

*Office of Environmental Management – Grand Junction*



# Environmental Air Monitoring Data Quarterly Report for the Moab, Utah, Site

## Third Quarter 2005 (July through October 2005)

February 2006



U.S. Department  
of Energy

## **Office of Environmental Management**

**Moab, Utah**  
Environmental Air Monitoring Results  
July – October 2005

**Contents**

<u>Item No.</u>	<u>Description of Contents</u>
1.	<b>Summary of Results</b> Table 1. Moab Environmental Air Monitoring Locations with Samples that Exceeded Applicable Regulatory Standards, Limits, or Guidelines During the Third Quarter, 2005
2.	<b>Data Assessment</b> Environmental Air Monitoring Field Activities Verification Checklist Data Assessment Summary
3.	<b>Environmental Air Monitoring Data</b> Environmental Air Monitoring Data Summary Table 2. Summary of Environmental Radon and Gamma Radiation Monitoring Data for the Moab Site for Calendar Year 2005 Table 3. Summary of Radioparticulate Air Monitoring Data for the Moab Site for Calendar Year 2005 Time Versus Concentration Graphs
4.	<b>Sample Location Maps</b>

## Summary of Results

**Site:** Moab, Utah

**Sampling Period:** July through October 2005

**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 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 for the third quarter have been measured to be 0.7 pCi/L; therefore, the guideline for radon-222 emissions at the Moab Site for this sampling period is 3.7 pCi/L. Monitoring data collected from the third quarter of 2005 indicate that this guideline was exceeded at three on-site monitoring locations, as shown in Tables 1 and 2. Duplicate detectors were also deployed off-site at the Maximally Exposed Individual (MEI) location, which represents the member of the public residing closest to the tailings pile and is considered to have the greatest potential for exposure. None of the off-site radon monitoring locations, including the MEI location, exceeded DOE's monitoring guideline for radon.

**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 during the third quarter has been annualized at 88 mrem/yr; therefore, the gamma dose limit for the Moab Site is 188 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 third quarter of 2005, elevated gamma measurements were observed at eight on-site monitoring locations, as shown in Tables 1 and 2. None of the off-site monitoring locations, including the MEI location, exceeded DOE's gamma radiation dose limit.

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 (on an annual basis) at or near these elevated locations. Monitoring data observed at the MEI location represents the greatest potential exposure to a member of the public. These data are less than the DOE annual public dose limit (100 mrem/yr), therefore the dose limit to the public is not being exceeded.

**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.

*Table 1. Moab Environmental Air Monitoring Locations with Samples that Exceeded Applicable Regulatory Standards, Limits, or Guidelines During the Third Quarter, 2005*

Analyte	Standard / Guideline	Sampling Locations Exceeding Standards/Guidelines
Radon-222	3.7 pCi/L	0106, 0107, 0108
Direct Gamma Radiation	188 mrem/yr	0101, 0105, 0107, 0108, 0109, 0110, 0111, 0113



Kenneth E. Karp  
Moab Project Manager

3-7-06

Date

# **Data Assessment**

## Environmental Air Monitoring Field Activities Verification Checklist

<b>Project</b>	<u>Moab, Utah</u>	<b>Date(s) of Water Sampling</b>	<u>July through October 2005</u>
<b>Date(s) of Verification</b>	<u>February 2, 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	
Did any of the samplers require air flow adjustment?	Yes	
4. Were detectors (radon cups, TLDs) and monitoring equipment found to be in undisturbed and operable condition upon arrival?	Yes	
5. Were the hourly clocks on the low-volume air samplers operational upon arrival?	Yes	
Were the run times recorded for each radioparticulate monitoring location?	Yes	
6. Were duplicates (for radon and gamma radiation) taken at a frequency of one per 20 samples?	Yes	
7. 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.
8. Were trip blanks (for radon and gamma radiation) included with each shipment?	Yes	
9. Was the identity of the QC sample locations protected?	Yes	
Were the true locations of the QC samples recorded in the Field Log Book?	Yes	
10. Were all samples collected as specified in the SAP?	Yes	
11. Were chain of custody records completed and was sample custody maintained?	Yes	
12. Are field data sheets signed and dated by sampling personnel?	Yes	
13. 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*. Third quarter 2005 analytical radon data were received in a report dated November 23, 2005. 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, and 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 at the Moab Site, 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). Third quarter 2005 environmental gamma radiation data were received in a report dated November 22, 2005. All data are reported at the 95% confidence level (2 sigma). Once the data report is received, sampling personnel review all data to insure that the results are consistent with other data points, and 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 third quarter of 2005 were sent to STL for analysis on November 15, 2005.

STL analyzed the glass fiber (47 mm) air filters for radioparticulates (radium-226, thorium-230, polonium-210, and uranium-total). Analytical results for the third quarter 2005 sampling period are reported by STL in Report Identification Number (RIN) 05110262. 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 third quarter of 2005 were reviewed, validated, and summarized in the *Data Review and Validation Report for RIN 05110262* (December 28, 2005), 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 locations:

1) MPS-0117, an off-site, background monitoring site, with consistently low readings; 2) MPS-0107, an on-site location with consistently elevated readings; and 3) MPS-0127, an off-site location that is immediately up-wind of the city of Moab, and is directly south of the Moab Site. 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.

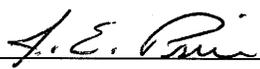
Duplicate samples are not collected for radioparticulate samples. Because the radioparticulate sample data collected to date indicate that all of the isotopes are several orders of magnitude below their respective DCGs, the costs associated with purchasing a duplicate sampler, providing additional electrical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

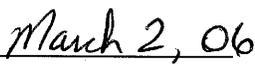
## Suspected Anomalies

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 third quarter of 2005, there were no anomalous data identified.

## Summary

Data collected during the third quarter of 2005 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 are summarized in Table 2; radioparticulate data are summarized in Table 3. Each data table also displays monitoring data collected during the previous quarters for the calendar year.

Background concentration values for all analytes have historically been calculated on an annual basis. However, since background values change on a quarterly basis, background values will now be reported on a quarterly basis.

Sample location identifiers have been changed slightly since the second quarter report was published. This change was necessary so the environmental data can be given unique identifiers, which will facilitate more efficient data management. The "MPS" prefix has been dropped, however, the unique numeric designation has not changed. Also, the reader will note in some of the data tables that specific analyte data now have a suffix. The suffix designations are as follows: radon data have an "rn" suffix, radioparticulate data have an "rp" suffix, and gamma radiation data have a "tld" suffix.

Time versus concentration graphs have also been prepared for each matrix. 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 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 Chuck Wagon) 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 1 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 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 Chuck Wagon) 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 south-east 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 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 Chuck Wagon) 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 1 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 2005

Station Number	1st Quarter 2005 (01/18/05 - 04/06/05)		2nd Quarter 2005 (04/06/05 - 07/11/05)		3rd Quarter 2005 (07/11/05 - 11/08/05)		4th Quarter 2005 (11/08/05 - 12/XX/05)	
	Radon pCi/L	Gamma mR/91 d (EAA) <sup>3</sup>	Radon pCi/L	Gamma mR/91 d (EAA)	Radon pCi/L	Gamma mR/91 d (EAA)	Radon pCi/L	Gamma mR/91 d (EAA)
<b>On-Site Locations</b>								
0101	2.2	72.5(290.8)	2.1	64.8(260.0)	3.0	65.9(264.3)		
0102	1.6	23.6(94.7)	1.3	24.2(97.1)	1.3	25.0(100.3)		
0103	1.4	24.5(98.3)	1.3	24.2(97.1)	1.4	26.1(104.7)		
0104	1.6	30.6(122.7)	1.6	26.5(106.3)	2.0	26.8(107.5)		
0105	2.2	46.1(184.9)	2.1	49.1(196.9)	2.9	49.9(200.1)		
0106	5.8	39.7(159.2)	5.3	41.2(165.3)	7.6	43.4(174.1)		
0107	2.2	49.2(197.3)	4.3	58.0(232.6)	5.2	57.5(230.6)		
0108	2.7	117.4(470.9)	4.7	139.4(559.1)	5.0	131.9(529.0)		
0109	1.7	51.3(205.8)	1.8	59.4(238.3)	2.3	55.7(223.4)		
0110	1.4	81.2(325.7)	3.4	89.6(359.4)	2.3	89.7(359.8)		
0111	0.6	63.7(255.5)	1.3	NDA	1.0	71.5(286.8)		
0112	1.3	37.3(149.6)	1.9	38.1(152.8)	2.3	42.3(169.7)		
0113	1.7	79.6(319.3)	2.4	74.6(299.2)	2.8	73.6(295.2)		
<b>Off-Site Locations</b>								
0117	0.7	21.1(84.6)	0.7	24.4(97.9)	0.8	23.5(94.3)		
0118	0.5	15.1(60.6)	0.8	18.9(75.8)	0.9	17.3(69.4)		
0119	0.6	21.6(86.6)	1.0	26.0(104.3)	1.0	25.3(101.5)		
0120	0.4	16.6(66.6)	0.7	25.1(100.7)	0.9	19.9(79.8)		
0121	0.4	19.2(77.0)	0.6	21.8(87.4)	0.9	21.3(85.4)		
0122	0.4	16.4(65.8)	0.6	19.1(76.6)	0.5	19.0(76.2)		
0123 <sup>1</sup>	0.4	18.0(72.2)	0.4	18.3(73.4)	0.6	20.4(81.8)		
0124	0.8	18.8(75.4)	NDA	23.9(95.9)	1.4	22.2(89.0)		
0125	0.9	23.1(92.7)	1.5	25.4(101.9)	2	25.4(101.9)		
0126	0.9	20.4(81.8)	1.7	24.5(98.3)	2	23.2(93.1)		
0127	0.4	17.8(71.4)	0.8	25.8(103.5)	1.1	21.2(85.0)		
MEI <sup>2</sup>	1.2 (1.3) dup	14.2(57.0)	0.8 (1.4) dup	16.3(65.4)	1.5 (1.5) dup	19.2(77.0)		

<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> "EAA" is the estimated annual average and is calculated by dividing the actual reading by the number of days of the exposure period, then multiplying by 365. Values for annual averages are in units of mrem/yr. For example, the EAA for MPS-0108 is calculated as follows: 135 mR (observed value) / 91 days (exposure period) × 365 days = 542.

NA = Not Applicable.

NDA = No Data Available.

Table 3. Summary of Radioparticulate Air Monitoring Data for the Moab Site for Calendar Year 2005

Station Number	Isotope	First Quarter 2005 (μCi/mL) <sup>5</sup>	Second Quarter 2005 (μCi/mL)	Third Quarter 2005 (μCi/mL)	Fourth Quarter 2005 (μCi/mL)	Annual Average (μCi/mL)
<b>On-Site Locations</b>						
<b>0102-RP</b>	Uranium <sup>1</sup>	7.5E-17	1.6E-16	2.0E-17		8.6E-17
	Thorium-230 <sup>2</sup>	5.6E-17	1.3E-16	1.4E-16		1.1E-16
	Radium-226 <sup>3</sup>	1.3E-16	9.9E-17	2.4E-16		1.6E-16
	Polonium-210 <sup>4</sup>	1.1E-14	1.6E-15	3.2E-15		5.2E-15
<b>0105-RP</b>	Uranium <sup>1</sup>	1.6E-16	3.0E-16	3.2E-16		2.6E-16
	Thorium-230 <sup>2</sup>	6.3E-17	2.8E-16	7.9E-16		3.8E-16
	Radium-226 <sup>3</sup>	1.3E-16	9.7E-17	2.2E-16		1.5E-16
	Polonium-210 <sup>4</sup>	9.9E-15	2.4E-15	7.9E-15		6.7E-15
<b>Off-Site Locations</b>						
<b>0117-RP</b>	Uranium <sup>1</sup>	1.4E-17	2.5E-17	8.6E-18		1.6E-17
	Thorium-230 <sup>2</sup>	2.8E-17	7.6E-17	1.0E-16		6.9E-17
	Radium-226 <sup>3</sup>	1.3E-16	6.4E-17	2.9E-16		1.6E-16
	Polonium-210 <sup>4</sup>	5.0E-15	2.9E-15	5.6E-15		4.5E-15
<b>0118-RP</b>	Uranium <sup>1</sup>	2.3E-17	3.2E-17	1.1E-17		2.2E-17
	Thorium-230 <sup>2</sup>	5.2E-17	1.4E-16	8.3E-17		9.0E-17
	Radium-226 <sup>3</sup>	2.0E-16	2.0E-17	2.9E-16		1.7E-16
	Polonium-210 <sup>4</sup>	6.6E-15	2.5E-15	4.7E-15		4.6E-15
<b>0119-RP</b>	Uranium <sup>1</sup>	2.3E-17	9.4E-17	2.8E-17		4.8E-17
	Thorium-230 <sup>2</sup>	4.5E-17	1.6E-16	1.2E-16		1.1E-16
	Radium-226 <sup>3</sup>	1.4E-16	5.4E-17	1.8E-16		1.2E-16
	Polonium-210 <sup>4</sup>	6.8E-15	3.2E-15	5.6E-15		5.2E-15
<b>0120-RP</b>	Uranium <sup>1</sup>	1.5E-17	2.1E-17	1.6E-17		1.7E-17
	Thorium-230 <sup>2</sup>	4.7E-17	1.5E-16	7.1E-17		9.0E-17
	Radium-226 <sup>3</sup>	1.2E-16	2.8E-17	3.3E-16		1.6E-16
	Polonium-210 <sup>4</sup>	4.3E-15	1.7E-15	4.9E-15		3.6E-15
<b>0121-RP</b>	Uranium <sup>1</sup>	1.8E-17	1.8E-17	2.2E-17		1.9E-17
	Thorium-230 <sup>2</sup>	1.8E-17	1.2E-16	1.6E-16		1.0E-16
	Radium-226 <sup>3</sup>	1.4E-16	9.0E-18	2.3E-16		1.3E-16
	Polonium-210 <sup>4</sup>	5.9E-15	1.6E-15	4.9E-15		4.1E-15
<b>0122-RP</b>	Uranium <sup>1</sup>	1.5E-17	1.9E-17	9.7E-18		1.4E-17
	Thorium-230 <sup>2</sup>	2.2E-17	2.4E-16	8.1E-17		1.1E-16
	Radium-226 <sup>3</sup>	1.7E-16	3.0E-17	2.0E-16		1.3E-16
	Polonium-210 <sup>4</sup>	3.4E-15	1.7E-15	3.8E-15		3.0E-15
<b>0123-RP</b>	Uranium <sup>1</sup>	1.6E-17	2.4E-17	9.5E-18		1.6E-17
	Thorium-230 <sup>2</sup>	3.7E-17	7.7E-17	1.5E-16		8.7E-17
	Radium-226 <sup>3</sup>	1.7E-16	2.8E-17	2.0E-16		1.3E-16
	Polonium-210 <sup>4</sup>	7.5E-15	2.7E-15	5.2E-15		5.1E-15

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

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

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

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

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

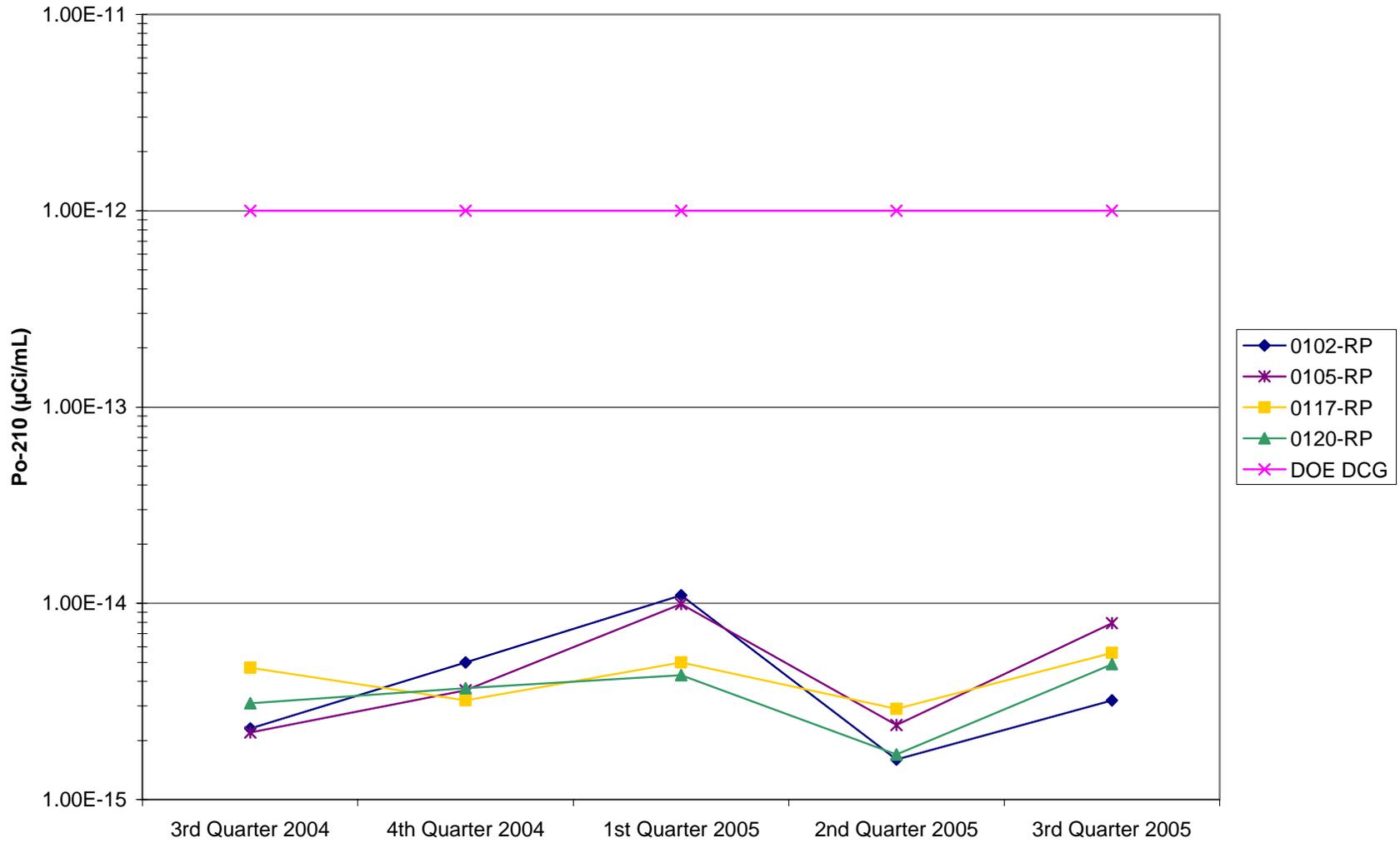


Figure 1. Moab Radioparticulate Concentration (Po-210)

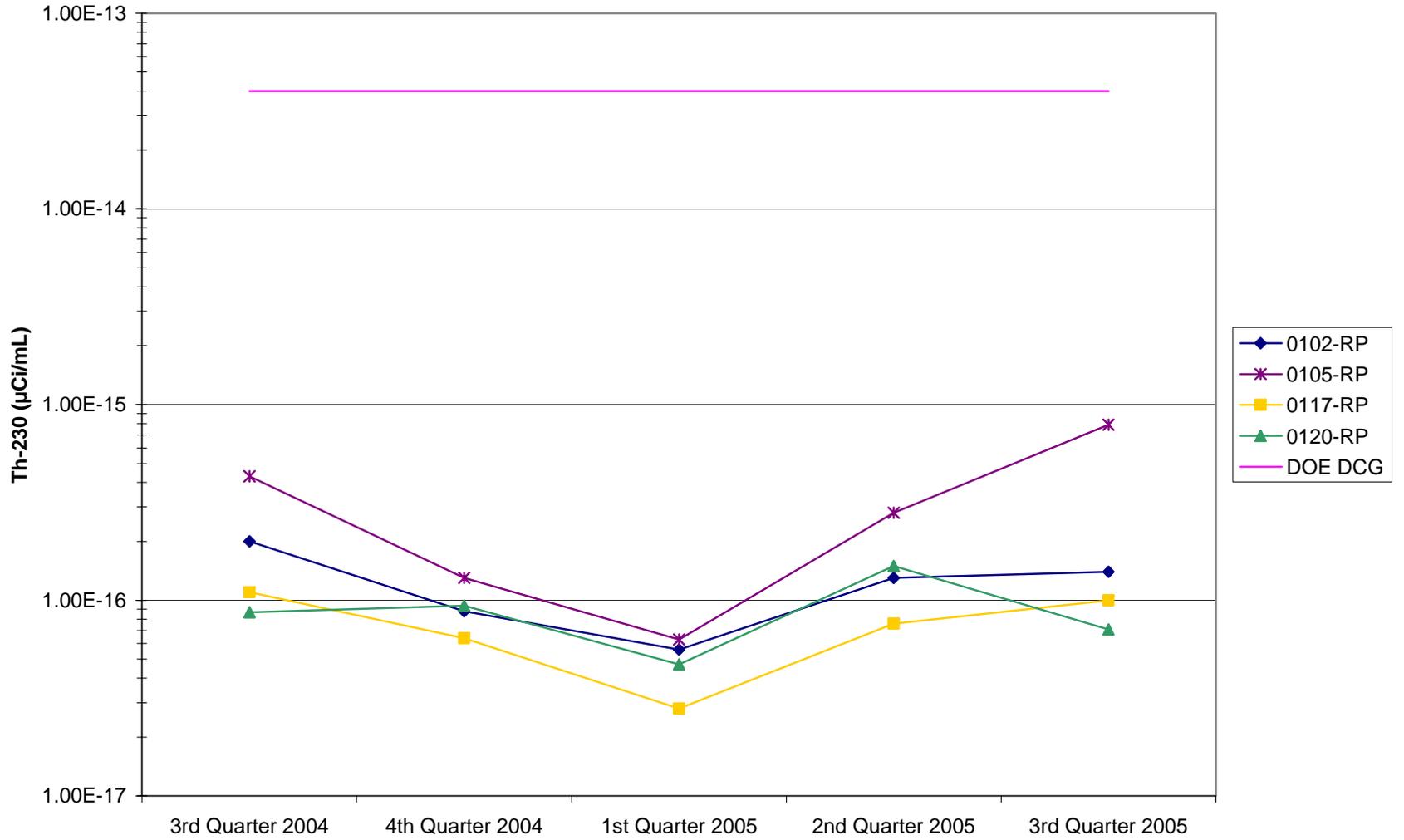


Figure 2. Moab Radioparticulate Concentration (Th-230)

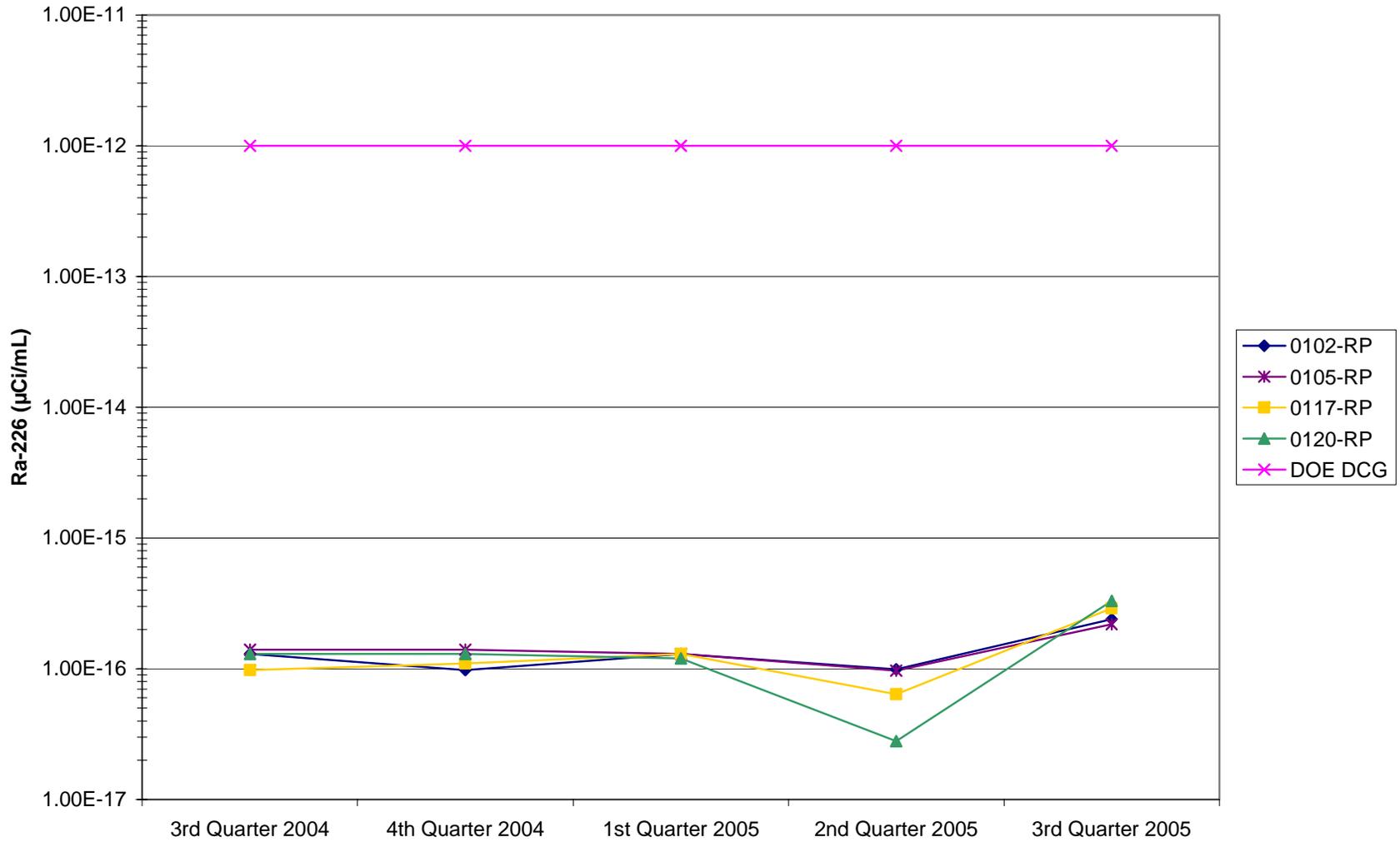


Figure 3. Moab Radioparticulate Concentration (Ra-226)

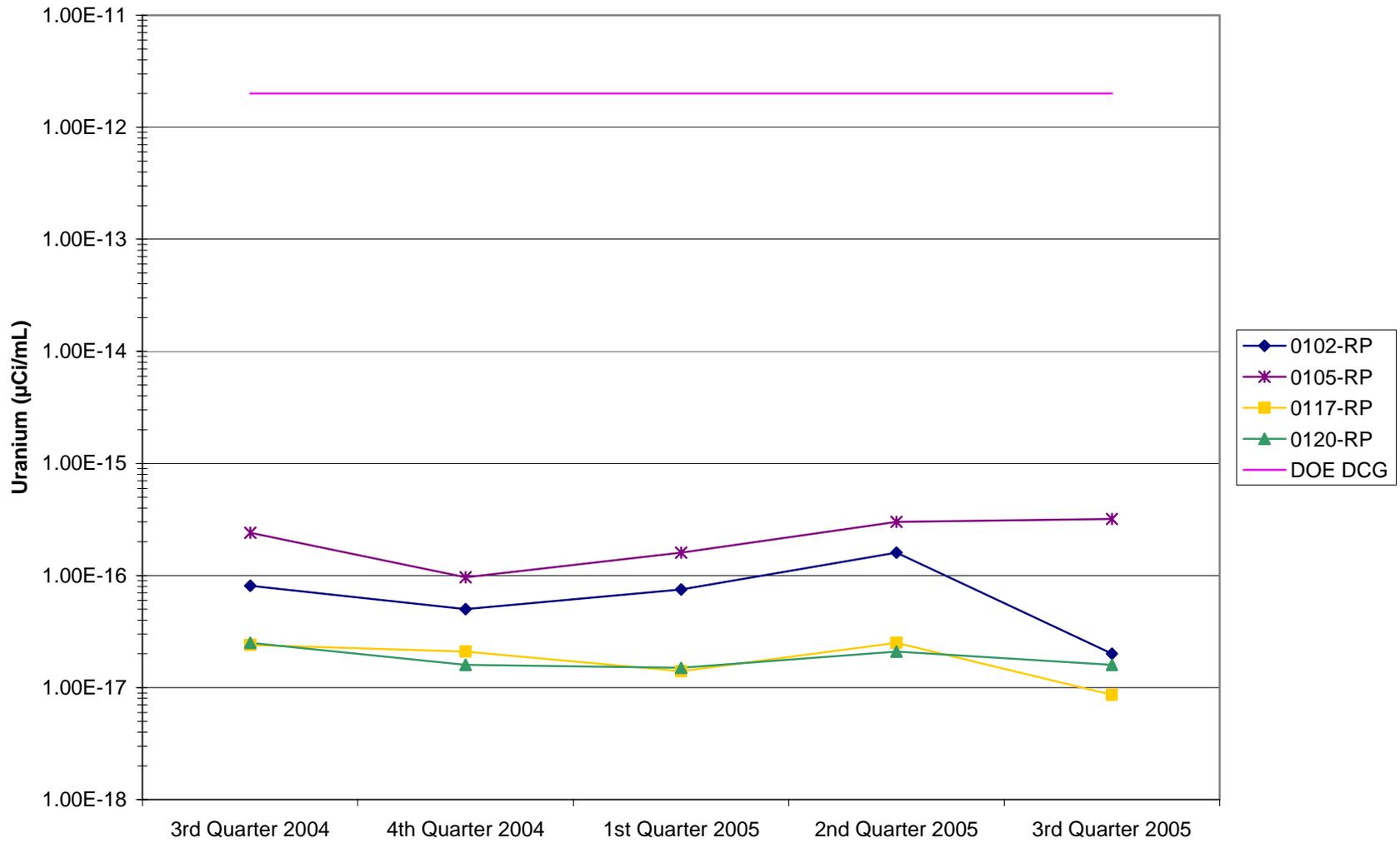


Figure 4. Moab Radioparticulate Concentration (Uranium)

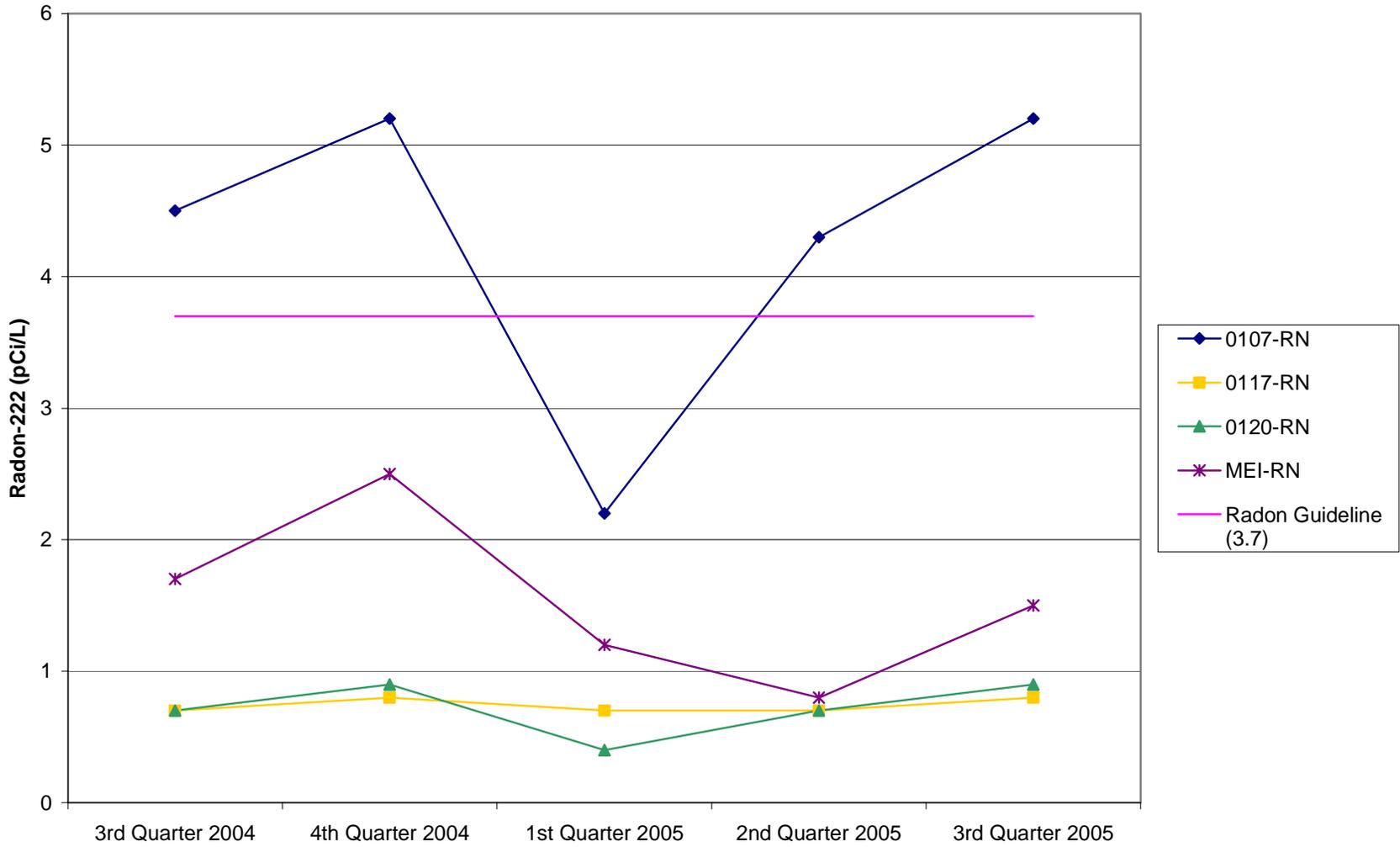


Figure 5. Moab Atmospheric Radon-222 Concentration

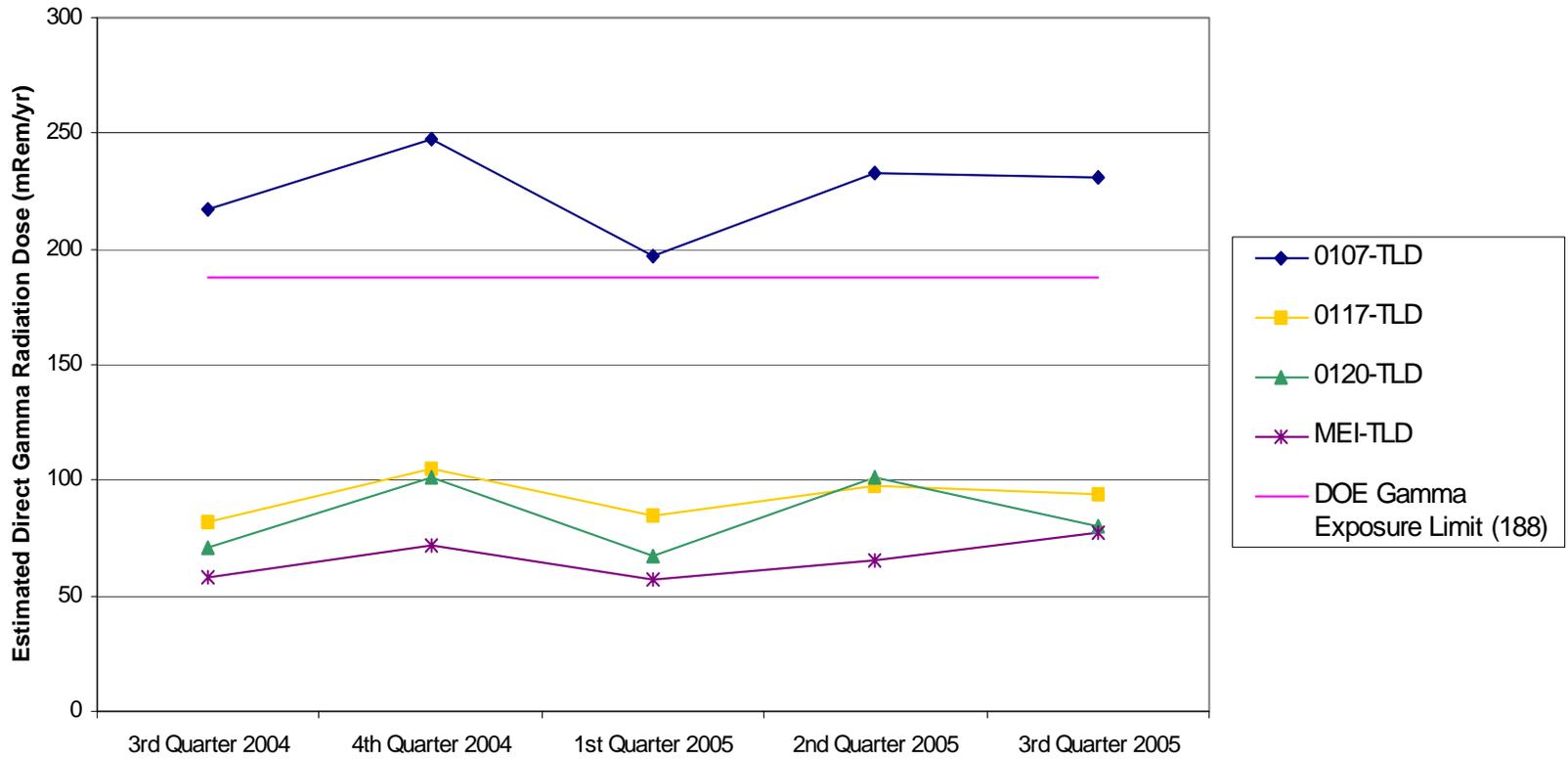
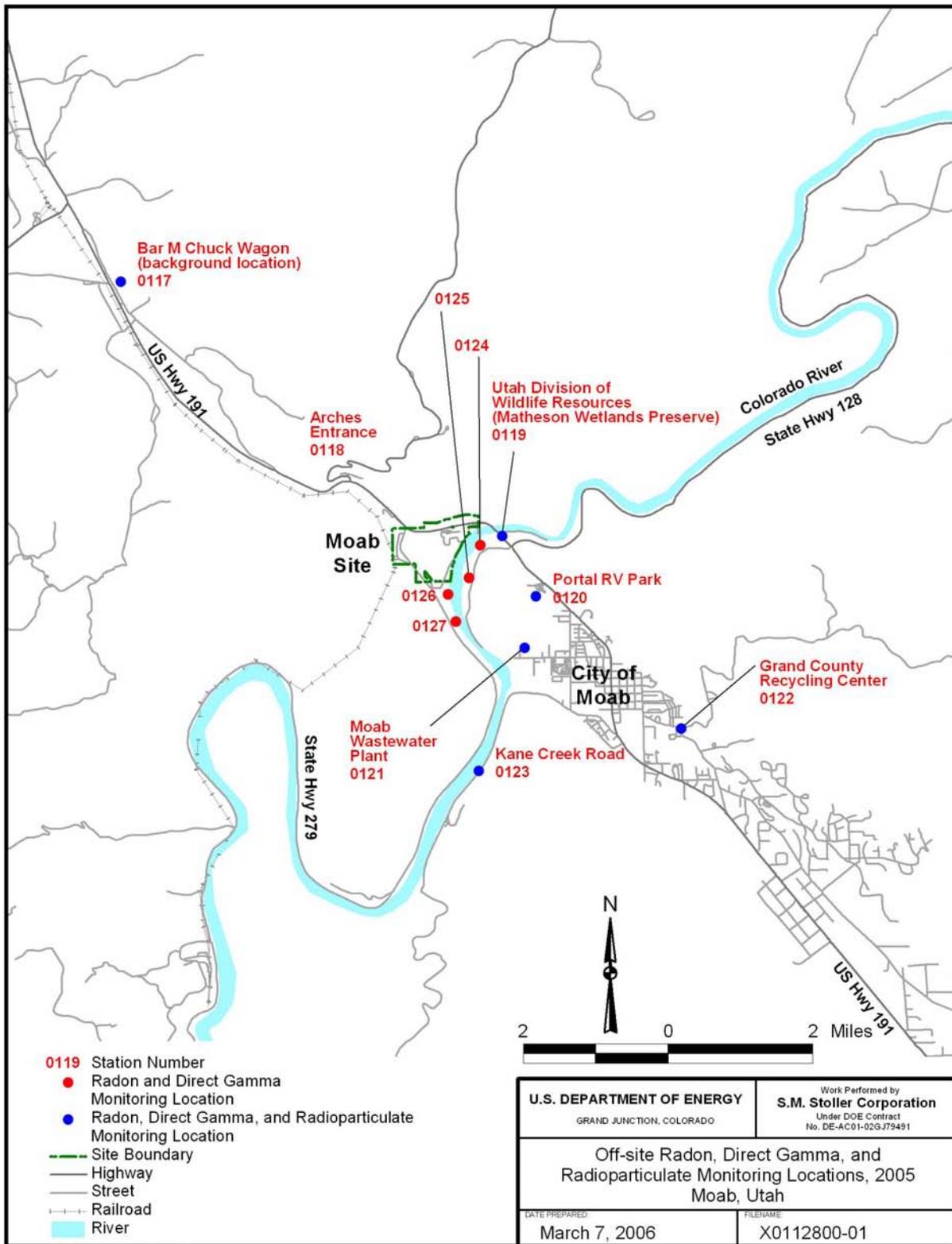


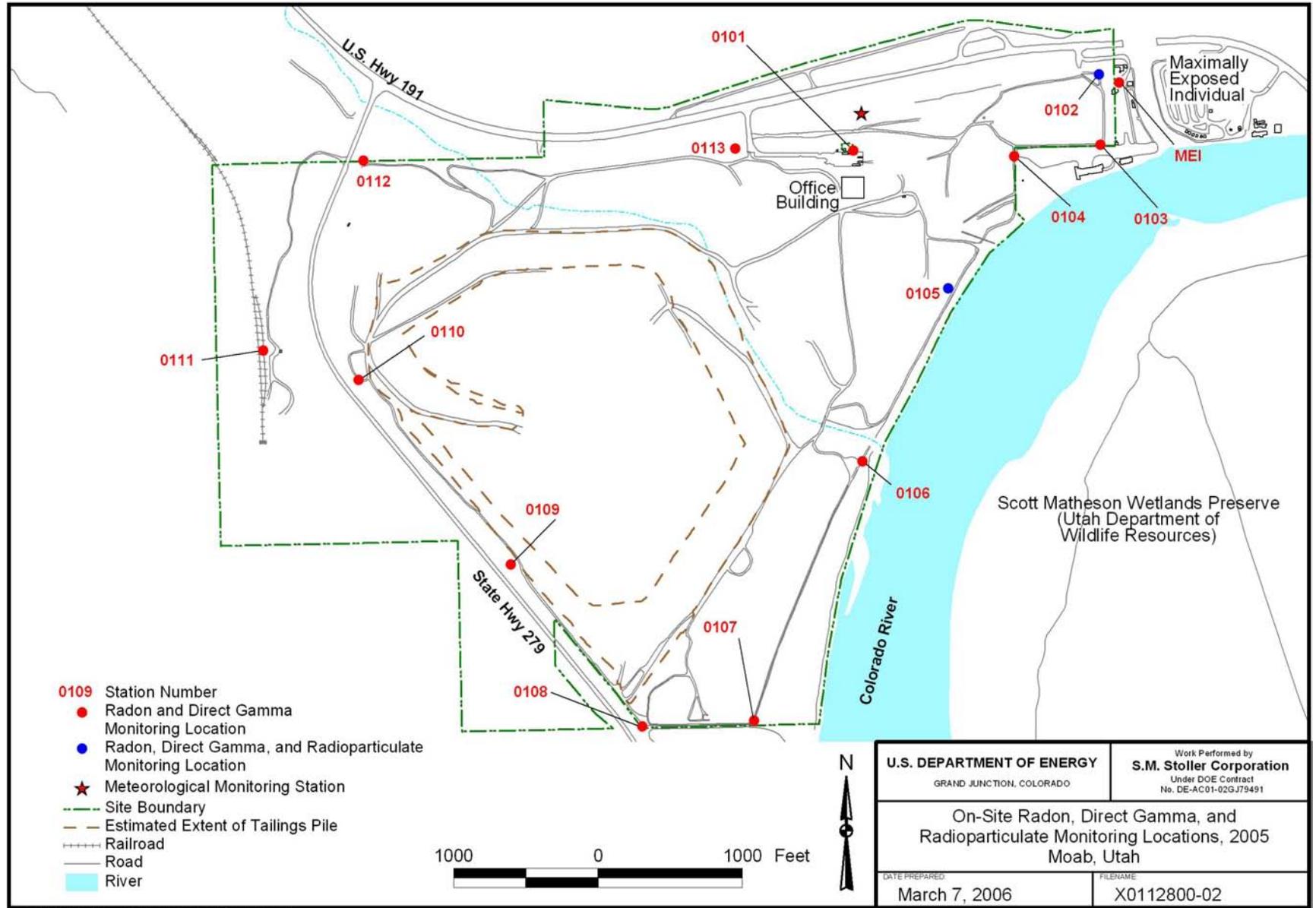
Figure 6. Moab Direct Gamma Radiation Dose

## **Sample Location Maps**



n:\moa\999\0005\011006a\01128\0112800.apr e50084 3/7/2006, 13:23

Figure 7. Off-site Radon, Direct Gamma, and Radioparticulate Monitoring Locations, 2005



n:\moa\1999\0005\011006a\01128\0112800.apr e50084 3/7/2006, 13:21

Figure 8. Onsite Radon, Direct Gamma, and Radioparticulate Monitoring Locations, 2005