

Office of Environmental Management – Grand Junction



Environmental Air Monitoring Data
Quarterly Report for the Moab and
Crescent Junction, Utah, Sites
First Quarter 2019
(January through March 2019)

July 2019



U.S. Department
of Energy

Office of Environmental Management

**Moab UMTRA Project
Environmental Air Monitoring Data Quarterly Report
for the Moab and Crescent Junction, Utah, Sites First Quarter 2019
(January – March 2019)**

Revision 0

Review and Approval

7/17/2019

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1.0 Introduction

The purpose of this Report is to present the results of environmental air monitoring at the U.S. Department of Energy (DOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) Project sites during the first quarter of 2019. The Project sites consist of the former uranium ore-processing mill located three miles north of Moab, Utah, and the disposal site located near Crescent Junction, Utah.

2.0 Regulatory Requirements

This report demonstrates compliance with DOE Order (O) 458.1, Admin Chg 3, “Radiation Protection of the Public and the Environment,” which states DOE radiological activities must be conducted in a manner that does not cause a total effective dose to the public that exceeds 100 millirems (mrem) in a year. This limit excludes doses from background radiation, radon gas and its decay products in air, occupational doses, and medical exposures.

For the Project, the total effective dose is the sum of the direct gamma radiation and radioactive particulate material (radioparticulate) exposure. DOE O 458.1 also specifies releases of radioactive material to the atmosphere from DOE activities shall not exceed an annual average concentration of 3 picocuries per liter (pCi/L) of radon or its decay products, excluding background, at the site boundary.

Compliance with DOE O 458.1 may be demonstrated by calculating the dose to the maximally exposed individual (MEI) or the representative person or group from the public likely to receive the highest radiation dose based on exposure pathways and parameters. The Project established an MEI for each of the Project sites.

3.0 Results for January through March 2019

Monitoring data are reported quarterly for radon, direct gamma radiation, and select radioparticulates. Off-site monitoring locations for the Moab site are shown on Figure 1, and on-site and MEI locations are shown on Figure 2. Monitoring locations for the Crescent Junction site are shown on Figure 3.

3.1 Moab Site

A total of 15 air monitoring stations are equipped with radon and gamma detectors located on site; another 12 off-site stations also have these detectors. Of these 27 stations, three on-site and six off-site stations are also equipped with air sampling pumps to measure air radioparticulates. Location 0114 was established in the beginning of the fourth quarter 2018 to measure the air radioparticulate concentration, gamma doses, and the radon concentration in the vicinity of the interim action (IA) well field (near groundwater extraction well 0810). Only the first and second rounds of data from this new location are presented in this report. The gamma detector was removed during the first quarter 2019 from location 0125 (in the Matheson Wetlands) by unauthorized personnel, so the gamma dose results for this location are not provided.

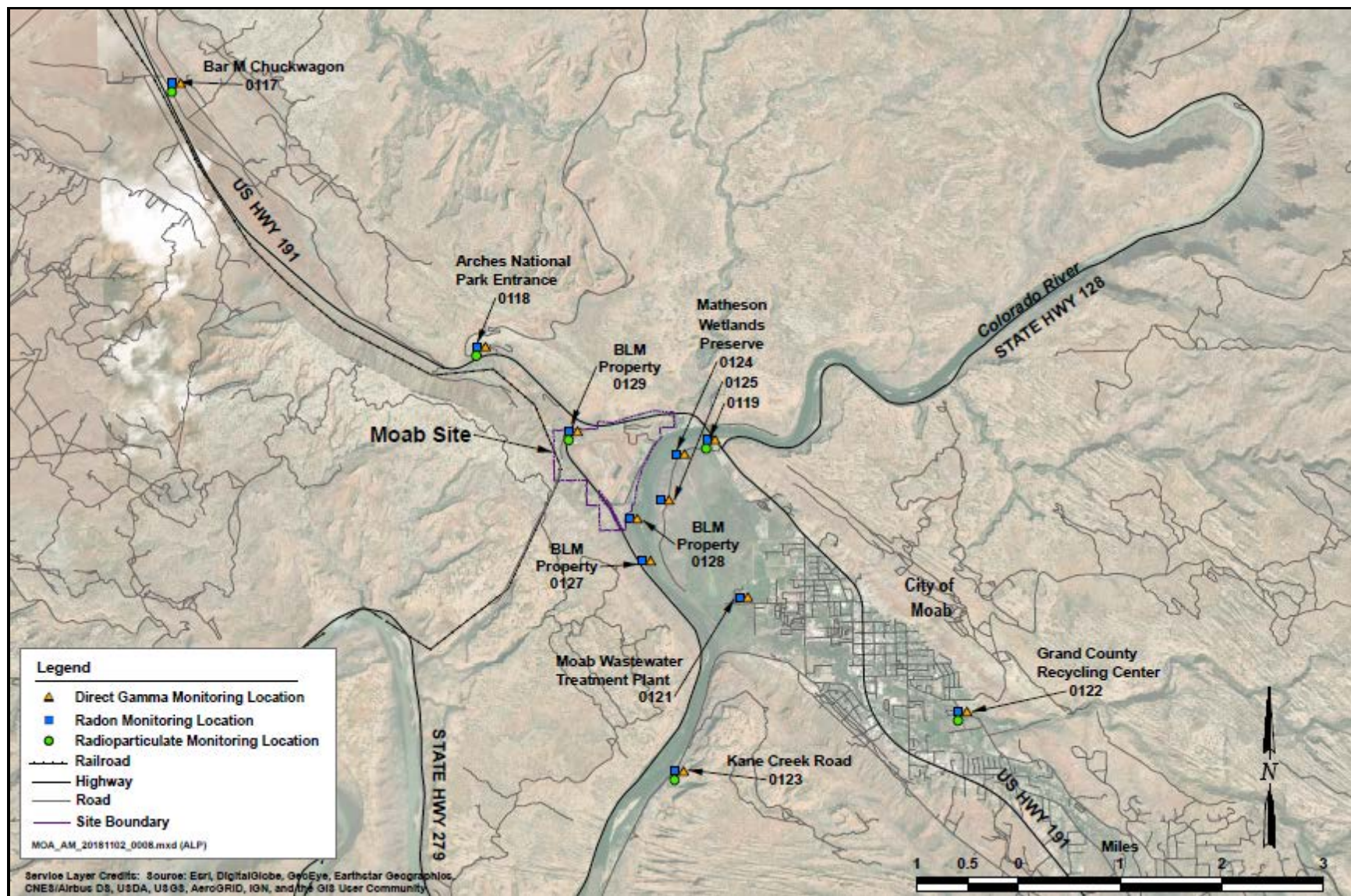
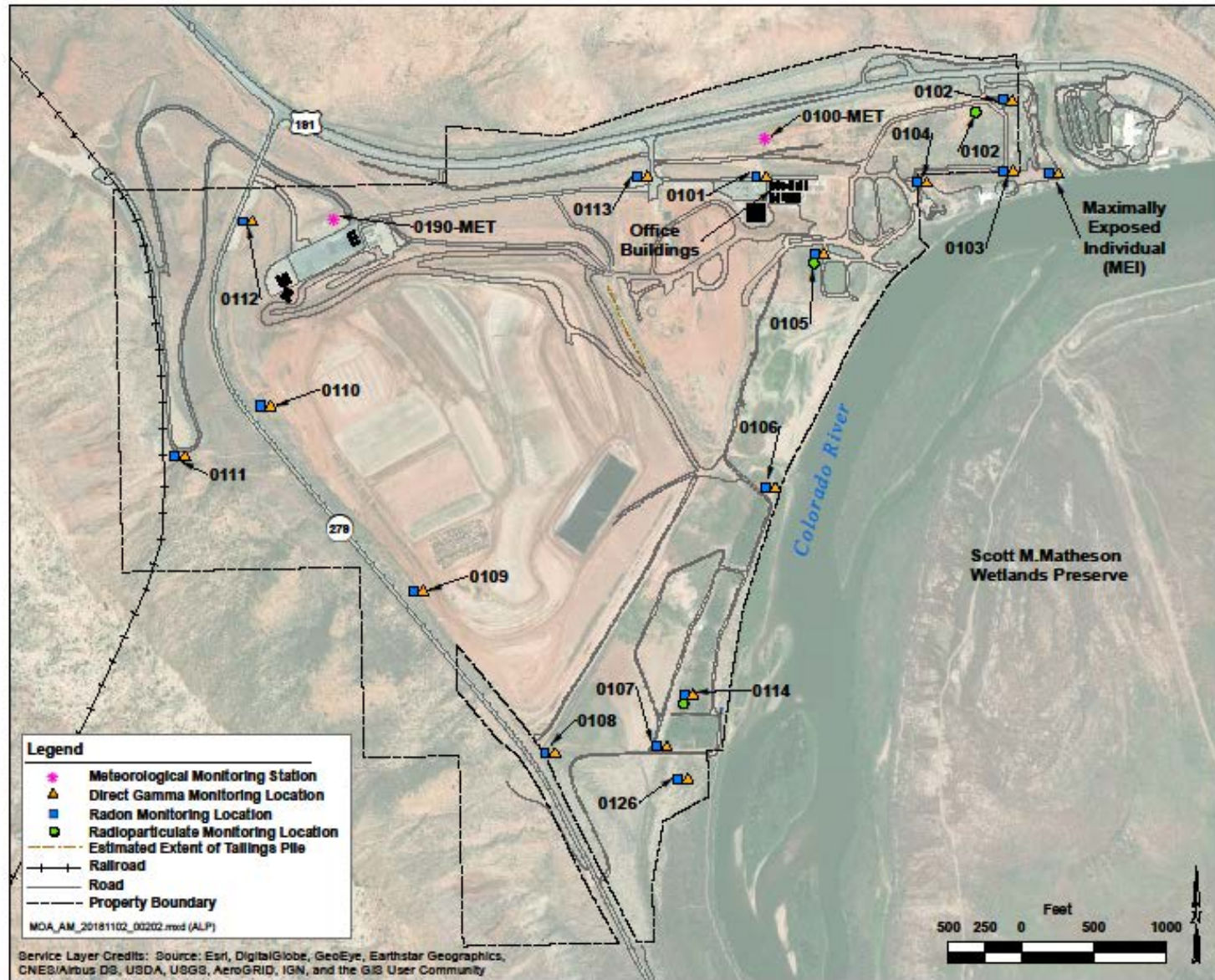


Figure 1. Moab Off-site Environmental Air Monitoring Locations



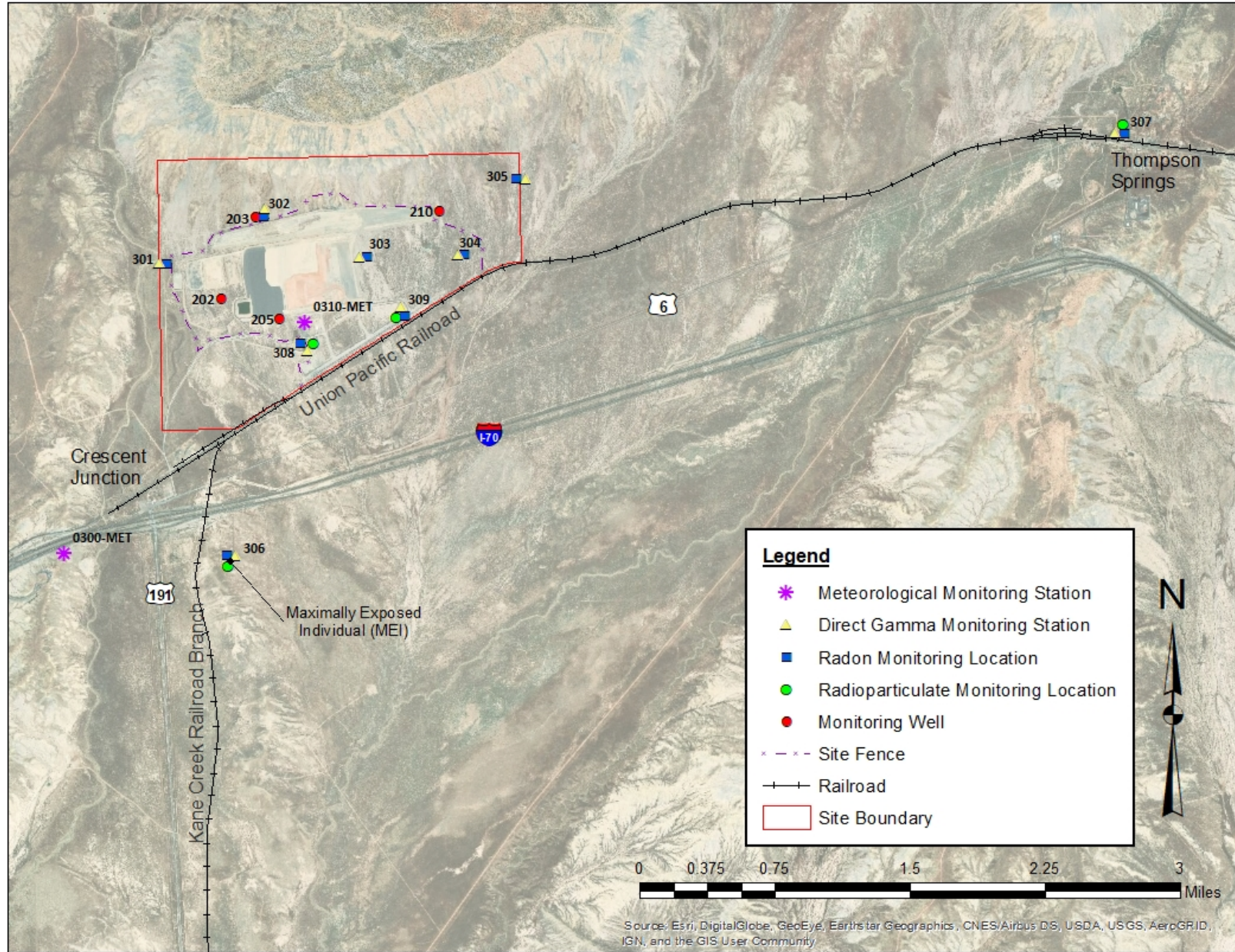


Figure 3. Crescent Junction Site Environmental Air Monitoring Locations

3.1.1 Radon

Based on 5 years of data between 2003 and 2008 from stations 0117 and 0123, the average background concentration of radon in the Moab area was established as 0.7 pCi/L; therefore, the Project annual average radon emission limit at the Moab site boundary is 3.7 pCi/L. On-site monitoring locations close to the site boundary or publically accessible areas are used to demonstrate compliance at the boundary. Table 1 shows quarterly and annual radon results for the past year (including background) for on- and off-site locations, none of which exceeded the 3.7 pCi/L annual average.

Table 1. Radon Concentrations for Moab Site for Past Year

Station Number	2nd Quarter 2018 (pCi/L)	3rd Quarter 2018 (pCi/L)	4th Quarter 2018 (pCi/L)	1st Quarter 2019 (pCi/L)	Annual Average Concentration Based on Four Quarters (pCi/L)
On-site Locations					
0101	1.9	1.9	4.2	1.8	2.5
0102	0.7	0.9	2.8	1.7	1.5
0103	1.0	1.0	2.7	1.4	1.5
0104	1.1	1.4	3.8	2.2	2.1
0105	1.4	1.7	4.2	2.5	2.5
0106	1.9	1.7	5.4	3.2	3.1
0107	1.8	1.8	5.1	3.1	3.0
0108	2.4	2.8	5.9	3.3	3.6
0109	1.3	2.0	2.4	1.7	1.9
0110	1.0	1.7	2.0	1.6	1.6
0111	0.5	0.7	0.9	0.7	0.7
0112	1.7	2.0	3.3	1.6	2.2
0113	2.6	2.8	4.4	2.2	3.0
0114	NS	NS	5.3	3.5	NA
0126	1.4	1.4	4.4	2.9	2.5
Off-site Locations					
0117	<0.4	<0.4	0.6	0.8	0.6
0118	0.5	0.5	0.7	1.1	0.7
0119	0.5	0.5	1.4	1.2	0.9
0121	<0.4	<0.4	NS	0.7	NA
0122	<0.4	<0.4	0.4	0.8	0.5
0123	<0.4	<0.4	0.4	0.6	0.5
0124	0.5	0.6	2.1	1.2	1.1
0125	0.8	0.8	2.3	1.7	1.4
0127	0.7	0.8	1.5	1.1	1.0
0128	1.3	1.4	4.0	2.6	2.3
0129	1.2	1.9	3.0	1.8	2.0
MEI	0.6	0.6	2.4	1.5	1.3

NS = No Sample collected from this location

NA = Not Applicable, insufficient data to calculate a representative annual average

The five Moab locations (0101, 0106, 0107, 0108, and 0113) with the highest annual average radon concentrations as of the first quarter of 2019 are displayed on Figure 4. Locations 0105 and 0126 had the same annual average as location 0101 (2.5 pCi/l), but only the 0101 data were used to generate Figure 4. This graph displays the annual average concentrations since the first quarter of 2016 for these locations.

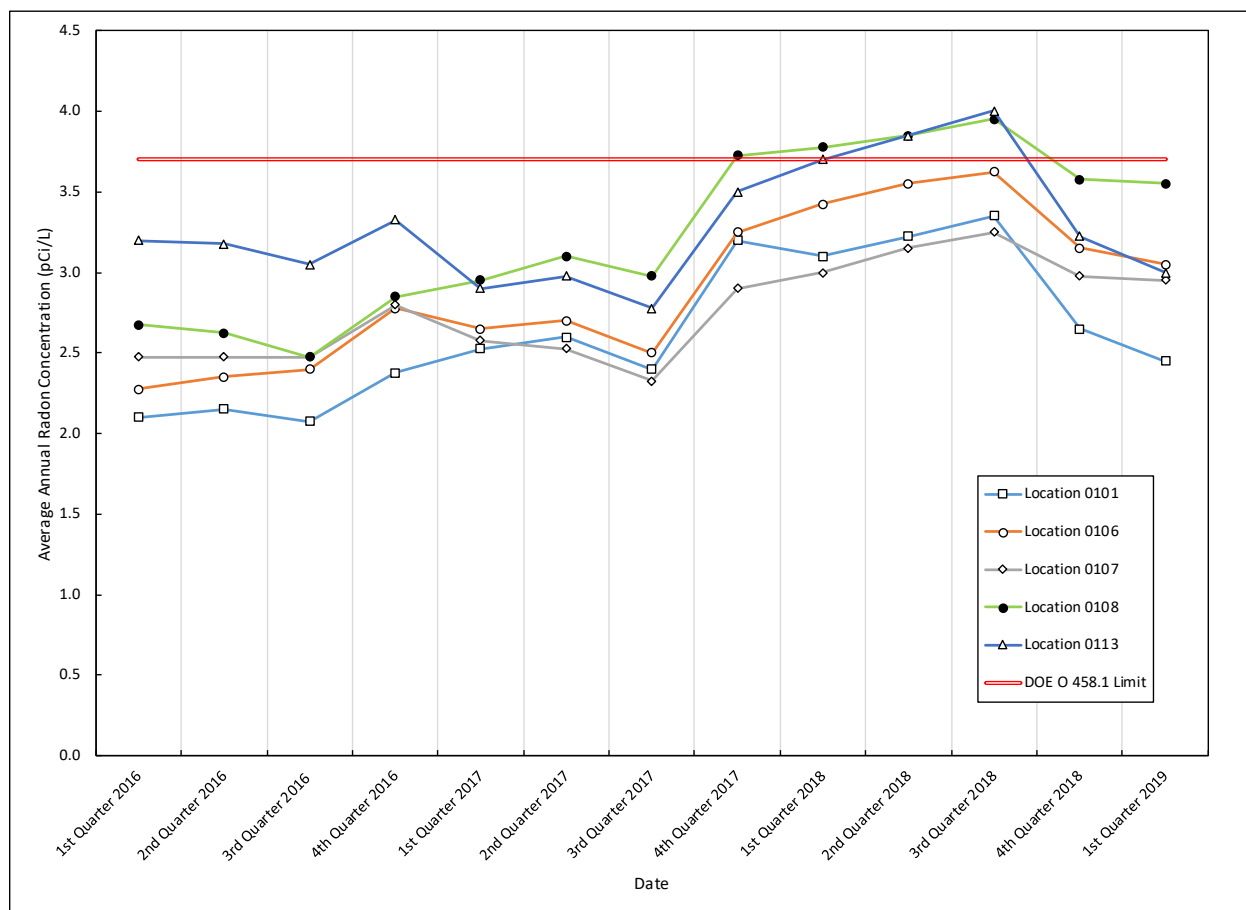


Figure 4. Moab Locations with Highest First Quarter 2019 Average Annual Radon Concentrations

Radon concentrations have historically peaked during the fourth quarter for any year. When compared to the previous quarter, the data indicate the first quarter 2019 concentrations decreased at all 15 on-site locations (as much as 2.6 pCi/L), and decreased at seven of the 12 off-site locations (as much as 1.4 pCi/L). The remaining off-site locations did not increase more than 0.4 pCi/L.

3.1.2 Direct Gamma Radiation

The average annual background (based on 5 years of data between 2003 and 2008) direct gamma radiation effective dose for the Moab area was established as 82 mrem. Table 2 shows quarterly and annual gamma results for the past year, including background, at on- and off-site locations.

These readings represent the gamma dose an individual would receive from occupying a location for an entire year. The first quarter 2019 analytical results indicated the dose increased up to 5 mrem at 20 of the 25 locations (it was not possible to include the results from locations 0121 and 0125) compared to the fourth quarter 2018. The dose decreased at on-site locations 0101, 0108, 0109, 0110, and 0113 as much as 11 mrem.

Table 2. Gamma Radiation Effective Doses for Moab Site for Past Year

Station Number	2nd Quarter 2018 (mrem)	3rd Quarter 2018 (mrem)	4th Quarter 2018 (mrem)	1st Quarter 2019 (mrem)	Annual Dose Based on Four Quarters (mrem)
On-site Locations					
0101	40	46	43	41	170
0102	23	28	26	27	104
0103	23	27	27	28	105
0104	26	30	29	30	115
0105	23	30	28	29	110
0106	32	38	35	36	141
0107	27	31	31	31	120
0108	40	46	44	42	172
0109	116	120	113	102	451
0110	104	113	99	88	404
0111	36	42	38	43	159
0112	45	54	49	49	197
0113	40	48	42	41	171
0114	NS	NS	35	35	NA
0126	28	32	30	31	121
Off-site Locations					
0117	24	28	27	29	108
0118	22	27	26	28	103
0119	25	26	26	27	104
0121	22	25	NS	26	NA
0122	21	24	22	25	92
0123	21	24	22	25	92
0124	23	29	27	29	108
0125	27	31	30	NS	NA
0127	25	29	28	29	111
0128	25	28	29	29	111
0129	30	35	33	33	131
MEI	24	27	27	27	105

NS = No Sample collected from this location

NA = Not Applicable, insufficient data to calculate a representative annual average

3.1.3 Radioparticulates

The effective background dose from inhalation of radioparticulates was not determined, so all effective dose from radioparticulates measured at the Project's monitoring stations is assumed to be from the Project.

Table 3 provides the calculated quarterly and annual effective dose from inhalation of radioparticulates for the past year for the Moab site. Samples were collected at or near the Moab site to measure the concentrations of total uranium, actinium-227, thorium-230, radium-226, and polonium-210. Because actinium-227 and protactinium-231 are assumed to be in equilibrium, the concentration of protactinium-231 is estimated by dividing the analyzed actinium-227 concentration by a correction factor of 0.614, which is consistent with the *Moab UMTRA Project Health Physics Plan* (DOE-EM/GJ3003). These analytical results are used to calculate the effective dose from the inhalation of radioparticulates.

Table 3. Radioparticulate Effective Doses for Moab Site for Past Year

Station Number	Isotope	2nd Quarter 2018 (mrem)	3rd Quarter 2018 (mrem)	4th Quarter 2018 (mrem)	1st Quarter 2019 (mrem)	Annual Dose Based on Four Quarters (mrem)
On-site Locations						
0102-RP ¹	Total Uranium	0.003	0.004	0.003	0.002	4.17
	Thorium-230	0.029	0.043	0.043	0.019	
	Radium-226	0.066	0.036	0.053	0.048	
	Polonium-210	0.374	0.488	0.716	0.765	
	Actinium-227	0.396	0.149	0.466	0.186	
	Protactinium-231	0.091	0.034	0.107	0.043	
0105-RP	Total Uranium	0.004	0.006	0.004	0.002	6.98
	Thorium-230	0.077	0.109	0.085	0.051	
	Radium-226	0.176	0.029	0.079	0.034	
	Polonium-210	0.399	0.513	0.814	0.895	
	Actinium-227	0.420	1.352	0.490	0.746	
	Protactinium-231	0.097	0.311	0.113	0.172	
0114-RP ²	Total Uranium	NS	NS	0.006	0.002	NA
	Thorium-230	NS	NS	0.192	0.049	
	Radium-226	NS	NS	0.354	0.092	
	Polonium-210	NS	NS	0.792	1.106	
	Actinium-227	NS	NS	0.691	0.489	
	Protactinium-231	NS	NS	0.159	0.113	
Off-site Locations						
0117-RP	Total Uranium	0.003	0.003	0.003	0.002	3.40
	Thorium-230	0.026	0.021	0.021	0.016	
	Radium-226	0.034	0.003	0.185	0.000	
	Polonium-210	0.315	0.472	0.554	0.757	
	Actinium-227	0.028	0.280	0.098	0.420	
	Protactinium-231	0.006	0.064	0.023	0.097	
0118-RP	Total Uranium	0.003	0.004	0.002	0.002	3.81
	Thorium-230	0.069	0.067	0.019	0.027	
	Radium-226	0.022	0.021	0.066	0.031	
	Polonium-210	0.366	0.529	0.529	0.741	
	Actinium-227	0.280	0.280	0.200	0.303	
	Protactinium-231	0.064	0.064	0.046	0.070	
0119-RP	Total Uranium	0.003	0.003	0.002	0.002	3.94
	Thorium-230	0.025	0.029	0.021	0.015	
	Radium-226	0.066	0.014	0.030	0.018	
	Polonium-210	0.350	0.529	0.578	0.814	
	Actinium-227	0.350	0.172	0.396	0.256	
	Protactinium-231	0.080	0.040	0.091	0.059	
0122-RP	Total Uranium	0.003	0.003	0.002	0.002	3.16
	Thorium-230	0.024	0.011	0.016	0.010	
	Radium-226	0.029	0.015	0.026	0.024	
	Polonium-210	0.342	0.423	0.472	0.741	
	Actinium-227	0.303	0.217	0.303	ND	
	Protactinium-231	0.070	0.050	0.070	ND	

¹MEI location,

²1Q19 dose values increased 23 percent due to air pump operating only 77 percent of the quarter.

NS = No Sample collected from this location

ND = Not Detected, analyte concentration below detection limit

NA = Not Applicable, insufficient data available to calculate Annual Dose

Table 3. Radioparticulate Effective Doses for Moab Site for Past Year (continued)

Station Number	Isotope	2nd Quarter 2018 (mrem)	3rd Quarter 2018 (mrem)	4th Quarter 2018 (mrem)	1st Quarter 2019 (mrem)	Annual Dose Based on Four Quarters (mrem)
Off-site Locations (continued)						
0123-RP	Total Uranium	0.003	0.003	0.002	0.002	3.41
	Thorium-230	0.032	0.015	0.022	0.015	
	Radium-226	0.048	0.026	0.026	0.029	
	Polonium-210	0.358	0.423	0.554	0.741	
	Actinium-227	0.325	0.131	0.280	0.170	
	Protactinium-231	0.075	0.030	0.064	0.039	
0129-RP	Total Uranium	0.006	0.009	0.004	0.003	9.28
	Thorium-230	0.293	0.346	0.125	0.093	
	Radium-226	0.422	0.070	0.211	0.097	
	Polonium-210	0.399	0.602	0.627	0.814	
	Actinium-227	1.445	1.585	0.606	0.559	
	Protactinium-231	0.333	0.365	0.139	0.129	

As previously mentioned, the location 0114 air particulate sampling equipment was installed at the beginning of the fourth quarter, and the results provided in Table 3 only display the dose for only two quarters (the annual dose could not be calculated). In addition, due to LOTO applied to the well field for maintenance issues during the first quarter, the location 0114 air radioparticulate sampling pump operated only 77 percent of the time. To provide a representative dose associated with this location, the values provided in Table 3 include an increase of 23 percent.

The annual dose associated with the stations closest to the site operations (0102, 0105, and 0129) is higher compared to the remaining stations, as expected. Of the eight locations where the first quarter 2019 dose could be compared to the previous quarter, the dose associated with six of the locations increased an average of 0.49 mrem (with a maximum of 1.08 mrem at location 0105). The dose essentially remained the same at location 0102 (only decreased 0.005 mrem), and the dose decreased 0.23 mrem at location 0122.

The results indicate the dose associated with polonium-210 increased (an average of 0.175 mrem) at all nine locations, and the dose associated with uranium did not significantly change (on average only 0.001 mrem) at all locations compared to the previous quarter. At eight of the nine locations the dose associated with thorium-230 and radium-226 decreased compared to the fourth quarter 2018 results, while the doses associated with actinium-227 and protactinium-230 decreased at six of the nine locations.

3.1.4 Total Effective Dose

The Project must ensure the annual effective dose to gamma radiation and radioparticulates from Project activities does not exceed 100 mrem above background. The annual total effective dose to the MEI was 27.17 mrem, which is well below the DOE limit. This value was calculated by subtracting the background dose of 82 mrem from the MEI gamma radiation dose of 105 mrem and then adding the radioparticulate dose of 4.17 mrem for location 0102, the closest radioparticulate station to the MEI.

Compared to the previous quarter, the total effective dose was essentially the same, decreasing only 0.8 mrem as shown in the *Moab UMTRA Project Environmental Air Monitoring Data Quarterly Report for the Moab and Crescent Junction, Utah, Sites Fourth Quarter 2018 (October – December 2018)* (DOE-EM/GJTAC3010). Figure 5 is a plot of the total effective dose from for the eight Moab locations since 2016. To provide more detail, the background was subtracted from the gamma data, so the DOE Limit is shown as 100 mrem. As this plot displays, there has generally been a gradual increase since 2018.

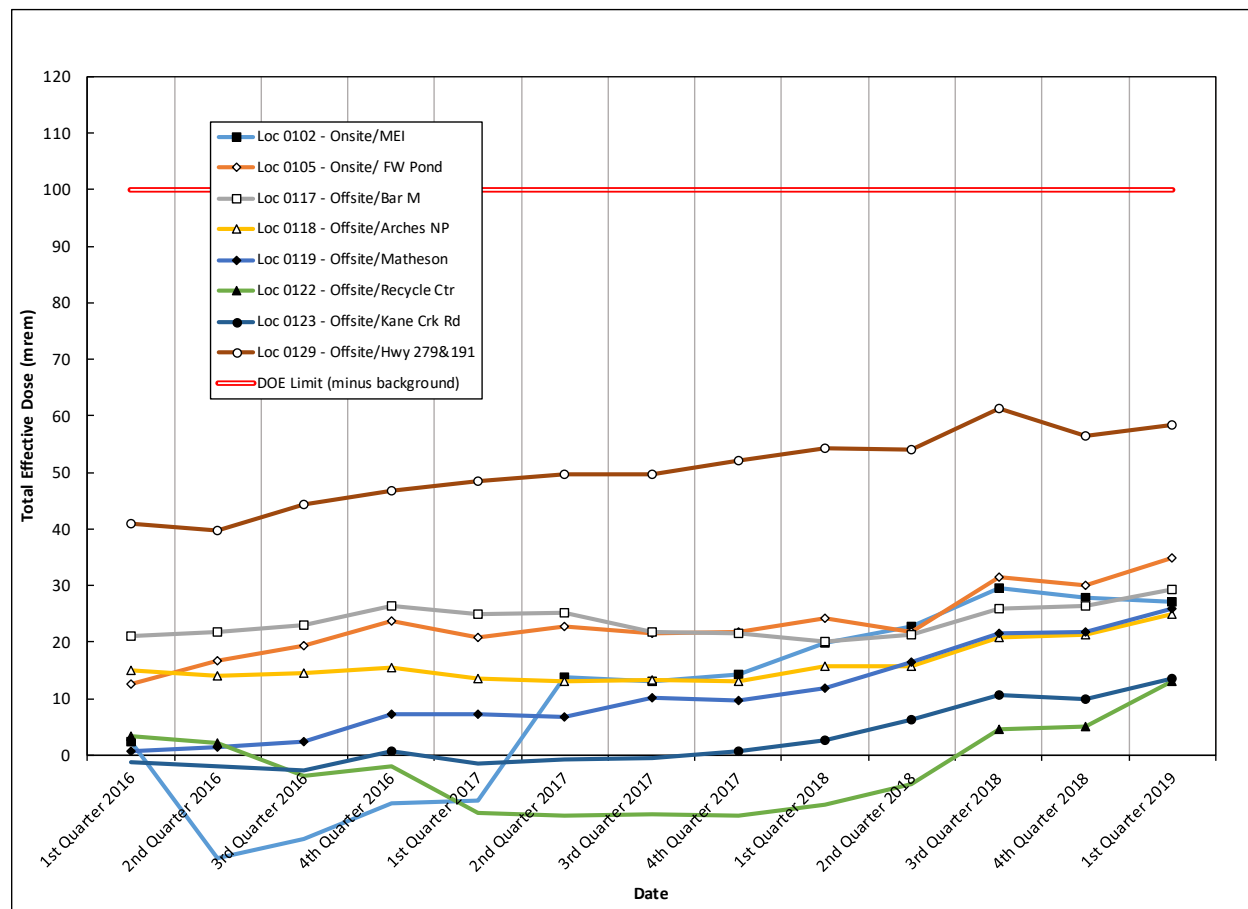


Figure 5. Total Effective Dose Measured at Moab Locations since 2016

3.2 Crescent Junction Site

There are nine air monitoring stations associated with the Crescent Junction site, two located off site and seven on site. All nine are equipped with radon and gamma detectors, and two of the on-site and the two off-site stations also measure air radioparticulates. After mill tailings disposal began in the second quarter of 2009, Crescent Junction monitoring location 0306 became the MEI.

3.2.1 Radon

Based on 3 years of data from 2006 to 2009, the Crescent Junction area radon background concentration was established as 0.9 pCi/L, so the Project must limit radon emissions at the Crescent Junction site boundary (withdrawal area) to 3.9 pCi/L.

Table 4. Radon Concentrations for Crescent Junction Site for Past Year

Station Number	2nd Quarter 2018 (pCi/L)	3rd Quarter 2018 (pCi/L)	4th Quarter 2018 (pCi/L)	1st Quarter 2019 (pCi/L)	Annual Average Concentration Based on Four Quarters (pCi/L)
On-site Locations					
0301	0.5	0.4	0.7	0.8	0.6
0302	<0.4	<0.4	0.8	1	0.7
0303	0.7	0.5	1.3	1.2	0.9
0304	<0.4	0.4	1.2	0.9	0.7
0305	<0.4	<0.4	1.1	0.6	0.6
0308	2.1	2.6	3.0	1.9	2.4
0309	0.8	1.0	1.5	1.4	1.2
Off-site Locations					
0306¹	<0.4	<0.4	0.9	0.6	0.6
0307	<0.4	<0.4	0.6	0.6	0.5

¹MEI location

Locations 0301, 0305, and 0309 are used to demonstrate compliance with the public dose limit in DOE O 458.1 at the site boundary. Table 4 shows quarterly and annual radon results for the past year, including background, for on- and off-site locations. The five Crescent Junction locations that had the highest annual average radon concentrations by the first quarter of 2019 (0302, 0303, 0304, 0308, and 0309) are displayed on Figure 6. This graph displays the annual average concentrations for these locations since the first quarter of 2016.

None of the on- or off-site stations exceeded the limit of 3.0 pCi/L above background. Compared to the previous quarter, the radon concentrations decreased up to 1.1 pCi/L at six of the nine locations, increased at only two locations (up to 0.2 pCi/L), and did not change at the remaining location.

3.2.2 Direct Gamma Radiation

The average annual background direct gamma radiation exposure dose for the Crescent Junction area was established as 92.5 mrem based on 3 years of data from 2006 to 2009. Table 5 shows quarterly and annual results for the past year, including background, for on- and off-site locations. These results represent the gamma dose an individual would receive from occupying a location for an entire year.

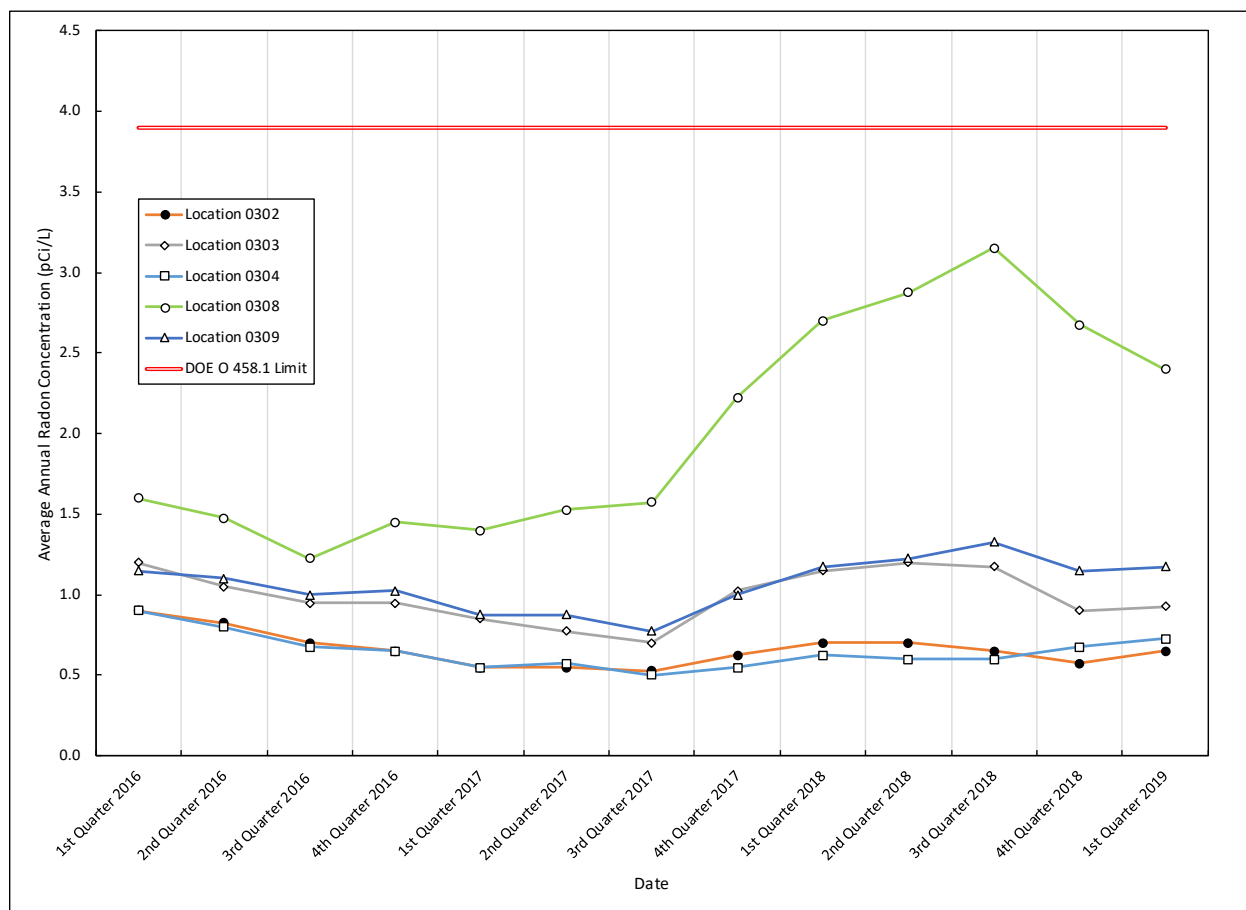


Figure 6. Crescent Junction Locations with Highest First Quarter 2019 Average Annual Radon Concentrations

Table 5. Gamma Radiation Effective Doses for Crescent Junction Site for Past Year

Station Number	2nd Quarter 2018 (mrem)	3rd Quarter 2018 (mrem)	4th Quarter 2018 (mrem)	1st Quarter 2019 (mrem)	Annual Dose Based on Four Quarters (mrem)
On-site Locations					
0301	24	28	27	29	108
0302	24	28	28	30	110
0303	31	34	33	35	133
0304	25	29	27	30	111
0305	25	29	29	31	114
0308	25	30	28	30	113
0309	24	36	27	30	117
Off-site Locations					
0306 ¹	23	28	27	29	107
0307	25	31	28	30	114

¹MEI location

Following the same general trend shown by the Moab site, the first quarter 2019 analytical results indicated the dose increased at all nine locations (up to 3 mrem) compared to the previous quarter.

3.2.3 Radioparticulates

As with the Moab sampling results, the effective background dose from inhalation of radioparticulates at the Crescent Junction site was not determined, so all effective dose measured at the Project's monitoring stations is assumed to be from the Project. Samples were collected at the four monitoring locations at or near the Crescent Junction site to determine the air particulate concentrations of total uranium, thorium-230, radium-226, polonium-210, actinium-227, and protactinium-231 (based on the actinium-227 concentration, as described in Section 3.1.3).

The analytical results are used to calculate effective dose from the inhalation of radioparticulates. Table 6 shows quarterly and annual radioparticulate doses for the past year for the Crescent Junction site. Compared to the previous quarter, the results indicate the dose measured at the off-site location 0306 (the MEI) decreased by 0.58 mrem and increased 0.02 mrem at location 0307 (Thompson Springs). On site, the dose measured from the samples collected from location 0308 (at the guard shack) decreased 0.31 mrem and increased at 0309 (eastern end of rail bench) 0.07 mrem.

Table 6. Radioparticulate Effective Doses for Crescent Junction Site for Past Year

Station Number	Isotope	2nd Quarter 2018 (mrem)	3rd Quarter 2018 (mrem)	4th Quarter 2018 (mrem)	1st Quarter 2019 (mrem)	Annual Dose Based on Four Quarters (mrem)
On-site Locations						
0308-RP	Total Uranium	0.003	0.004	0.002	0.002	4.40
	Thorium-230	0.061	0.077	0.037	0.035	
	Radium-226	0.092	0.048	0.066	0.053	
	Polonium-210	0.374	0.554	0.505	0.578	
	Actinium-227	0.490	0.629	0.326	0.105	
	Protactinium-231	0.113	0.145	0.075	0.024	
0309-RP	Total Uranium	0.004	0.003	0.003	0.002	4.78
	Thorium-230	0.117	0.064	0.080	0.061	
	Radium-226	0.229	0.026	0.167	0.114	
	Polonium-210	0.383	0.488	0.537	0.692	
	Actinium-227	0.373	0.233	0.466	0.396	
	Protactinium-231	0.086	0.054	0.107	0.091	
Off-site Locations						
0306-RP ¹	Total Uranium	0.002	0.002	0.002	0.002	2.72
	Thorium-230	0.019	0.009	0.014	0.016	
	Radium-226	0.032	0.003	0.037	0.000	
	Polonium-210	0.334	0.472	0.529	0.700	
	Actinium-227	0.147	0.070	0.089	0.140	
	Protactinium-231	0.034	0.016	0.020	0.032	
0307-RP	Total Uranium	0.003	0.003	0.003	0.002	3.70
	Thorium-230	0.032	0.014	0.021	0.011	
	Radium-226	0.038	0.000	0.009	ND	
	Polonium-210	0.326	0.529	0.472	0.602	
	Actinium-227	0.350	0.326	0.373	0.280	
	Protactinium-231	0.080	0.075	0.086	0.064	

¹MEI location

ND = Not Detected, analyte concentration below detection limit

Similar to the results associated with the Moab site, the data indicate that from the fourth quarter 2018 to the first quarter 2019, the dose associated with polonium-210 increased at all four sampling locations (an average of 0.13 mrem), while the dose from uranium did not change.

The dose associated with radium-226 decreased at all four locations (on average 0.03 mrem), and the doses calculated from the actinium-227, thorium-230, and protactinium-231 results decreased at locations 0307, 0308, and 0309, but increased at location 0306.

3.2.4 Total Effective Dose

The annual total effective dose to the MEI was 17.22 mrem, which is well below the annual limit of 100 mrem above background. This is calculated by subtracting the background dose of 92.5 mrem from the MEI (location 0306) gamma radiation dose of 107 mrem and then adding the radioparticulate dose of 2.72 mrem for the MEI.

The total effective dose increased 3.42 mrem compared to the fourth quarter 2018. Figure 7 is a plot of the total effective dose from the four Crescent Junction locations since 2016. To provide more detail, the background was subtracted from the gamma data as with Figure 5, so the DOE limit is shown as 100 mrem. As Figure 7 displays, there has generally been a gradual increase in the total effective dose since late 2017.

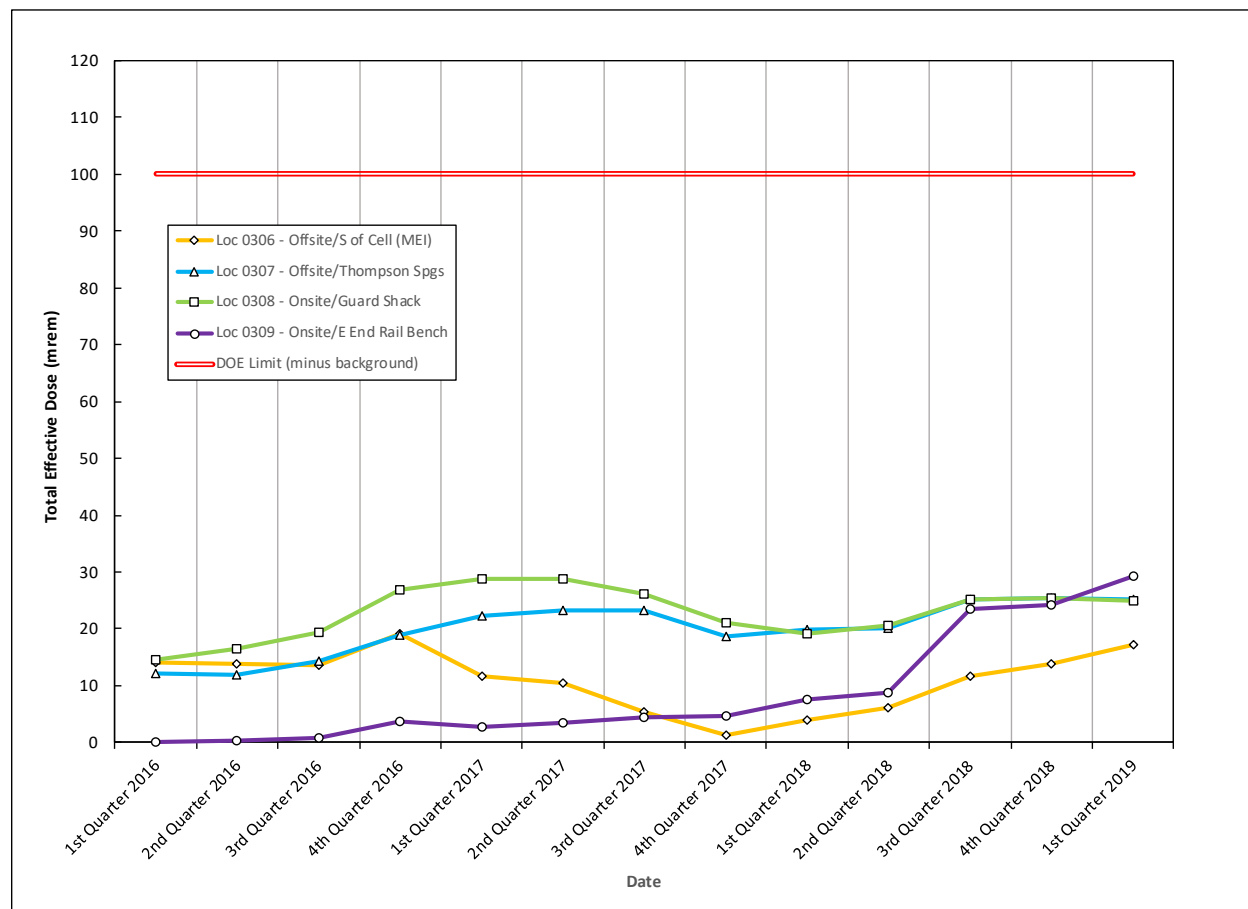


Figure 7. Total Effective Dose Measured at Crescent Junction Locations since 2016

4.0 Data Assessment

Radon detectors, thermoluminescent dosimeters used for continuous dose measurements, and radioparticulate sample filters were sent to certified off-site laboratories for analyses in accordance with the *Moab UMTRA Project Environmental Air Monitoring Sampling and Analysis Plan* (DOE-EM/GJTAC2219) (SAP).

Qualified Project personnel evaluated the analytical data received for consistency with other data points and quality assurance/quality control samples.

Location 0114 was established in the beginning of the 2018 fourth quarter to measure the radioparticulate and gamma doses and the radon concentration in the vicinity of the IA well field, near groundwater extraction well 0810. Because this station was recently established, only quarterly results are presented in this report, and the annual average radon concentration, annual total gamma dose, and annual dose associated with radioparticulates for this location were not included in this report.

In addition, due to LOTO applied to the well field for maintenance issues, the dose reported for location 0114 reflects a 23 percent increase. All other air particulate sampling pumps operated 99 percent of the time, and it was not necessary to adjust the reported dose associated with these locations.

During the first quarter 2019, the gamma detector was removed by unauthorized personnel from location 0125 and could not be recovered, so there are no results to report associated with this location in the most recent quarter. In addition, it was not possible to calculate the annual dose.

4.1 Quality Assurance/Quality Control Sampling

Duplicate samples for radon were collected at Moab locations 0102, 0108, and 0111, and at Crescent Junction locations 0303 and 0308. In addition, duplicate direct gamma samples were collected at Moab locations 0102, 0108, and 0129 and Crescent Junction locations 0301 and 0305. All results associated with the duplicate sampling are provided in Table 7. No duplicate samples were collected for radioparticulate samples in accordance with the SAP.

Table 7. Duplicate Results for First Quarter 2019

Location	Result	Duplicate Result
Moab		
Radon:	pCi/L	pCi/L
0102	1.7	1.4
0108	3.1	3.3
0111	0.7	1.2
Gamma:	mrem	mrem
0102	27	28
0108	42	43
0129	33	33
Crescent Junction		
Radon:	pCi/L	pCi/L
0303	1.2	1.1
0308	1.9	2.2
Gamma:	mrem	mrem
0301	29	28
0305	31	29

As Table 7 displays, the five locations that included duplicate radon samples were within 0.5 pCi/L of each other. The five locations that were equipped with duplicate gamma detectors were all within 2 mrem of each other. These radon and gamma duplicate results are within the acceptable ranges, and the data are considered valid based on these results.

Control samples measure the dose (for gamma) the detectors are exposed to while being shipped from the site to the respective analytical laboratories. The two gamma control samples were 0 mrem, so it was not necessary to adjust any of the gamma results.

Table 8. Shipment Control Sample Results for First Quarter 2019

Sample	Result
Gamma:	mrem
In-transit 1	0
In-transit 2	0

A different radon detector was tested during the first quarter 2019 to determine if there was a significant difference between the detectors historically used (Radtrak2) compared to a new model that has been designed with a higher sensitivity for outdoor use (Rapidos). Ten of the Rapidos detectors were placed in the same locations where Radtrak2 detectors were placed, and exposed for the same amount of time. Table 9 provides the results of this comparison.

Table 9. Comparison of Radon Detectors Results for First Quarter 2019

Location	Radtrak2 Conc. (pCi/L)		Rapidos Conc. (pCi/L)	
	Result	Range (+/-)	Result	Range (+/-)
0101	1.8	0.4	2.0	0.3
0106	3.2	0.5	3.1	0.5
0108	3.1	0.5	2.9	0.4
0113	2.2	0.4	2.0	0.3
0119	1.2	0.3	0.9	0.2
0126	2.9	0.5	2.4	0.4
0129	1.8	0.4	1.4	0.3
MEI	1.5	0.3	1.3	0.3
0308	1.9	0.4	2.3	0.4
0309	1.4	0.4	1.1	0.2

Figure 8 is a graphical display of the results. The Radtrak2 results are on the x-axis, and the Rapidos results on the y-axis. Also shown is the 1:1 line. Of the 10 test locations, eight are below this line, which suggests the Radtrak2 detectors generally provide higher (and therefore more conservative) results. On average, the detectors were within 0.2 pCi/L of each other.

4.2 Suspected Anomalies

All analytical data are reviewed for anomalous or outlying data points. Monitoring data are evaluated against historical and minimum/maximum values to determine if the reported data are within reasonable expected ranges. No anomalous data were noted for the first quarter of 2019.

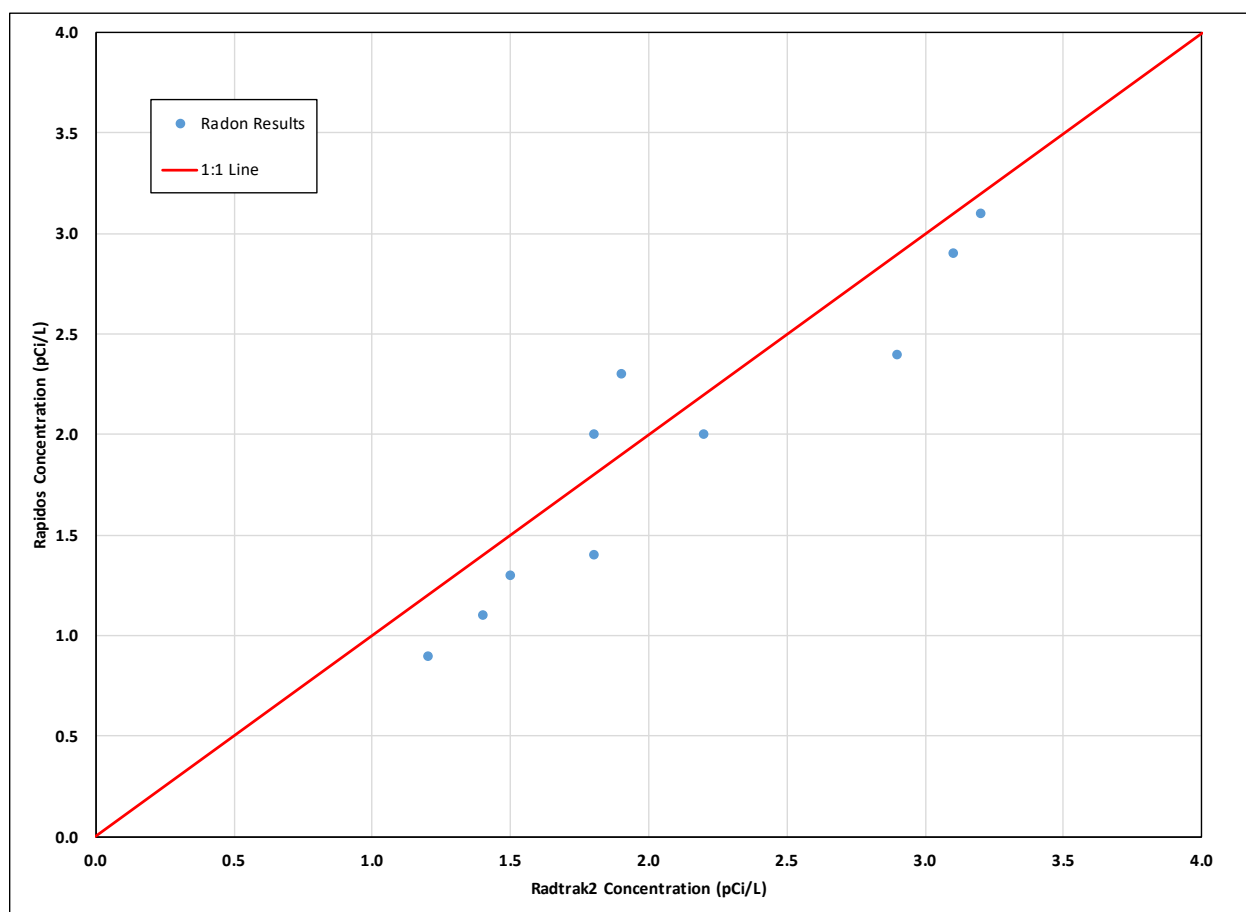


Figure 8. Graphical Display of Results of Radon Detector Comparison

4.3 Summary

Data collected during the first quarter of 2019 met the applicable laboratory control criteria for their respective analyses. The results were within the acceptable limits associated with each matrix. Data in this Report are considered validated and may be treated as final results.

5.0 References

DOE (U.S. Department of Energy), *Moab UMTRA Project Environmental Air Monitoring Sampling and Analysis Plan* (DOE-EM/GJTAC2219).

DOE (U.S. Department of Energy), *Moab UMTRA Project Environmental Air Monitoring Data Quarterly Report for the Moab and Crescent Junction, Utah, Sites Fourth Quarter 2018 (October – December 2018)* (DOE-EM/GJTAC3010).

DOE (U.S. Department of Energy), *Moab UMTRA Project Health Physics Plan* (DOE-EM/GJ3003).

DOE (U.S. Department of Energy) Order 458.1, Admin Chg 3, “Radiation Protection of the Public and the Environment.”