2E-15
0118-RP	Uranium <sup>1</sup>	5.9E-17				5.9E-17
	Thorium-230 <sup>2</sup>	1.2E-16				1.2E-16
	Radium-226 <sup>3</sup>	2.7E-16				2.7E-16
	Polonium-210 <sup>4</sup>	7.0E-15				7.0E-15
0119-RP	Uranium <sup>1</sup>	4.3E-17				4.3E-17
	Thorium-230 <sup>2</sup>	2.9E-16				2.9E-16
	Radium-226 <sup>3</sup>	1.6E-16				1.6E-16
	Polonium-210 <sup>4</sup>	6.5E-15				6.5E-15
0120-RP	Uranium <sup>1</sup>	2.6E-17				2.6E-17
	Thorium-230 <sup>2</sup>	3.5E-17				3.5E-17
	Radium-226 <sup>3</sup>	1.8E-16				1.8E-16
	Polonium-210 <sup>4</sup>	4.2E-15				4.2E-15
0121-RP	Uranium <sup>1</sup>	2.4E-17				2.4E-17
	Thorium-230 <sup>2</sup>	7.3E-17				7.3E-17
	Radium-226 <sup>3</sup>	2.0E-16				2.0E-16
	Polonium-210 <sup>4</sup>	4.6E-15				4.6E-15
0122-RP	Uranium <sup>1</sup>	2.7E-17				2.7E-17
	Thorium-230 <sup>2</sup>	3.1E-16				3.1E-16
	Radium-226 <sup>3</sup>	2.1E-16				2.1E-16
	Polonium-210 <sup>4</sup>	6.2E-15				6.2E-15
0123-RP	Uranium <sup>1</sup>	2.1E-17				2.1E-17
	Thorium-230 <sup>2</sup>	8.7E-17				8.7E-17
	Radium-226 <sup>3</sup>	1.9E-16				1.9E-16
	Polonium-210 <sup>4</sup>	5.5E-15				5.5E-15

<sup>1</sup>DOE DCG for Total Uranium = 2.E-12

<sup>2</sup>DOE DCG for Thorium-230 = 4.E-14

<sup>5</sup>μCi/mL = microCuries per milliliter

<sup>3</sup>DOE DCG for Radium-226 = 1.E-12

<sup>4</sup>DOE DCG for Polonium-210 = 1.E-12

Table 4. Summary of Environmental Radon and Gamma Radiation Monitoring Data for the Crescent Junction Site for Calendar Year 2006

Station Number	3rd Quarter 2005 (07/18/05 - 11/07/05)		4th Quarter 2005 (11/07/05 - 01/04/06)		1st Quarter 2006 (01/04/06 - 04/04/06)		2nd Quarter 2006 ( )		2006 Annual Average	
	Radon pCi/L	Gamma mrem/91 d <sup>1</sup>	Radon pCi/L	Gamma mrem/91 d <sup>1</sup>	Radon pCi/L	Gamma mrem/91 d <sup>1</sup>	Radon pCi/L	Gamma mrem/91 d <sup>1</sup>	Radon pCi/L	Gamma mrem/yr
0301	4.0	24.2	0.7	28.9	0.6	Lost				
0302	1.0	24.2	1.1	25.3	0.5	20.5				
0303	1.0	25.3	1.1	26.5	1.2	Lost				
0304	1.0	23.3	1	22.9	0.9	21.6				
0305	1.2	24.6	0.7	26.3	0.7	23.5				
0306	1.4	21.5	<0.5	24.3	1.1	19.4				
0307	1.0	24.5	0.8	26.4	2.1	21.5				

mrem value is prorated to a 91 day exposure period.

Table 5. Summary of Radioparticulate Air Monitoring Data for the Crescent Junction Site for Calendar Year 2006

Station Number	Isotope	Fourth Quarter 2005 ( $\mu\text{Ci/mL}$ ) <sup>5</sup>	First Quarter 2006 ( $\mu\text{Ci/mL}$ ) <sup>5</sup>	Second Quarter 2006 ( $\mu\text{Ci/mL}$ ) <sup>5</sup>	Third Quarter 2006 ( $\mu\text{Ci/mL}$ ) <sup>5</sup>	Annual Average ( $\mu\text{Ci/mL}$ ) <sup>5</sup>
0306-RP	Uranium <sup>1</sup>	1.2E-17	9.1E-18			9.1E-18
	Thorium-230 <sup>2</sup>	1.9E-16	5.1E-17			5.1E-17
	Radium-226 <sup>3</sup>	4.9E-16	1.4E-16			1.4E-16
	Polonium-210 <sup>4</sup>	2.4E-15	4.0E-15			4.0E-15
0307-RP	Uranium <sup>1</sup>	1.3E-17	1.4E-17			1.4E-17
	Thorium-230 <sup>2</sup>	1.8E-16	1.6E-16			1.6E-16
	Radium-226 <sup>3</sup>	3.0E-16	2.0E-16			2.0E-16
	Polonium-210 <sup>4</sup>	2.5E-15	3.3E-15			3.3E-15

<sup>1</sup>DOE DCG for Total Uranium = 2.E-12

<sup>2</sup>DOE DCG for Thorium-230 = 4.E-14

<sup>3</sup>DOE DCG for Radium-226 = 1.E-12

<sup>4</sup>DOE DCG for Polonium-210 = 1.E-12

<sup>5</sup> $\mu\text{Ci/mL}$  = microCuries per milliliter

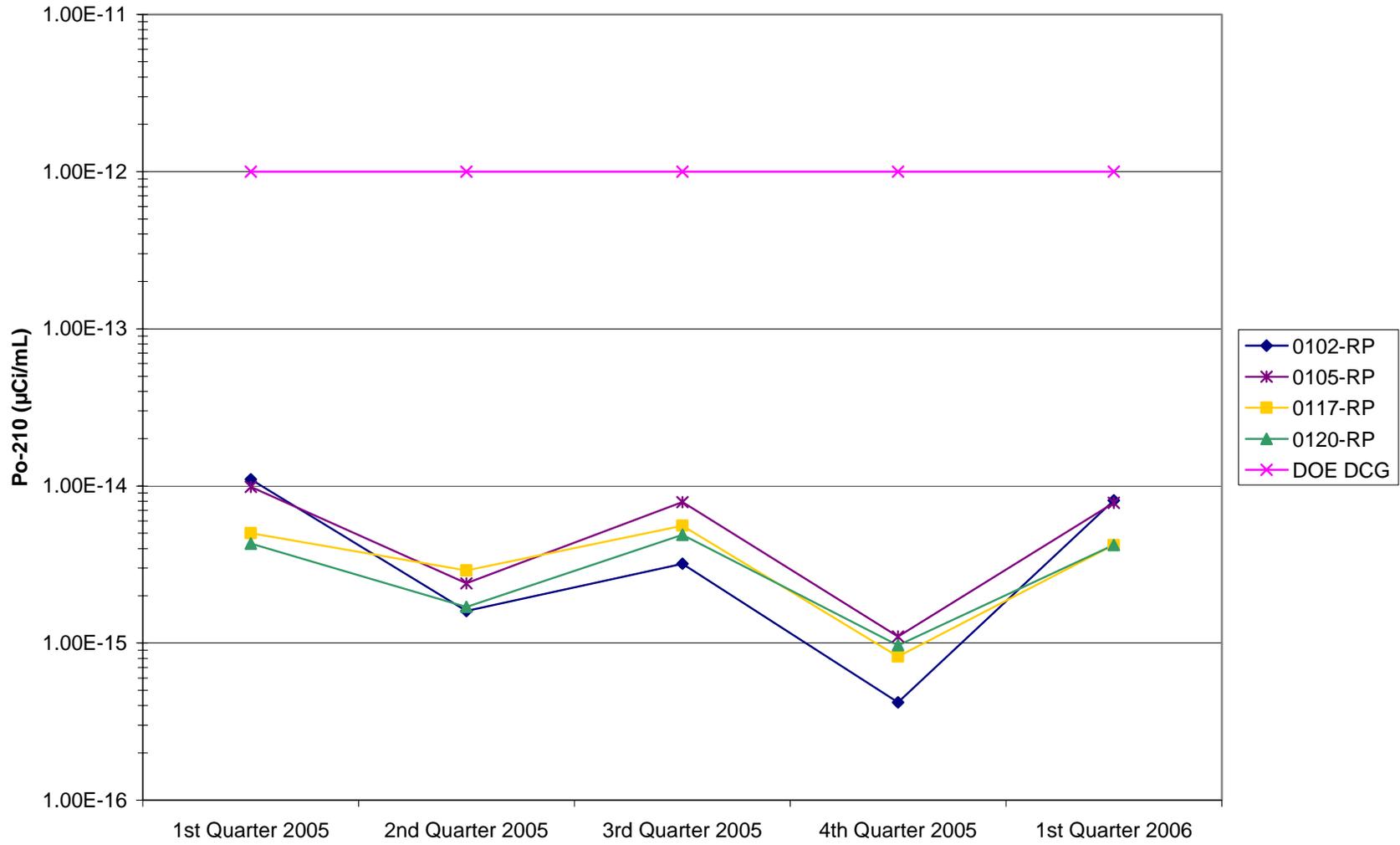


Figure 1. Moab Radioparticulate Concentration (Po-210)

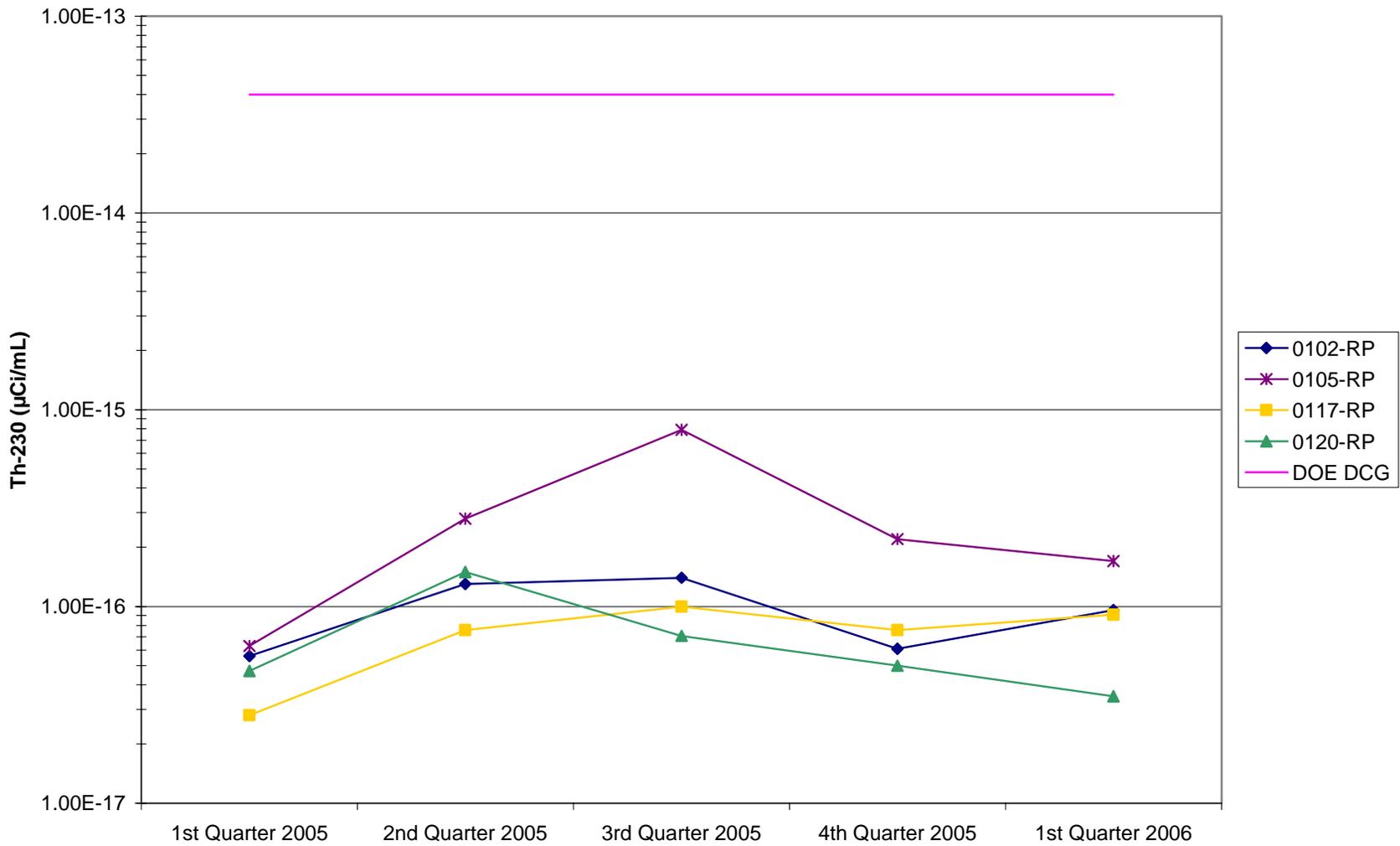


Figure 2. Moab Radioparticulate Concentration (Th-230)

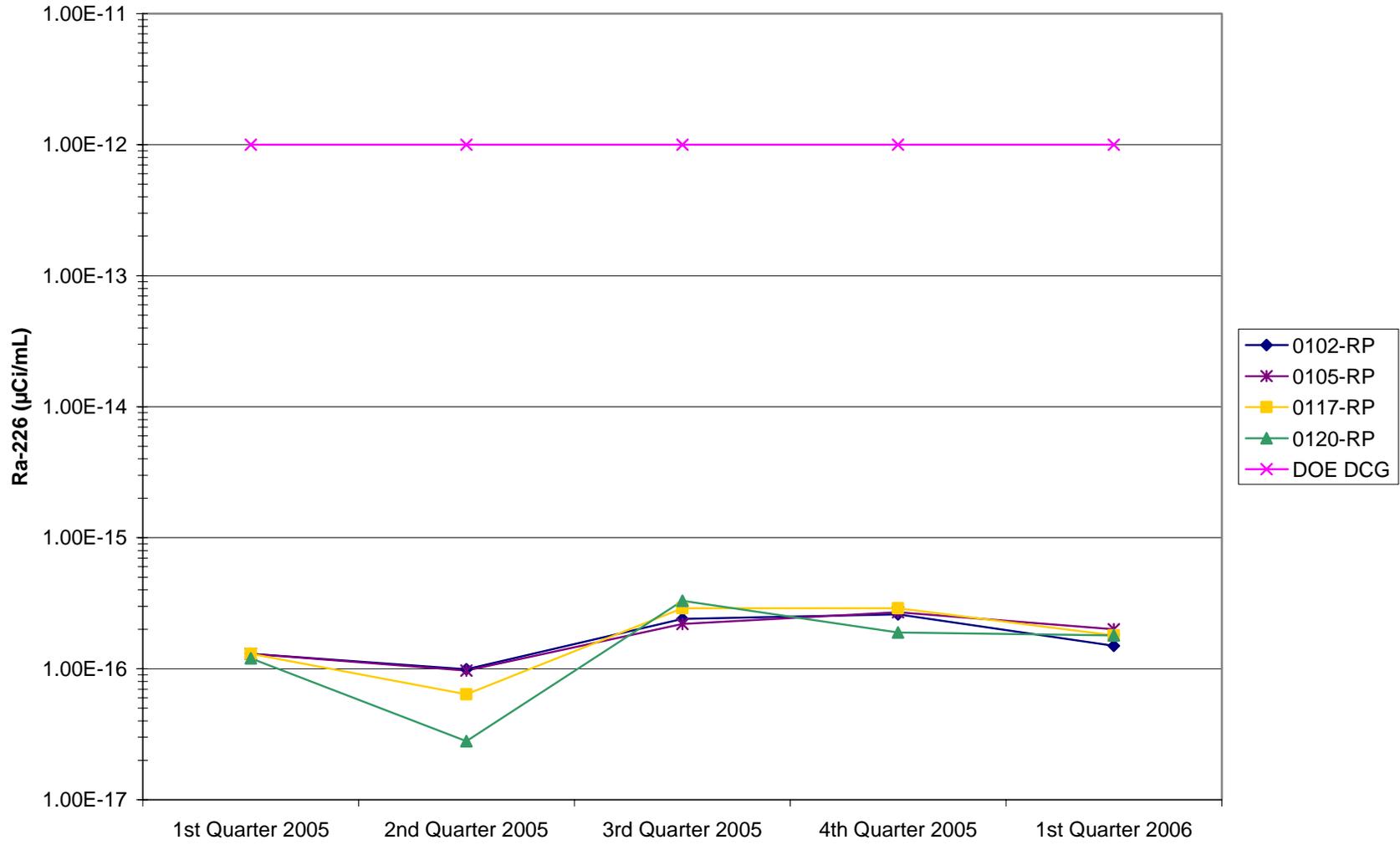


Figure 3. Moab Radioparticulate Concentration (Ra-226)

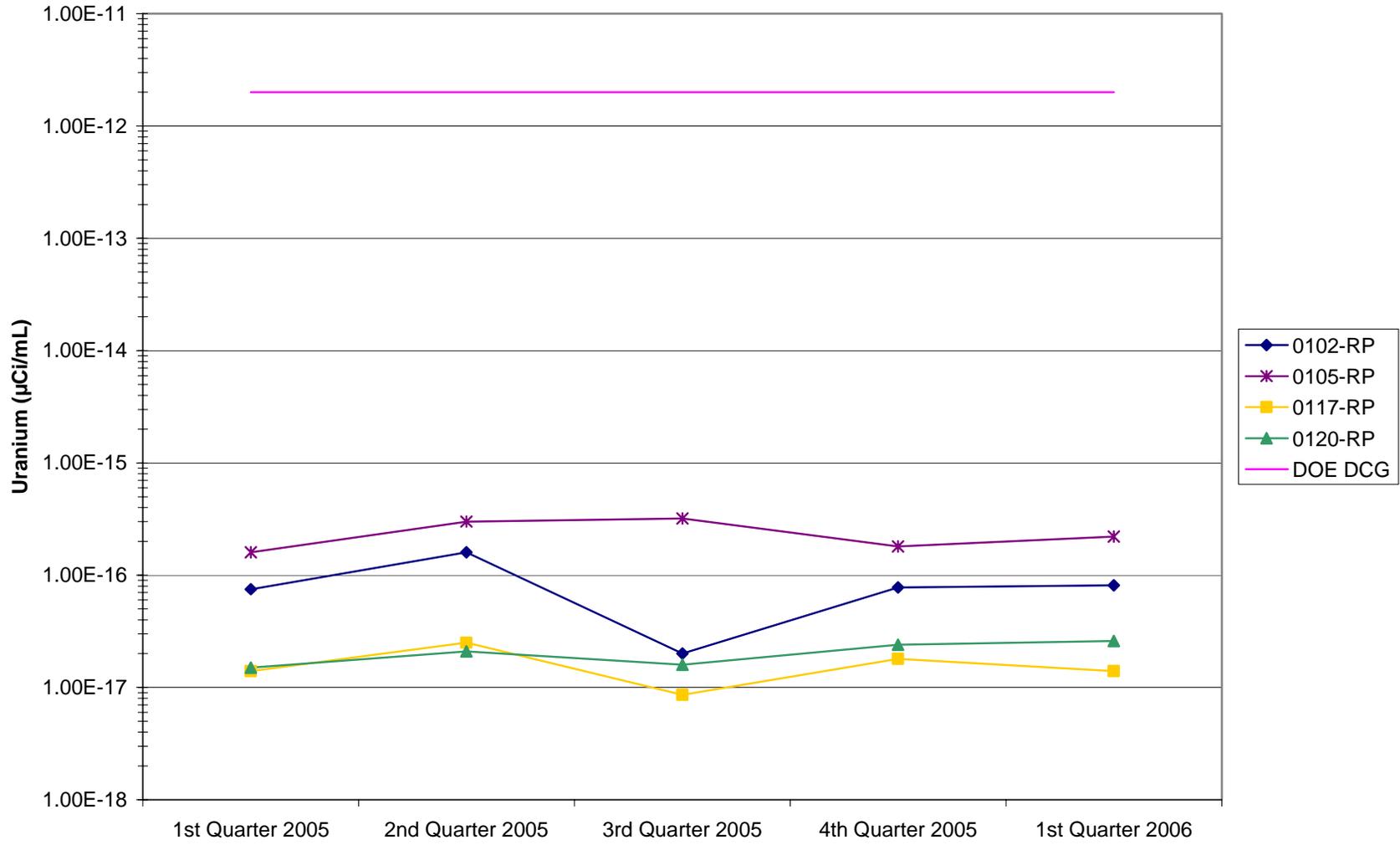


Figure 4. Moab Radioparticulate Concentration (Uranium)

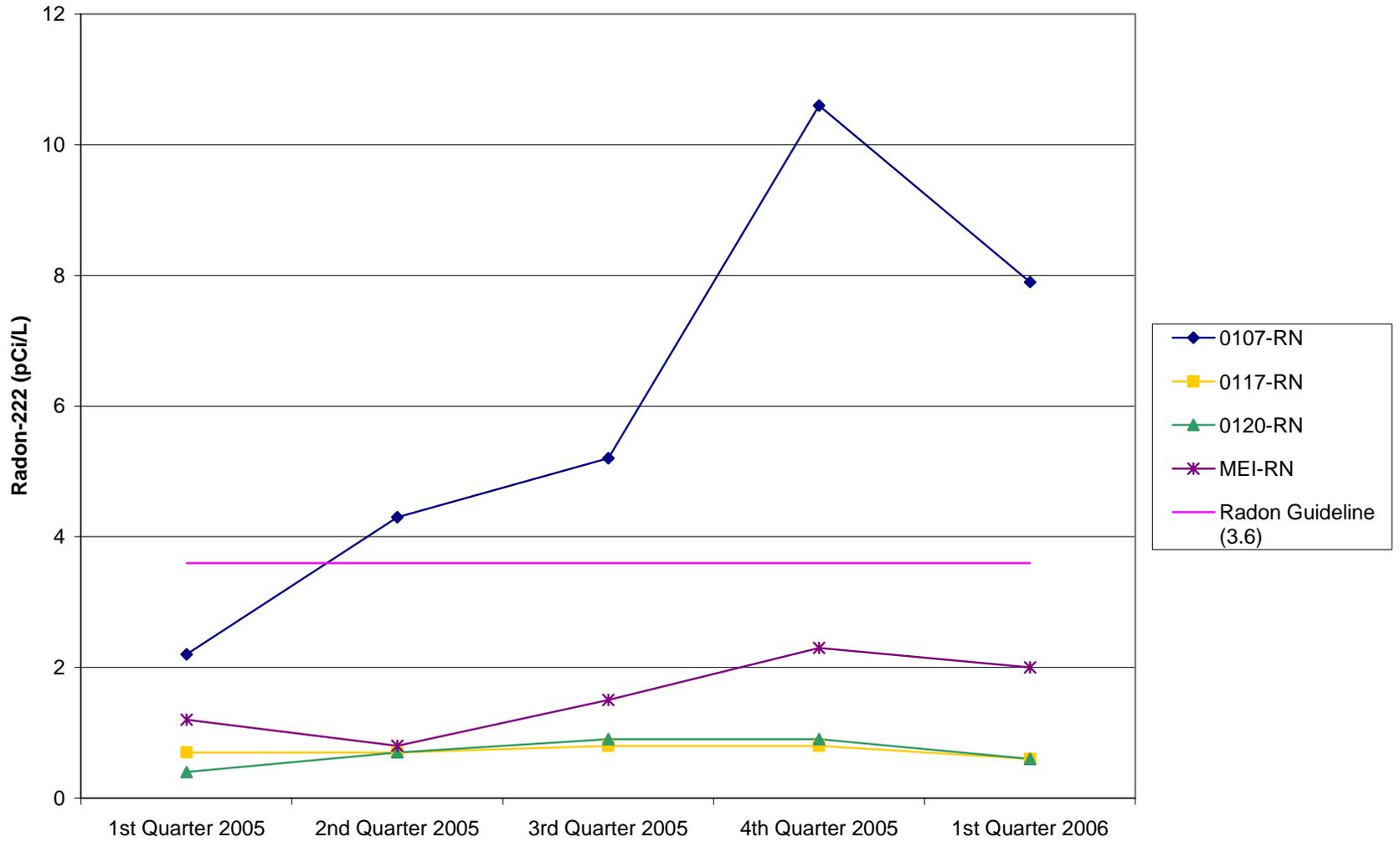


Figure 5. Moab Atmospheric Radon-222 Concentration

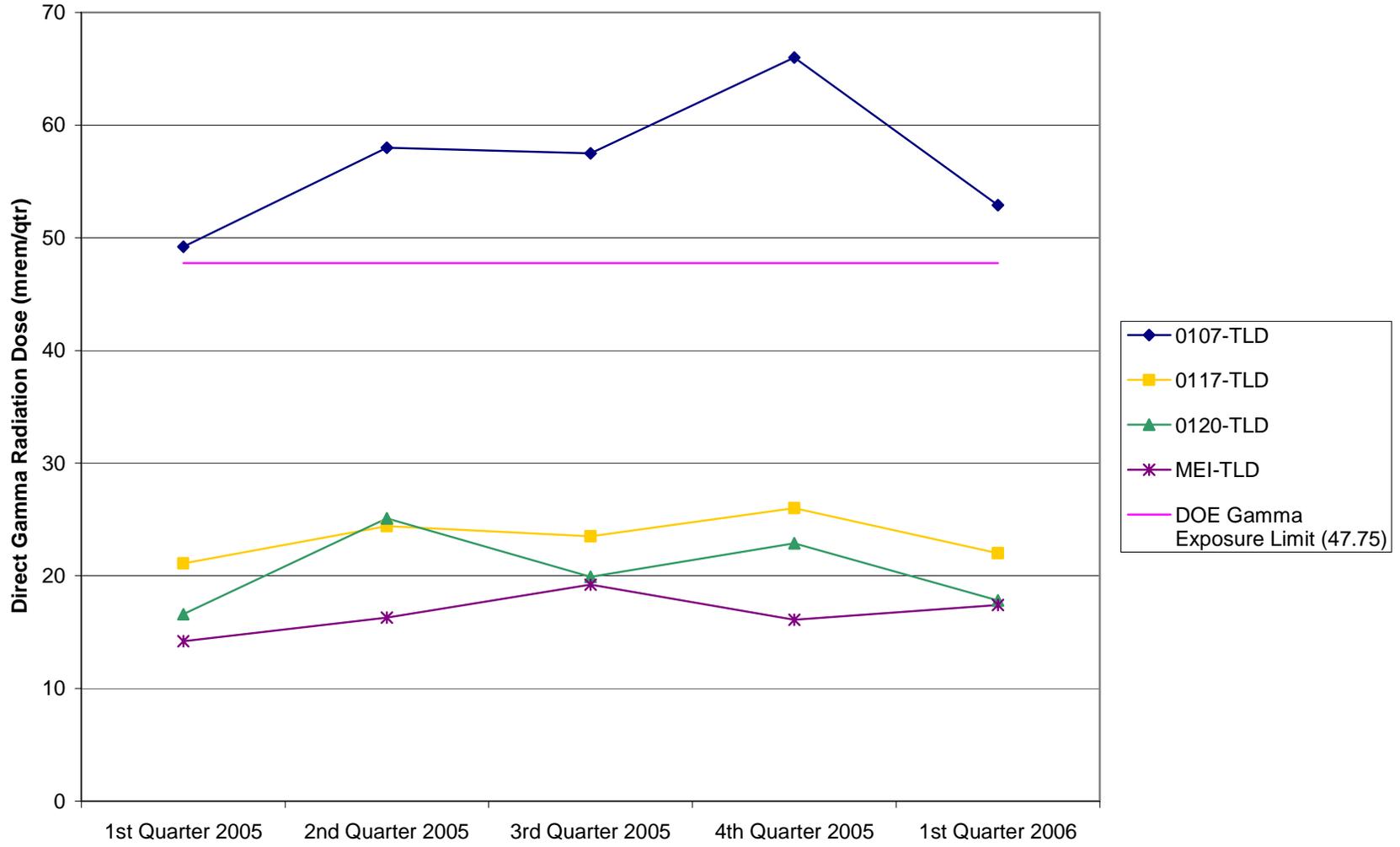
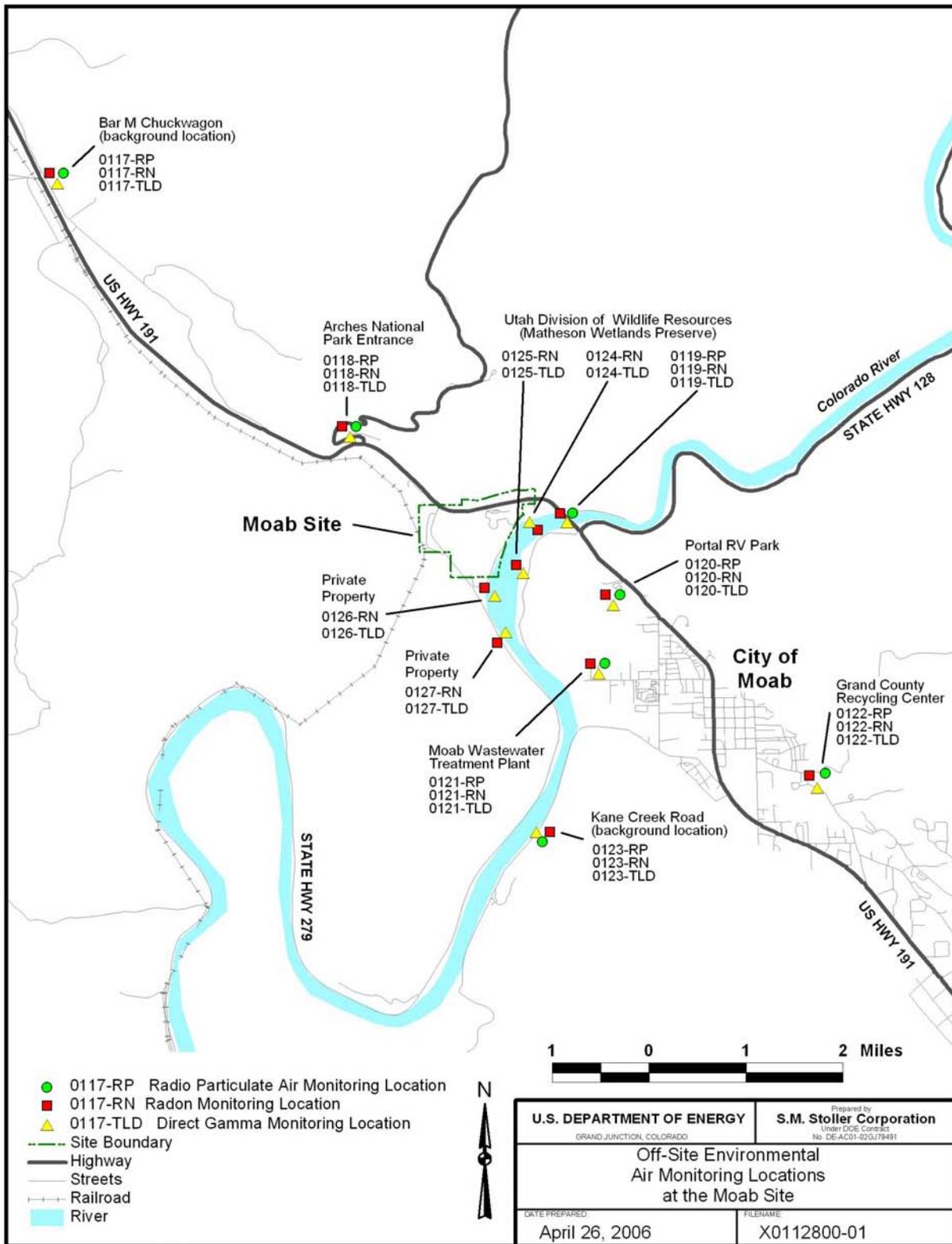


Figure 6. Moab Direct Gamma Radiation Dose

## **Sample Location Maps**



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Figure 7. Off-site Radon, Direct Gamma, and Radioparticulate Monitoring Locations, 2006

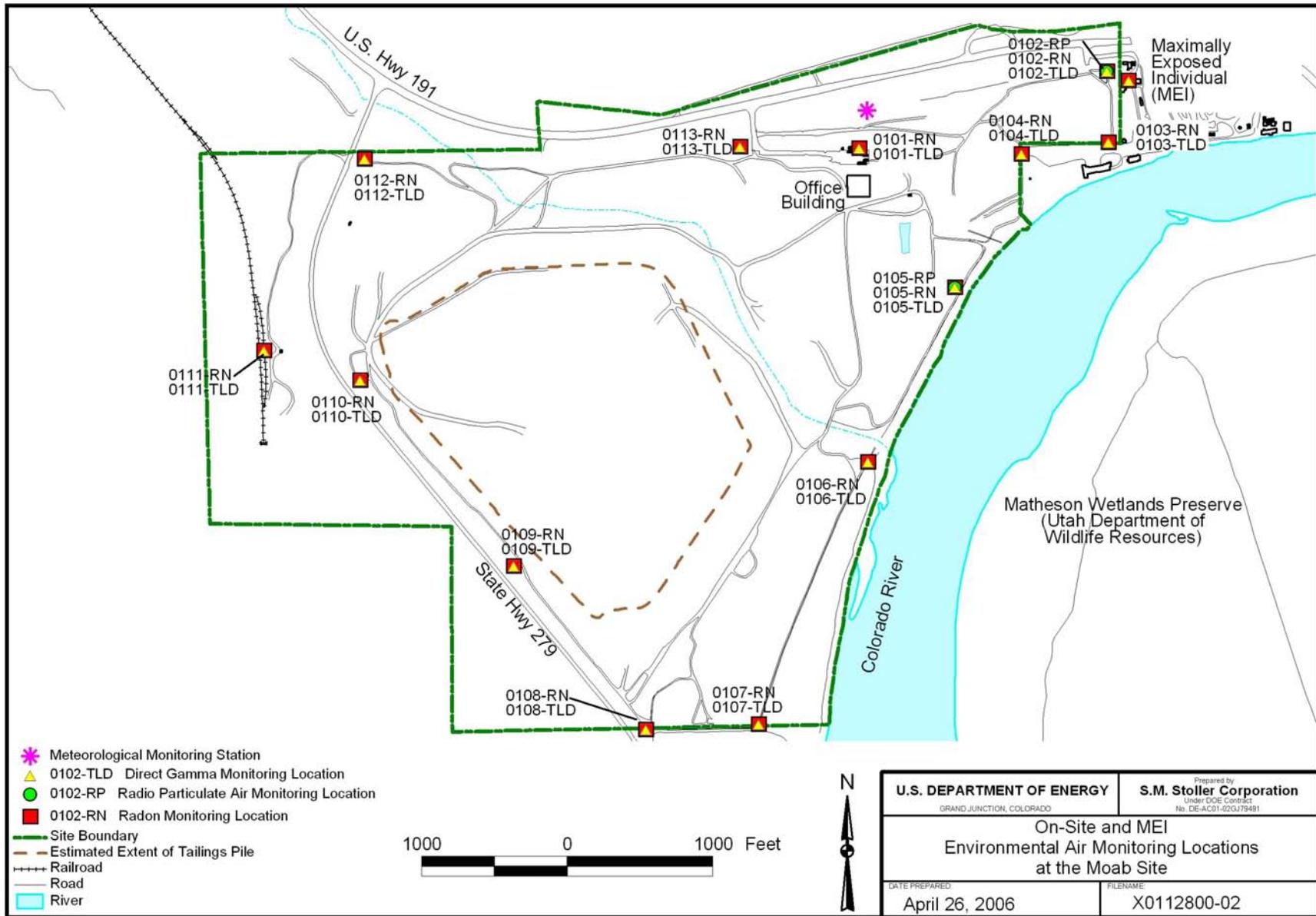


Figure 8. On-site Radon, Direct Gamma, and Radioparticulate Monitoring Locations, 2006

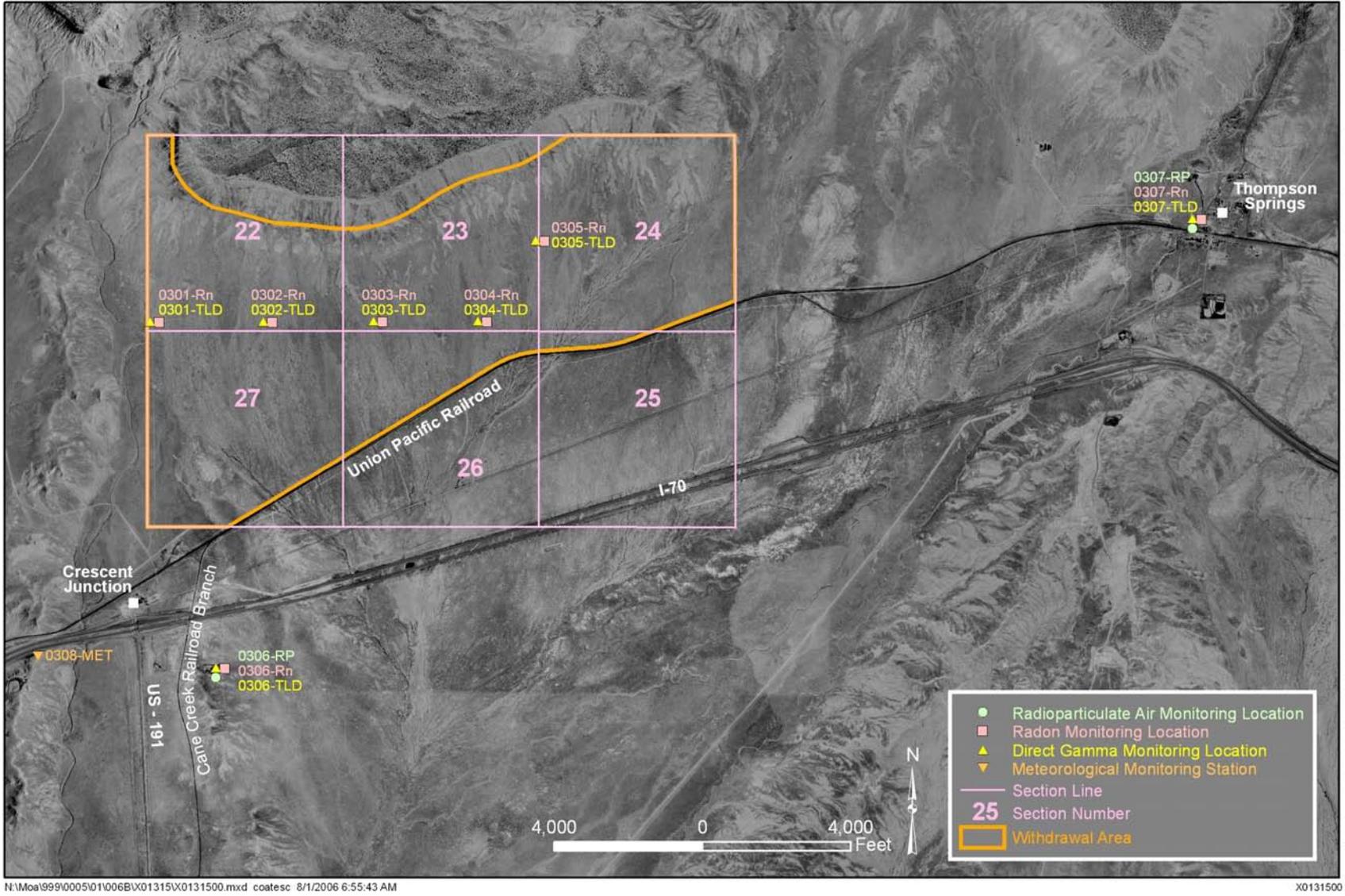


Figure 9. Sampling Location Map for the Crescent Junction Site