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Office of Environmental Management – Grand Junction

MOAB UTAH
UMTRA Project

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

Second Quarter 2006 (April through June 2006)

U.S. Department of Energy

Office of Environmental Management

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Moab/Crescent Junction, Utah

Environmental Air Monitoring Results
April − June 2006

Contents

Item No.	Description of Contents
1.	**Summary of Results**
	Table 1. Moab Environmental Air Monitoring Locations with Samples that Exceeded Applicable Regulatory Standards, Limits, or Guidelines During the Second Quarter, 2006
2.	**Data Assessment**
	Environmental Air Monitoring Field Activities Verification Checklist
	Data Assessment Summary
3.	**Environmental Air Monitoring Data**
	Environmental Air Monitoring Data Summary
	Table 2. Summary of Environmental Radon and Gamma Radiation Monitoring Data for the Moab Site for Calendar Year 2006
	Table 3. Summary of Radioparticulate Air Monitoring Data for the Moab Site for Calendar Year 2006
	Table 4. Summary of Environmental Radon and Gamma Radiation Monitoring Data for the Crescent Junction Site for Calendar Year 2006
	Table 5. Summary of Radioparticulate Air Monitoring Data for the Crescent Junction Site for Calendar Year 2006
	Time Versus Concentration Graphs
4.	**Sample Location Maps**

Summary of Results

Site: Moab, Utah

Sampling Period: April through June 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 second quarter of 2006 indicate that this guideline was equaled or exceeded at three 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 (45.5 mrem/qt). 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 second 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 52 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 Second Quarter, 2006.

Analyte	Standard/Guideline	Sampling Locations Exceeding Standards/Guidelines
Radon-222	3.7 pCi/L	0106, 0107, 0108
Direct Gamma Radiation	182 mrem/yr	0101, 0107, 0108, 0109, 0110, 0111, 0113

Site: Crescent Junction, Utah

Sampling Period: April through June 2006

Atmospheric Radon-222: 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. Please refer to Table 5 for a review of radioparticulate air monitoring data for the Crescent Junction Site.

Kenneth E. Karp
Moab Project Manager

9-29-06
Date

Data Assessment

Environmental Air Monitoring Field Activities Verification Checklist

Project	Moab/Crescent Junction, Utah	**Date(s) of Air Sampling**	April through June 2006
Date(s) of Verification	September 21, 2006	**Name of Verifier**	Jeff Price

		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?	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 and radon cups (0303 & 0304) to the ground at the Crescent Junction site. Radon cups at the MEI location in Moab were found on the ground.
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*. Second quarter 2006 analytical radon data were received in a report dated July 19, 2006. 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) 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, Revision 6* (Teledyne Isotopes 1995). Second quarter 2006 environmental gamma radiation data were received in a report dated July 19, 2006. All data are reported at the 95 percent 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, and were analyzed for radioparticulates (radium-226, thorium-230, polonium-210, and uranium-total). Results for the second quarter 2006 sampling period are in Report Identification Number (RIN) 06060421. 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 second quarter of 2006 were reviewed, validated, and summarized in the *Data Review and Validation Report for RIN 06060421* (August 1, 2006).

Field Activities

Duplicate samples are collected for direct gamma environmental radiation at three Moab locations: (1) 0117, one of the background monitoring locations; (2) 0107, 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: 0305 was a randomly chosen location on site, and 0306 and 0307 are sampling locations near private residences.

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 second quarter of 2006, it was determined that the reported radium-226 concentrations were incorrect. The laboratory was notified and a corrected report was sent.

Summary

Data collected during the second quarter of 2006 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.

Sam Campbell for

Jeff Price
Environmental Scientist

9-29-06
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 property line data for the 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/Direct Gamma Radiation

Radon-222 and gamma radiation data have been graphed (Figures 5 and 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 located on the southern property boundary of the Moab Site and has historically recorded some of the highest readings. (3) Location 0117 (near the Bar-M Chuckwagon) is a background monitoring location located approximately 5 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.

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, 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) 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 (04/04/06–06/28/06)		3rd Quarter 2006 ( )		4th Quarter 2006 ( )		2006 Annual Average	
	Radon pCi/L	Gamma mrem/91 d[3]	Radon pCi/L	Gamma mrem/91 d[3]	Radon pCi/L	Gamma mrem/91 d[3]	Radon pCi/L	Gamma mrem/91 d[3]	Radon pCi/L	Gamma mrem/yr
On-Site Locations										
0101	2.5	54.8	1.9	46.76						
0102	1.9	23.7	1.2	19.21						
0103	1.9	25.1	1.1	19.56						
0104	2.4	26.2	1.2	19.97						
0105	4.1	46.9	2.1	39.71						
0106	9.2	39.7	5.9	33.58						
0107	7.9	52.9	4.8	47.28						
0108	4.8	112.5	4.9	118.45						
0109	1.7	51.3	2.5	47.75						
0110	2.4	80.7	3.1	74.53						
0111	0.9	63.8	1	51.29						
0112	1.7	38.6	1.8	31.11						
0113	2.7	Lost	2.7	64.83						
Off-Site Locations										
0117[1]	0.6	22	0.5	19.36						
0118	0.8	20.2	0.6	18.97						
0119	1	21.4	0.8	21.18						
0120	0.6	17.8	0.7	17.28						
0121	0.8	20.1	0.7	18.62						
0122	0.6	18.5	0.5	18.07						
0123[1]	0.4	18.1	<0.4	14.82						
0124	1.6	20.5	1.3	20.04						
0125	2.2	23.7	1.7	21.25						
0126	2.7	22	1.8	19.48						
0127	0.9	19.7	0.9	20.85						
MEI[2]	2	17.4	<0.4	12.97						

[1]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.
[2]The maximally exposed individual (MEI) is the continually occupied residential property that is closest to the DOE property boundary.
[3]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	1st Quarter 2006 (µCi/mL)[5]	2nd Quarter 2006 (µCi/mL)	3rd Quarter 2006 (µCi/mL)	4th Quarter 2006 (µCi/mL)	Annual Average (µCi/mL)
On-Site Locations						
0102-RP	Uranium[1]	8.1E-17	1.2E-16			9.8E-17
	Thorium-230[2]	9.6E-17	2.5E-16			1.7E-16
	Radium-226[3]	1.5E-16	2.2E-16			1.9E-16
	Polonium-210[4]	8.1E-15	3.1E-15			5.6E-15
0105-RP	Uranium[1]	2.2E-16	2.5E-16			2.4E-16
	Thorium-230[2]	1.7E-16	3.3E-16			2.5E-16
	Radium-226[3]	2.0E-16	1.8E-16			1.9E-16
	Polonium-210[4]	7.8E-15	3.0E-15			5.4E-15
Off-Site Locations						
0117-RP	Uranium[1]	1.4E-17	2.7E-17			2.1E-17
	Thorium-230[2]	9.1E-17	1.2E-16			1.0E-16
	Radium-226[3]	1.8E-16	2.2E-16			2.0E-16
	Polonium-210[4]	4.2E-15	2.8E-15			3.5E-15
0118-RP	Uranium[1]	5.9E-17	4.9E-17			5.4E-17
	Thorium-230[2]	1.2E-16	7.5E-17			9.5E-17
	Radium-226[3]	2.7E-16	1.7E-16			2.2E-16
	Polonium-210[4]	7.0E-15	3.5E-15			5.3E-15
0119-RP	Uranium[1]	4.3E-17	3.5E-17			3.9E-17
	Thorium-230[2]	2.9E-16	4.1E-17			1.6E-16
	Radium-226[3]	1.6E-16	1.9E-16			1.8E-16
	Polonium-210[4]	6.5E-15	2.9E-15			4.7E-15
0120-RP	Uranium[1]	2.6E-17	4.8E-17			3.7E-17
	Thorium-230[2]	3.5E-17	1.1E-16			7.3E-17
	Radium-226[3]	1.8E-16	1.8E-16			1.8E-16
	Polonium-210[4]	4.2E-15	2.1E-15			3.2E-15
0121-RP	Uranium[1]	2.4E-17	3.6E-17			3.0E-17
	Thorium-230[2]	7.3E-17	8.8E-17			8.0E-17
	Radium-226[3]	2.0E-16	1.8E-16			1.9E-16
	Polonium-210[4]	4.6E-15	2.6E-15			3.6E-15
0122-RP	Uranium[1]	2.7E-17	3.2E-17			2.9E-17
	Thorium-230[2]	3.1E-16	1.1E-16			2.1E-16
	Radium-226[3]	2.1E-16	1.7E-16			1.9E-16
	Polonium-210[4]	6.2E-15	2.9E-15			4.6E-15
0123-RP	Uranium[1]	2.1E-17	5.6E-17			3.8E-17
	Thorium-230[2]	8.7E-17	7.7E-17			8.2E-17
	Radium-226[3]	1.9E-16	1.8E-16			1.9E-16
	Polonium-210[4]	5.5E-15	3.1E-15			4.3E-15

[1]DOE DCG for Total Uranium = 2.E-12
[2]DOE DCG for Thorium-230 = 4.E-14
[3]DOE DCG for Radium-226 = 1.E-12
[4]DOE DCG for Polonium-210 = 1.E-12
[5]µCi/mL = microCuries per milliliter

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

Station Number	1st Quarter 2006 (01/04/06–04/04/06)		2nd Quarter 2006 (04/04/06–06/28/06)		3rd Quarter 2006 ( )		4th Quarter 2006 ( )		2006 Annual Average	
	Radon pCi/L	Gamma mrem/91 d[1]	Radon pCi/L	Gamma mrem/91 d[1]	Radon pCi/L	Gamma mrem/91 d[1]	Radon pCi/L	Gamma mrem/91 d[1]	Radon pCi/L	Gamma mrem/91 d[1]
0301	0.6	Lost	0.6	22.34						
0302	0.5	20.5	0.6	22.13						
0303	1.2	Lost	Damaged	22.21						
0304	0.9	21.6	<0.4	18.71						
0305	0.7	23.5	1	22.07						
0306	1.1	19.4	0.5	20.71						
0307	2.1	21.5	0.6	22.25						

[1]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	1st Quarter 2006 (µCi/mL)[5]	2nd Quarter 2006 (µCi/mL)[5]	3rd Quarter 2006 (µCi/mL)[5]	4th Quarter 2006 (µCi/mL)	Annual Average (µCi/mL)[5]
0306-RP	Uranium[1]	9.1E-18	1.8E-17			1.4E-17
	Thorium-230[2]	5.1E-17	5.4E-17			5.3E-17
	Radium-226[3]	1.4E-16	1.8E-16			1.6E-16
	Polonium-210[4]	4.0E-15	3.2E-15			3.6E-15
0307-RP	Uranium[1]	1.4E-17	4.1E-17			2.7E-17
	Thorium-230[2]	1.6E-16	9.1E-17			1.2E-16
	Radium-226[3]	2.0E-16	1.9E-16			2.0E-16
	Polonium-210[4]	3.3E-15	3.7E-15			3.5E-15

[1]DOE DCG for Total Uranium = 2.E-12
[2]DOE DCG for Thorium-230 = 4.E-14
[3]DOE DCG for Radium-226 = 1.E-12
[4]DOE DCG for Polonium-210 = 1.E-12
[5]µCi/mL = microCuries per milliliter

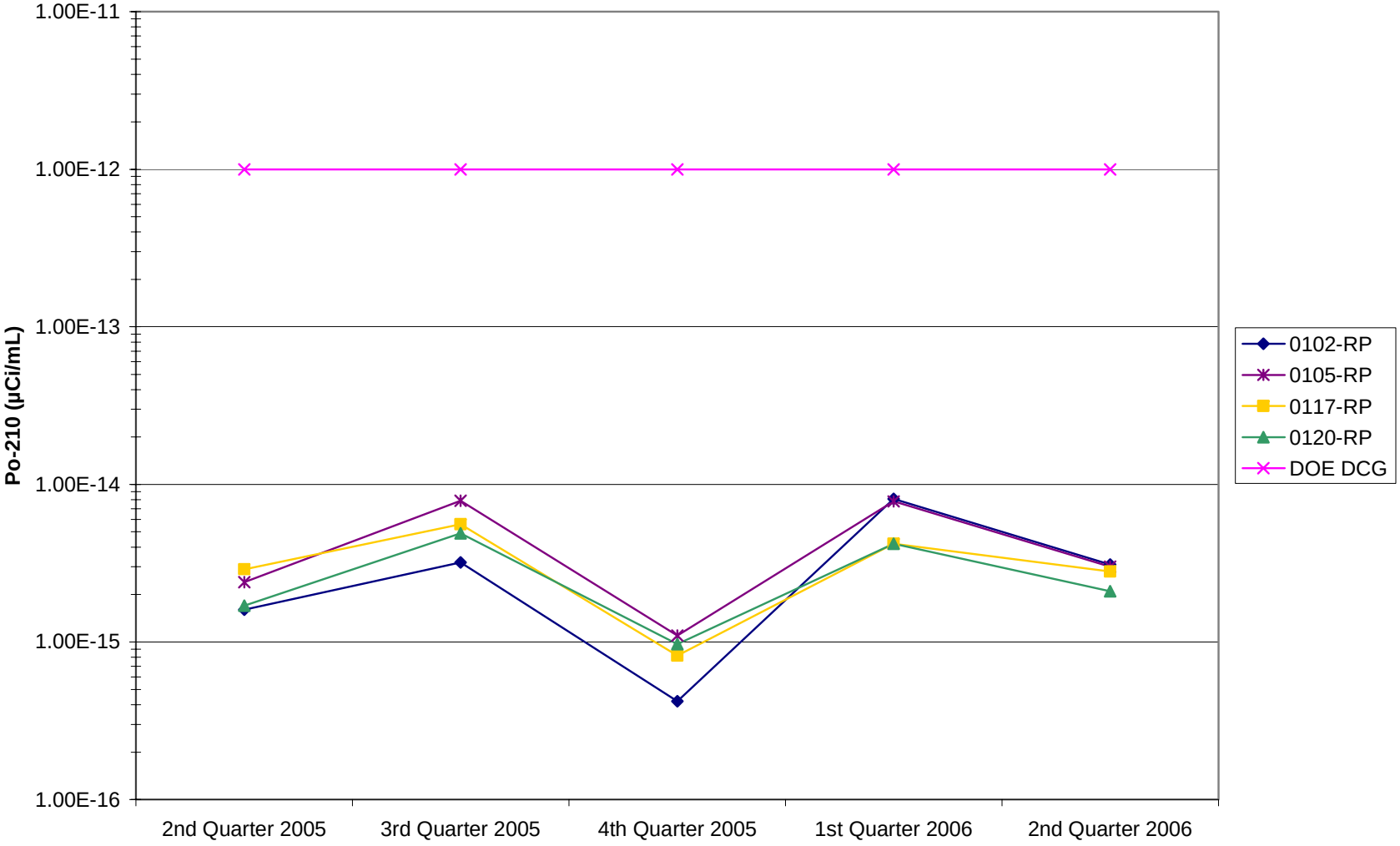

Figure 1. Moab Radioparticulate Concentration (Po-210)

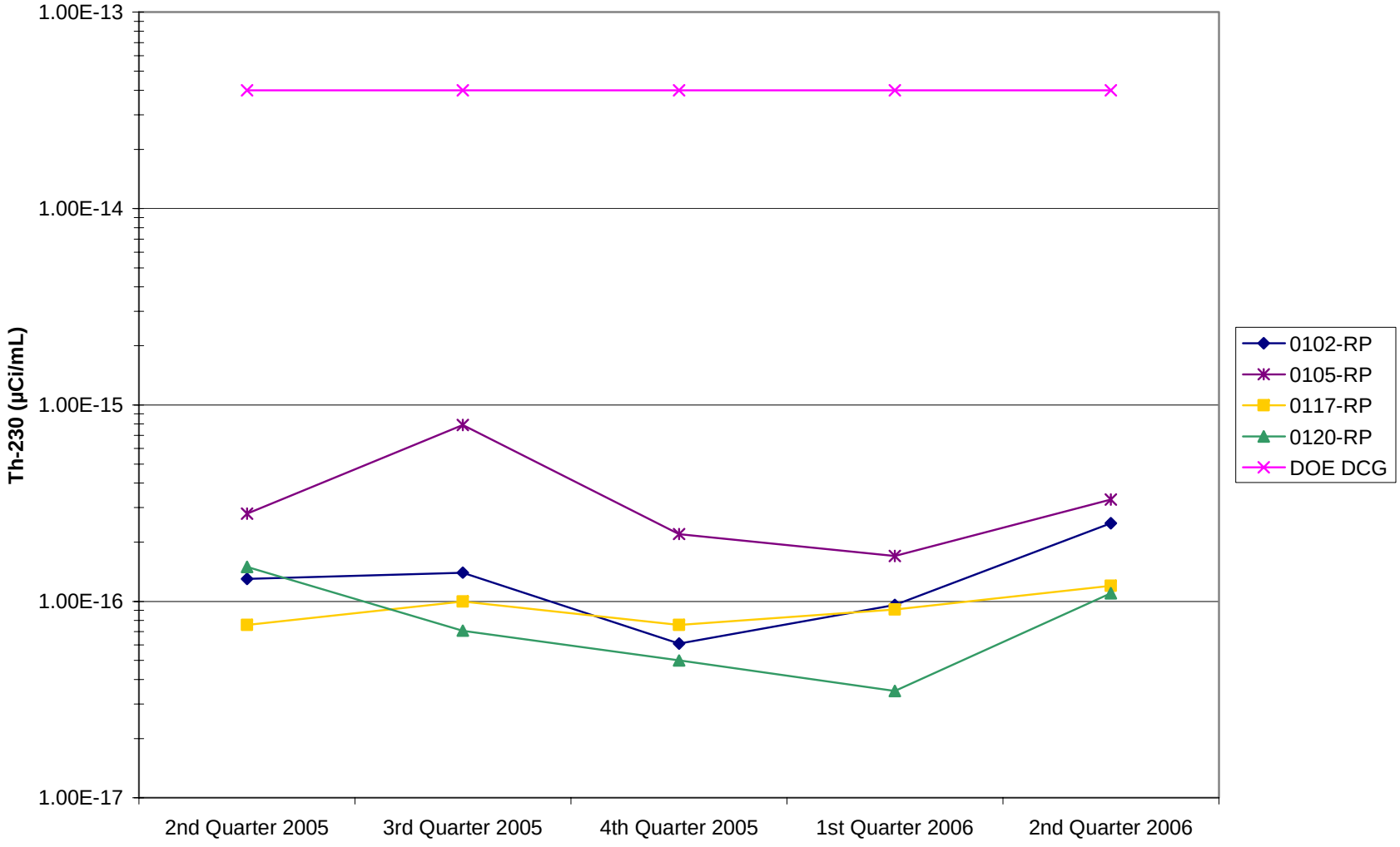

Figure 2. Moab Radioparticulate Concentration (Th-230)

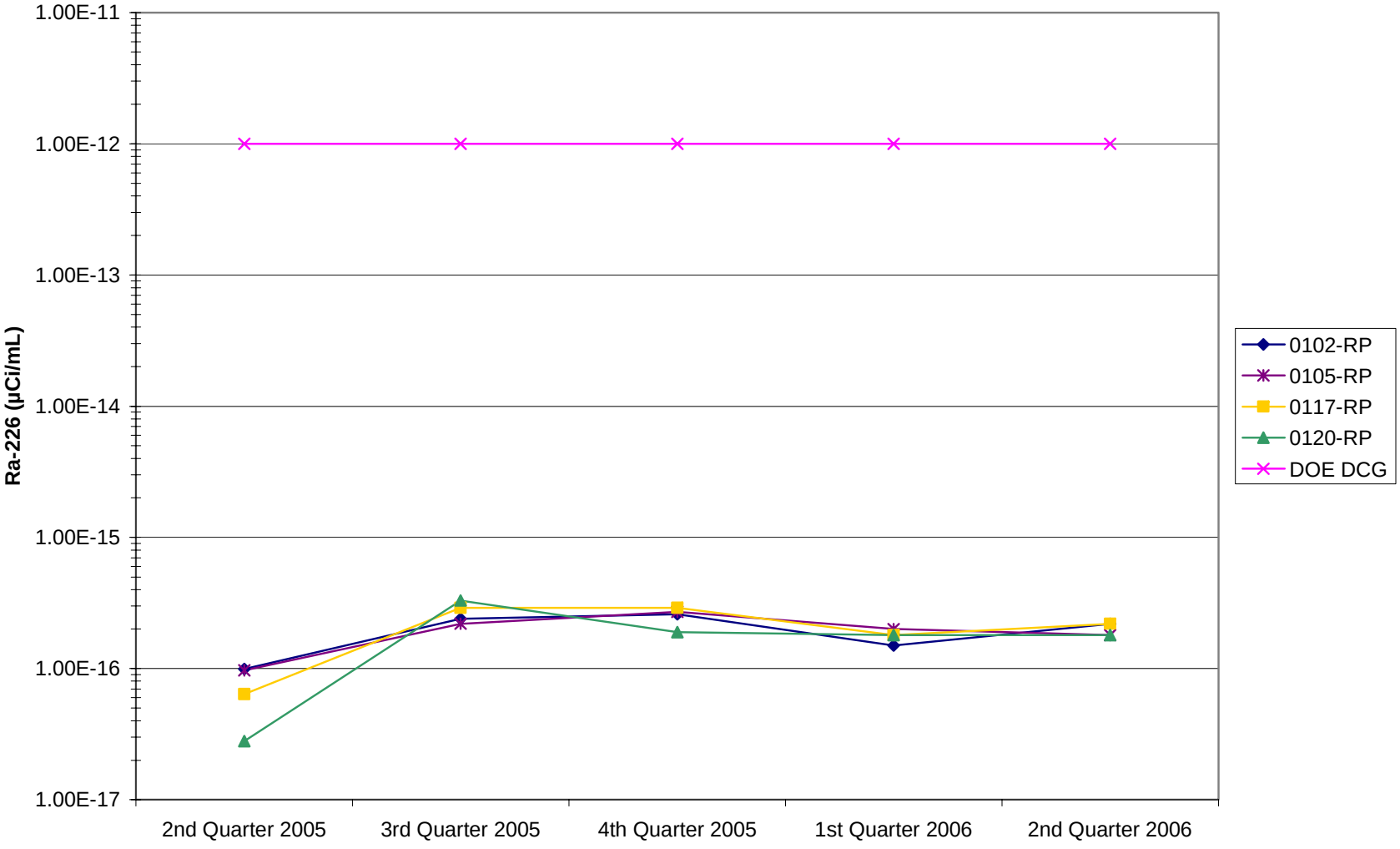

Figure 3. Moab Radioparticulate Concentration (Ra-226)

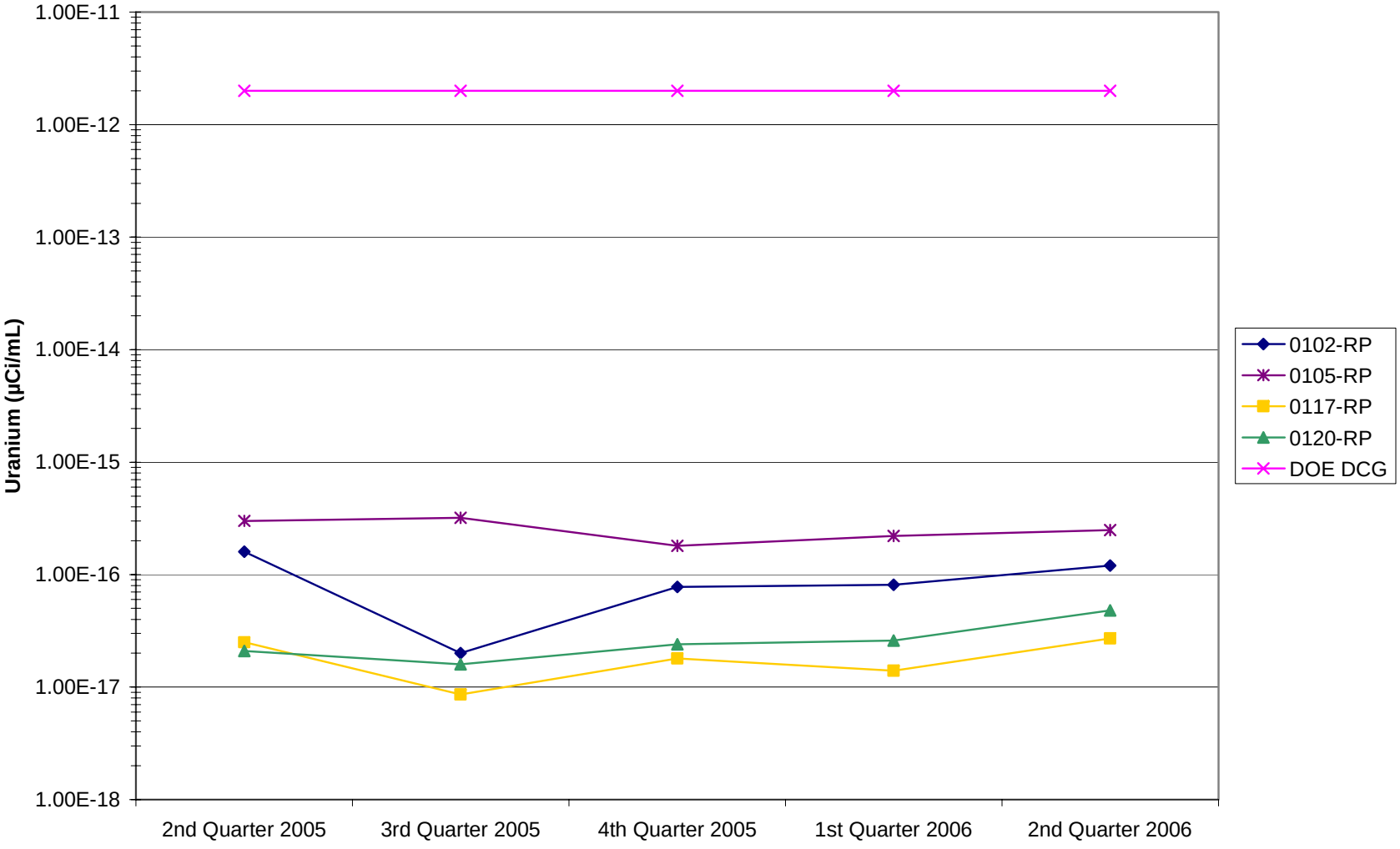

Figure 4. Moab Radioparticulate Concentration (Uranium)

Figure 5. Moab Atmospheric Radon-222 Concentration

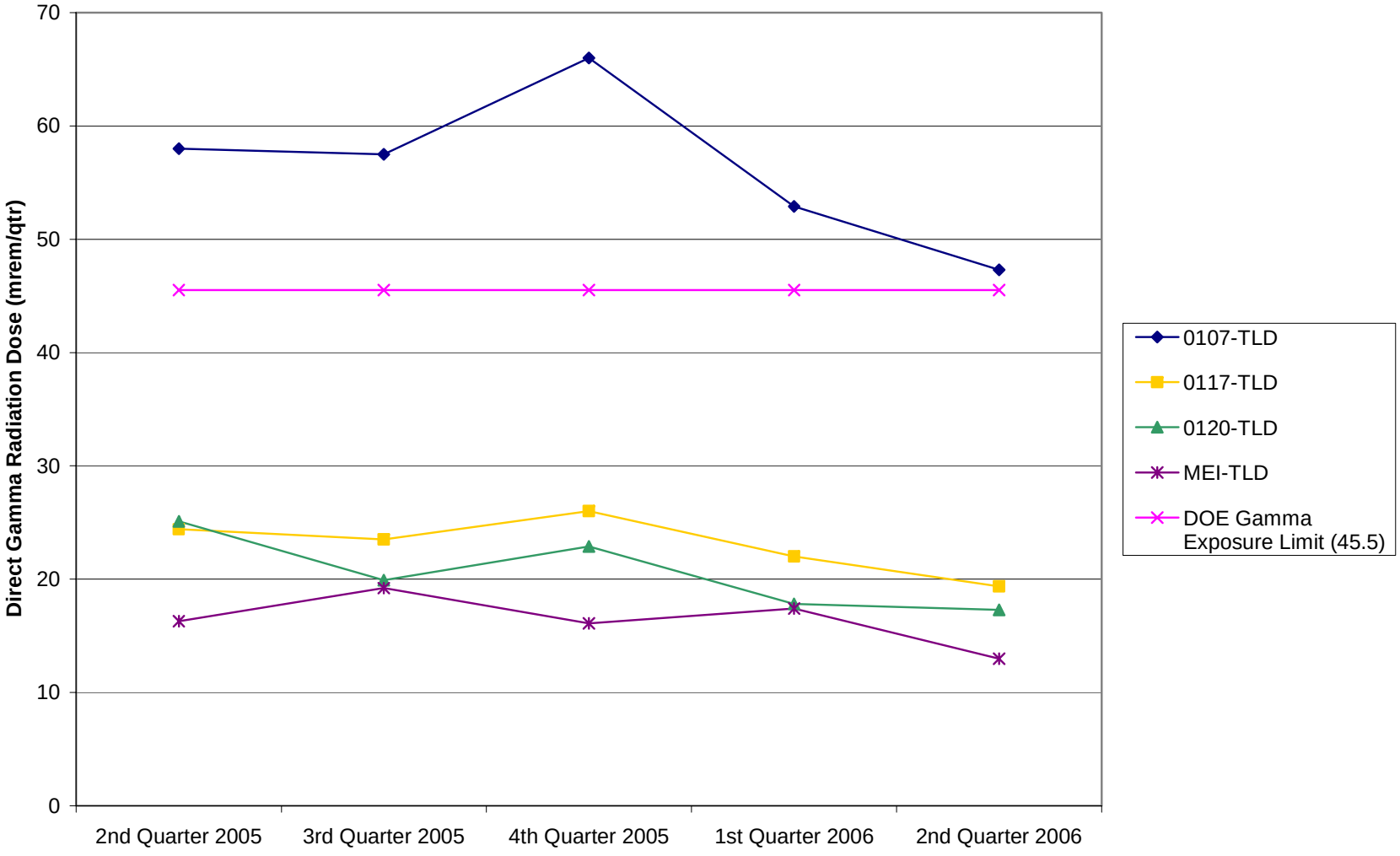

Figure 6. Moab Direct Gamma Radiation Dose

Sample Location Maps

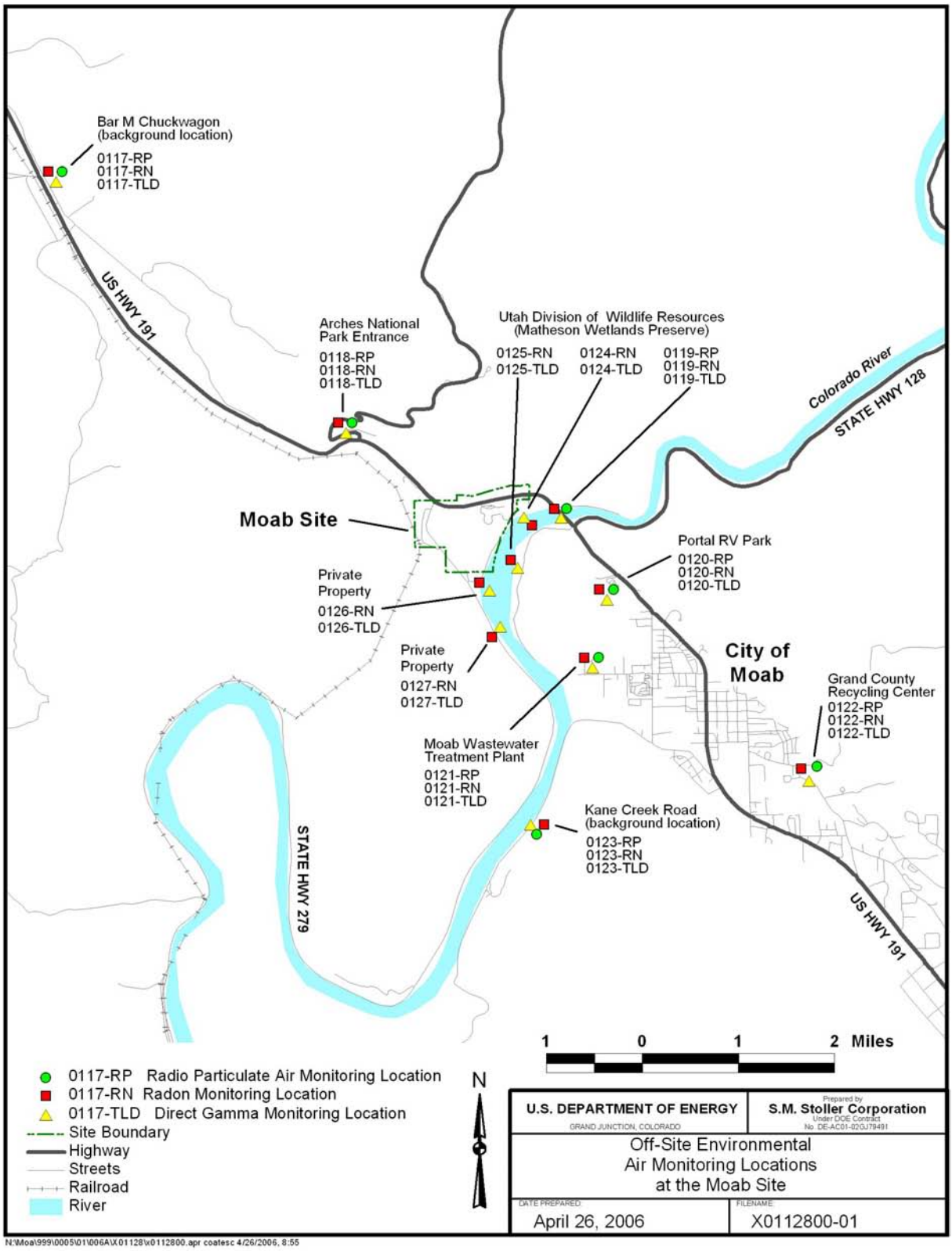

Figure 7. Off-site Radon, Direct Gamma, and Radioparticulate Monitoring Locations, 2006

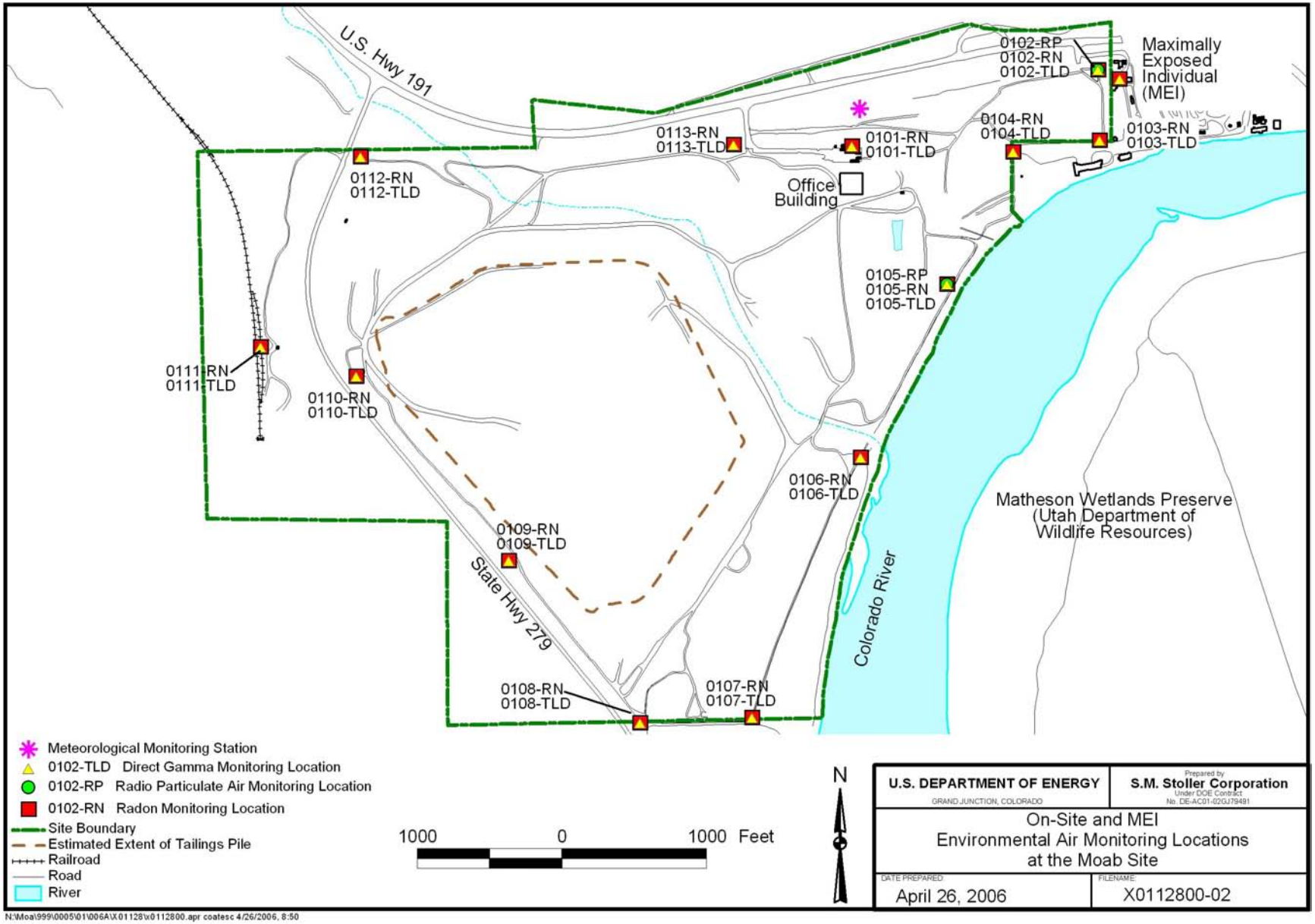

Figure 8. On-site Radon, Direct Gamma, and Radioparticulate Monitoring Locations, 2006

Figure 9. Sampling Location Map for the Crescent Junction Site