DOE–EM/GJTAC3056

Moab UMTRA Project Environmental Air Monitoring Data Quarterly Report for the Moab and Crescent Junction, Utah, Sites First Quarter 2021 (January through March 2021)

Revision 0

July 2021

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Moab UMTRA Project
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Revision 0

Review and Approval

7/12/2021

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Revision History

Revision	Date	Description
0	July 2021	Initial issue.

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Acronyms and Abbreviations

DOE	Department of Energy
MEI	maximally exposed individual
mrem	millirems
pCi	picocurie
pCi/L	picocurie per liter
SAP	Sampling Analysis Plan
TED	total effective dose
TLD	thermoluminescent dosimeter
UMTRA	Uranium Mill Tailings Remedial Action

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 2021. 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 1, "Radiation Protection of the Public and the Environment," which states DOE radiological activities must be conducted in a manner that does not cause total effective dose (TED) to the public to exceed 100 millirems (mrem) in a year, or an equivalent dose to the lens of the eye exceeding 1,500 mrem in a year, or an equivalent dose to the skin or extremities of 5,000 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 (minus background) 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 is demonstrated by calculating the total effective 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 has established an MEI for the Moab and Crescent Junction Project sites.

3.0 Results for January through March 2021

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

There are a total of 27 air monitoring stations equipped with radon and gamma detectors associated with the Moab site. Fifteen of these stations are located within the site boundary, while the additional 12 are located at relevant locations off-site. Of these 27 stations, three on-site and six off-site stations are also equipped with air sampling pumps to measure air radioparticulates.

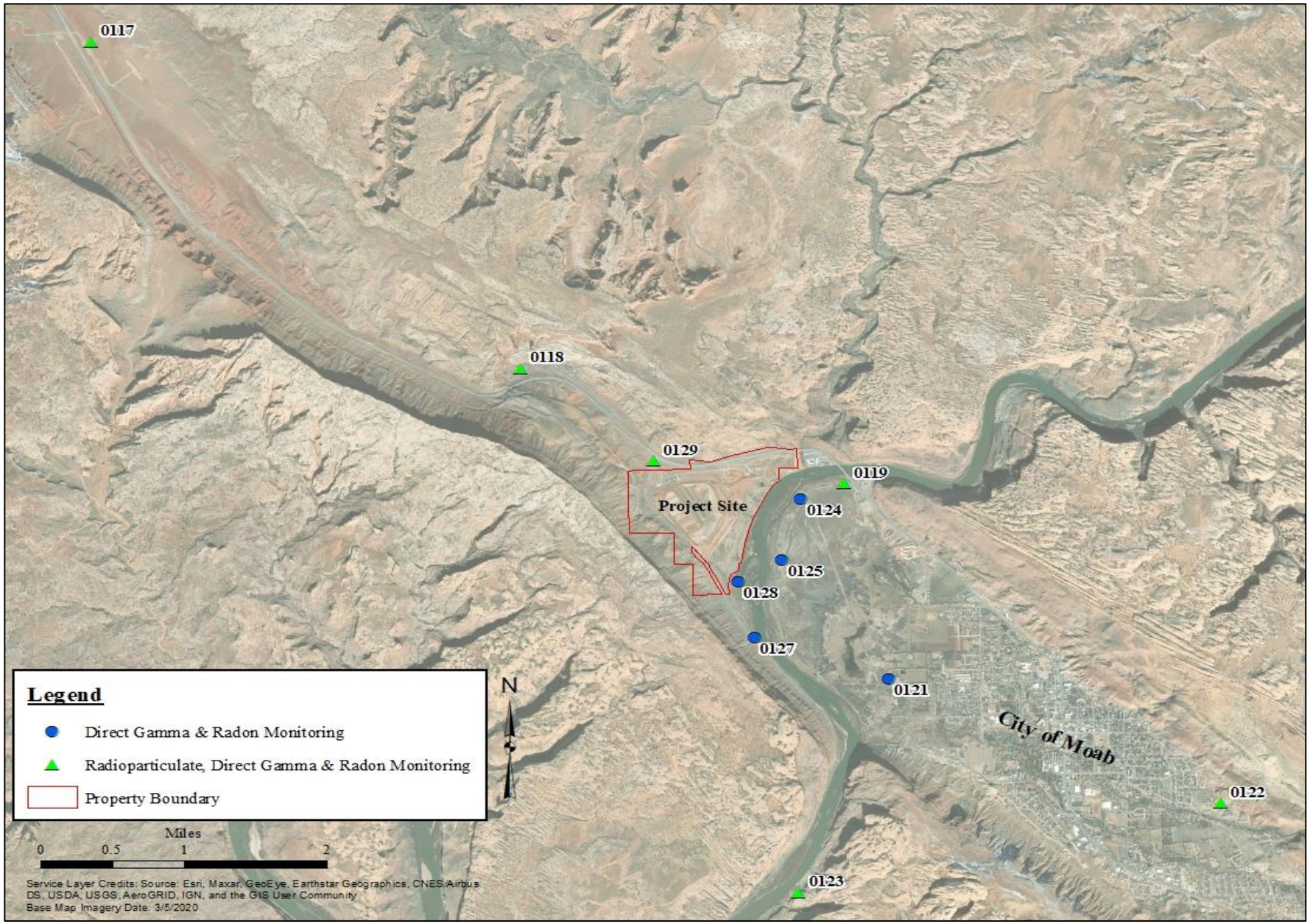

Figure 1. Moab Off-site Environmental Air Monitoring Locations

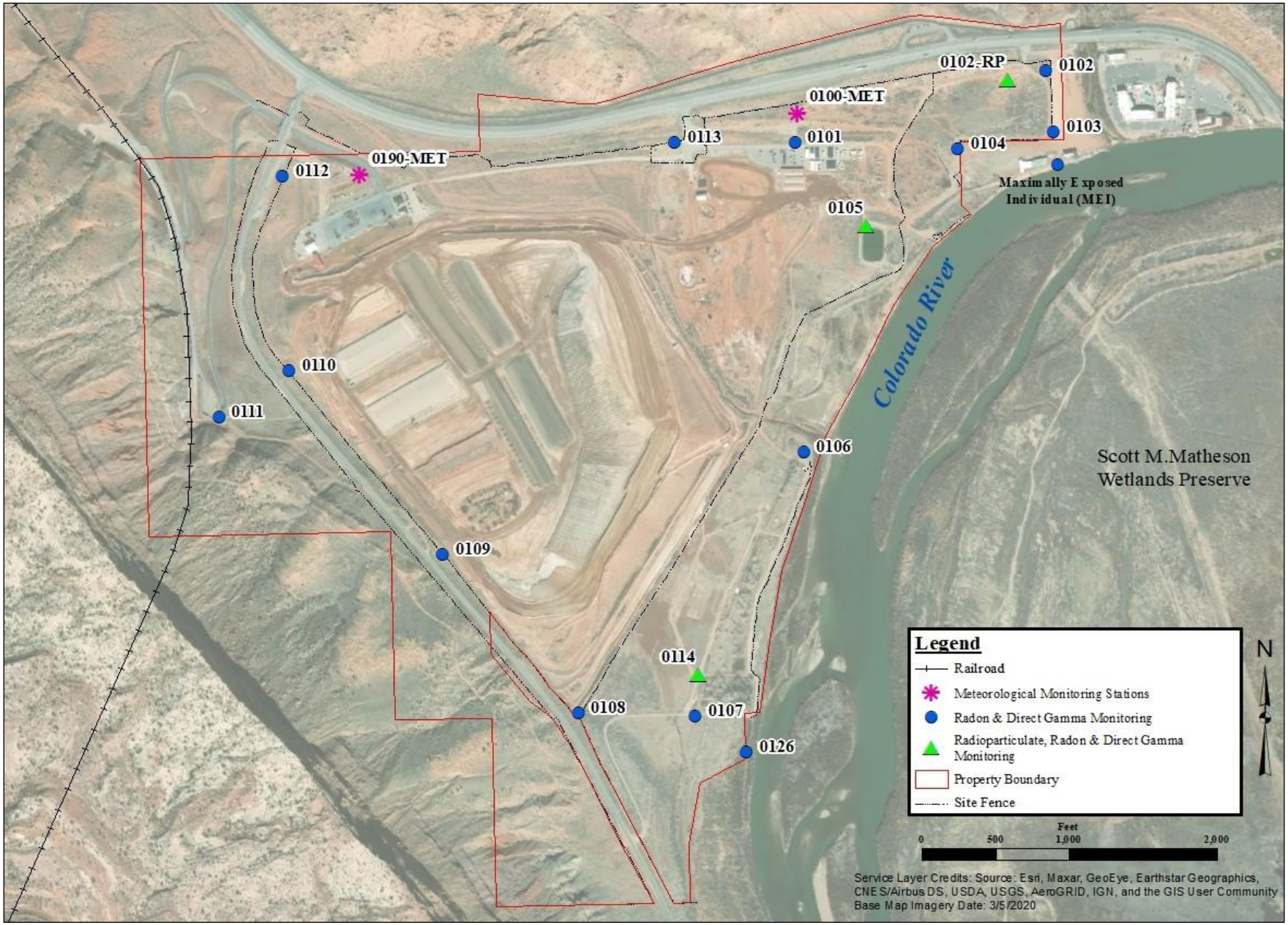

Figure 2. Moab On-site and Maximally Exposed Individual Environmental Air Monitoring Locations

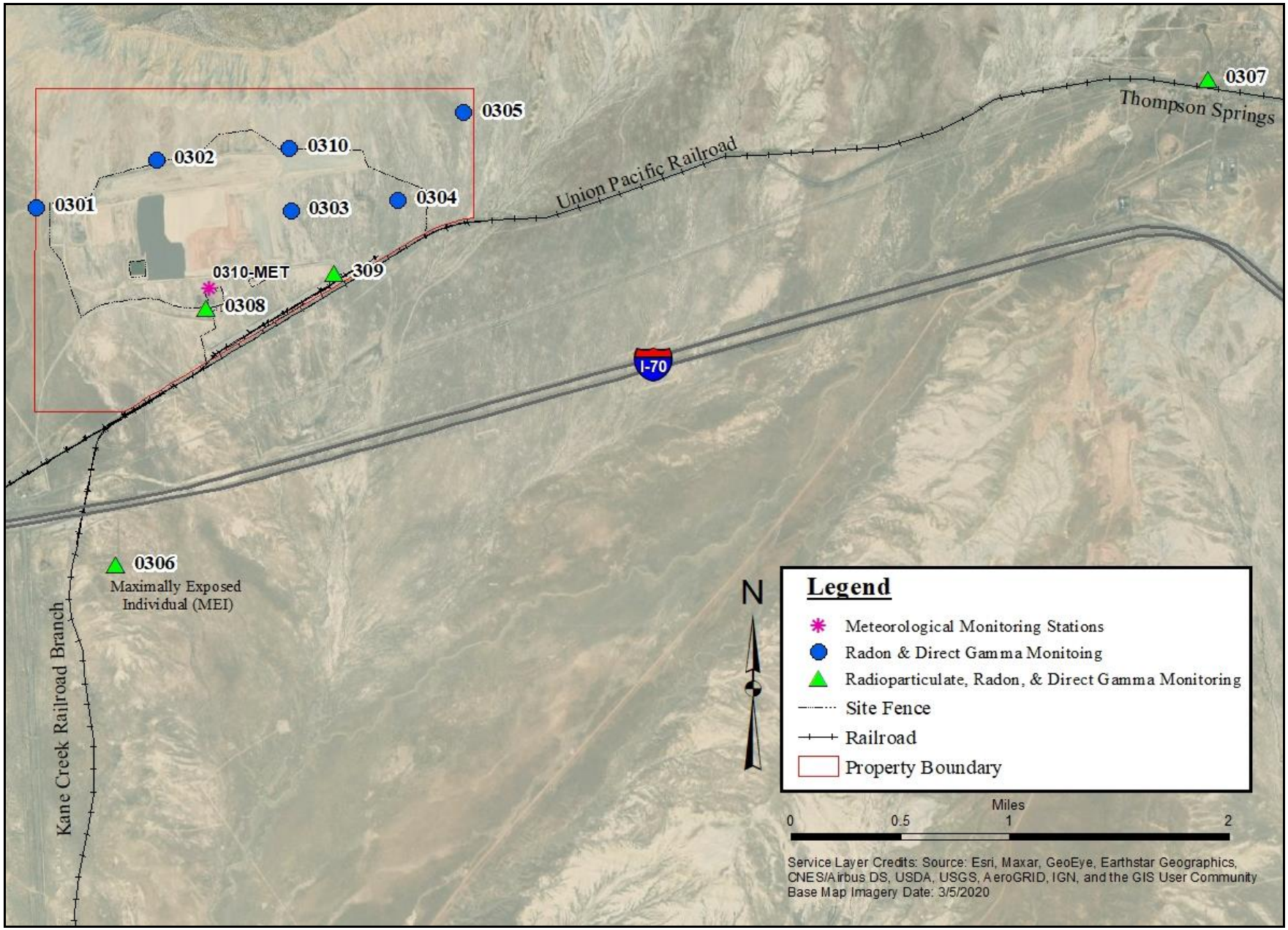

Figure 3. Crescent Junction Site Environmental Air Monitoring Locations

3.1.1 Meteorological Analysis

Meteorological data were collected from the on-site meteorological station (0190-Met) and downloaded from the Vista Data Vision online database, where meteorological data are uploaded from the site. Hourly averages were analyzed. Figure 4 displays the wind rose for this quarter, with the wedges on the wind rose showing which direction the wind is coming from. In first quarter 2021, the winds were primarily out of the northwest with the strongest winds from the southeast. The average temperature for the quarter was 40°F. The lowest recorded temperature for the quarter was 10°F, and the highest was 73°F.

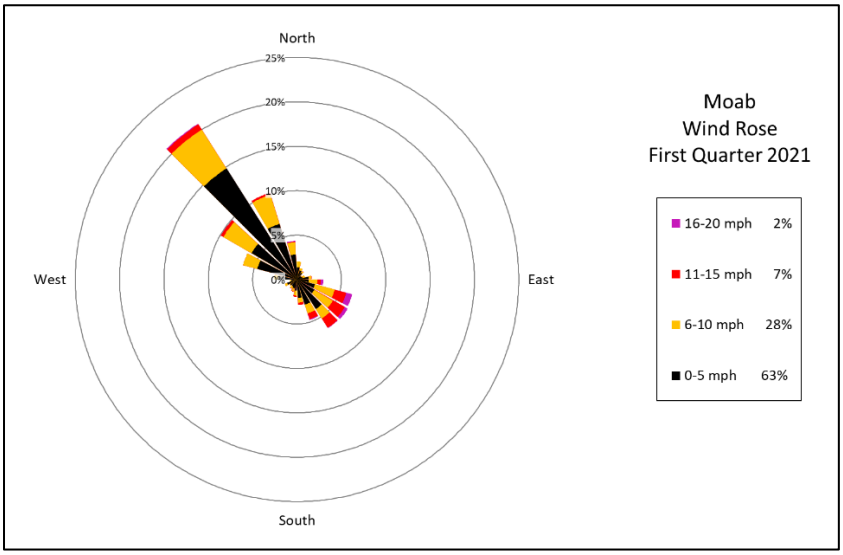

Figure 4. Moab Wind Rose for First Quarter 2021

The site received 1.41 inches of precipitation during first quarter 2021. Figure 5 presents the Moab ten-year average (based on data collected from 2010 through 2020) along with 2020 and 2021 cumulative precipitation. As this graph displays, first quarter 2021 precipitation is less than the site's ten-year average, but on average with first quarter 2020.

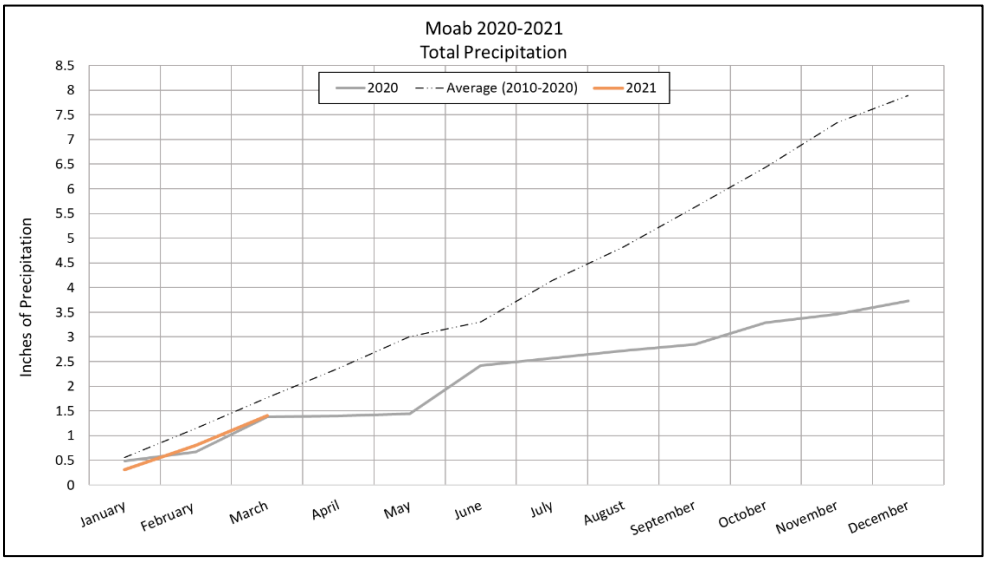

Figure 5. Moab Average, 2020, and First Quarter 2021 Cumulative Precipitation

3.1.2 Radon

Based on five years of data collected 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's 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 publicly 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.

Table 1. Radon Concentrations for the Moab Site for the Past Year

Station Number	Second Quarter 2020 (pCi/L)	Third Quarter 2020 (pCi/L)	Fourth Quarter 2020 (pCi/L)	First Quarter 2021 (pCi/L)	Annual Average Concentration Based on Four Quarters (pCi/L)
On-site Locations					
0101	1.4	2.8	5.1	2.3	**2.9**
0102	0.8	1.5	2.8	2.0	**1.8**
0103	0.8	1.4	3.0	1.6	**1.7**
0104	1.1	2.3	4.5	2.1	**2.5**
0105	1.4	2.5	5.2	2.4	**2.9**
0106	1.8	3.1	6.6	3.5	**3.8**
0107	1.5	2.6	5.0	3.1	**3.1**
0108	1.9	3.6	5.5	2.9	**3.5**
0109	1.2	1.9	2.2	1.4	**1.7**
0110	1.2	2.1	2.1	1.2	**1.7**
0111	0.5	0.9	1.0	0.7	**0.7**
0112	1.3	2.5	2.8	1.4	**2.0**
0113	1.4	3.3	5.1	2.1	**3.0**
0114	1.9	2.9	5.6	3.5	**3.5**
0126	1.3	2.1	4.2	2.5	**2.5**
Off-site Locations					
0117	0.2	0.4	0.7	0.5	**0.5**
0118	0.3	0.8	0.9	0.7	**0.6**
0119	0.4	0.9	1.5	1.2	**1.0**
0121	0.2	0.7	0.9	0.6	**0.6**
0122	<0.1	0.4	0.5	0.5	**0.5**
0123	0.2	0.4	0.7	0.5	**0.5**
0124	NS	1.1	2.2	1.4	**NA**
0125	0.7	1.2	2.3	1.6	**1.5**
0127	0.4	0.9	1.7	1.1	**1.0**
0128	1.3	1.9	4.1	2.3	**2.4**
0129	1.1	2.1	2.6	1.2	**1.8**
MEI	0.6	1.4	2.8	1.5	**1.6**

Background has not been subtracted from annual values

NS = No Sample collected from this location, detector missing upon collection (unknown cause)

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

The Moab locations with the highest annual average radon concentrations as of first quarter 2021 are displayed in Figure 6. Locations 0101, 0106, 0107, 0108, 0113, and 0114 continue to have the highest annual average from the last quarter. Location 0106 was the only station that exceeded the 3.7 pCI/L annual average limit. However, this station is located on-site and no member of the public has access to or occupies that location to receive a dose in excess of the annual limit. When compared to the previous quarter, the data indicate first quarter 2021 concentrations at all of the on-site locations decreased as much as 3.1 pCi/L, and as much as 1.8 pCi/L at all the off-site locations, except one which remained the same.

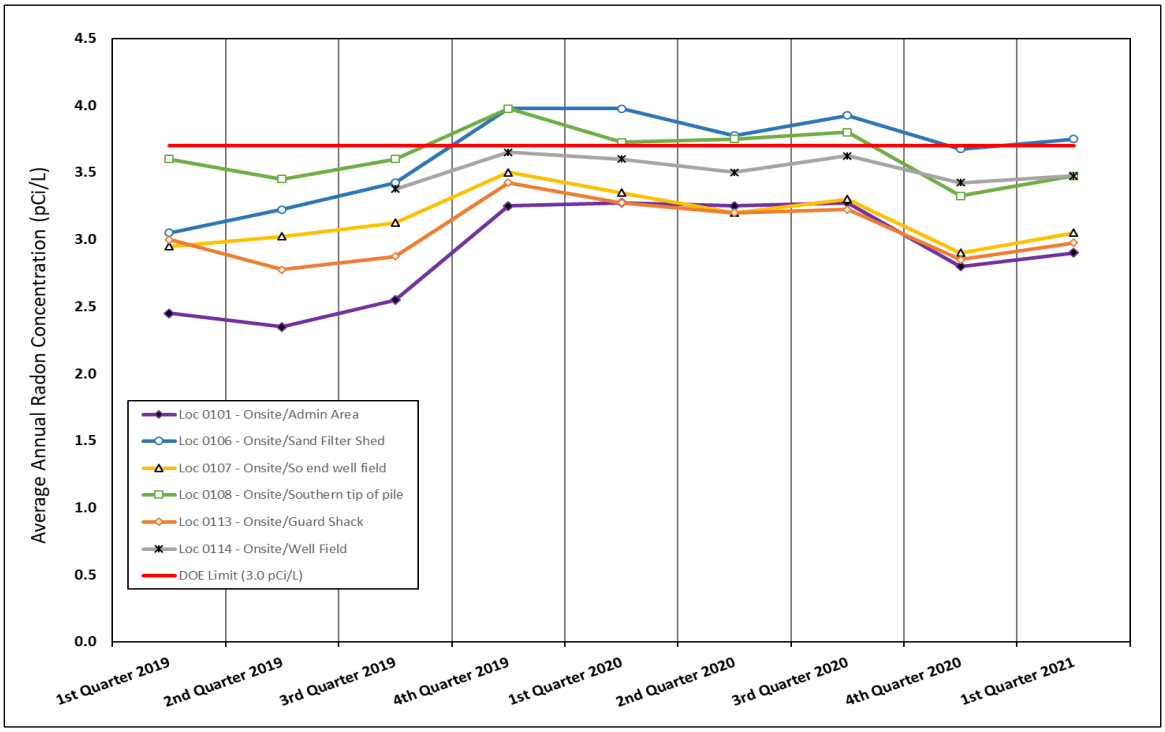

Figure 6. Moab Locations with Highest First Quarter 2021 Average Annual Radon Concentrations

3.1.3 Direct Gamma Radiation

The average annual background (based on five years of data collected between 2003 and 2008) of direct gamma radiation effective dose for the Moab area was established as 82 mrem/year. Table 2 provides quarterly and annual gamma results for the past year, including background, at on- and off-site locations. The annual gamma dose represents the dose an individual would receive from occupying a location for an entire year.

Compared to the previous quarter, this quarter's analytical results indicate the dose decreased at five on-site locations as much as 7 mrem, while eight on-site locations increased as much as 3 mrem. One on-site location results indicated no change from the previous quarter, and it was not possible to calculate the difference at one location due to a damaged thermoluminescent dosimeter (TLD). The off-site results indicate stations decreased as much as 2 mrem while 12 locations increased as much as 7 mrem.

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

Station Number	Second Quarter 2020 (mrem)	Third Quarter 2020 (mrem)	Fourth Quarter 2020 (mrem)	First Quarter 2021 (mrem)	Annual Dose Based on Four Quarters (mrem)
On-site Locations					
0101	45	43	44	40	**172**
0102	25	26	27	29	**107**
0103	25	25	28	28	**106**
0104	29	27	30	31	**117**
0105	27	28	31	30	**116**
0106	34	37	38	41	**150**
0107	31	30	32	34	**127**
0108	46	46	46	48	**186**
0109	112	119	112	109	**452**
0110	96	108	96	97	**397**
0111	38	39	40	NS	**NA**
0112	52	53	52	51	**208**
0113	46	43	44	37	**170**
0114	34	34	36	37	**141**
0126	29	28	31	34	**122**
Off-site Locations					
0117	27	26	28	30	**111**
0118	25	24	25	28	**102**
0119	26	25	25	32	**108**
0121	27	22	24	26	**99**
0122	23	20	22	25	**90**
0123	23	20	23	26	**92**
0124	NS	27	29	28	**NA**
0125	30	29	32	33	**124**
0127	28	27	26	29	**110**
0128	27	28	29	31	**115**
0129	33	33	33	34	**133**
MEI	24	27	28	26	**105**

Background has not been subtracted from annual values

NS = No Sample collected from this location, TLD missing upon collection (unknown cause)

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

3.1.4 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 are 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. Filters were analyzed for concentrations of total uranium, actinium-227, thorium-230, radium-226, and polonium-210. Since 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).

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

Station Number	Isotope	Second Quarter 2020 (mrem)	Third Quarter 2020 (mrem)	Fourth Quarter 2020 (mrem)	First Quarter 2021 (mrem)	Annual Total Dose Based on Four Quarters (mrem)
On-site Locations						
0102-RP (MEI)	Total Uranium	0.003	0.003	0.003	0.002	**3.98**
	Thorium-230	0.032	0.045	0.043	0.021	
	Radium-226	0.034	0.057	0.088	0.013	
	Polonium-210	0.301	0.383	0.773	0.716	
	Actinium-227	0.280	0.303	0.536	0.072	
	Protactinium-231	0.064	0.070	0.123	0.017	
0105-RP	Total Uranium	0.004	0.005	0.005	0.003	**5.04**
	Thorium-230	0.104	0.141	0.160	0.080	
	Radium-226	0.070	0.114	0.101	0.101	
	Polonium-210	0.350	0.627	0.895	0.790	
	Actinium-227	0.096	0.490	0.629	ND	
	Protactinium-231	0.022	0.113	0.145	ND	
0114-RP	Total Uranium	0.005	0.006	0.004	0.003	**8.75**
	Thorium-230	0.157	0.208	0.115	0.131	
	Radium-226	0.037	0.154	0.141	0.185	
	Polonium-210	0.358	0.635	0.895	0.895	
	Actinium-227	1.632	0.629	0.839	0.816	
	Protactinium-231	0.375	0.145	0.193	0.188	
Off-site Locations						
0117-RP	Total Uranium	0.003	0.003	0.003	0.002	**3.61**
	Thorium-230	0.017	0.017	0.021	0.014	
	Radium-226	0.011	0.007	0.044	0.020	
	Polonium-210	0.252	0.358	0.602	0.700	
	Actinium-227	0.256	ND	0.839	0.149	
	Protactinium-231	0.059	ND	0.193	0.034	
0118-RP	Total Uranium	0.004	0.002	0.003	0.002	**2.79**
	Thorium-230	0.064	0.067	0.048	0.012	
	Radium-226	0.066	0.037	0.075	0.003	
	Polonium-210	0.277	0.326	0.562	0.513	
	Actinium-227	0.233	0.126	0.233	ND	
	Protactinium-231	0.054	0.029	0.054	ND	
0119-RP	Total Uranium	0.003	0.003	0.004	0.002	**3.84**
	Thorium-230	0.026	0.032	0.035	0.025	
	Radium-226	0.009	0.019	0.023	0.053	
	Polonium-210	0.244	0.350	0.692	0.724	
	Actinium-227	0.154	0.326	0.443	0.373	
	Protactinium-231	0.035	0.075	0.102	0.086	
0122-RP	Total Uranium	0.003	0.003	0.003	0.002	**3.39**
	Thorium-230	0.029	0.020	0.024	0.019	
	Radium-226	0.038	0.023	0.048	0.012	
	Polonium-210	0.277	0.423	0.651	0.659	
	Actinium-227	0.303	0.072	0.326	0.233	
	Protactinium-231	0.070	0.017	0.075	0.054	

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

Station Number	Isotope	Second Quarter 2020 (mrem)	Third Quarter 2020 (mrem)	Fourth Quarter 2020 (mrem)	First Quarter 2021 (mrem)	Annual Total Dose Based on Four Quarters (mrem)
Off-site Locations (*continued*)						
0123-RP	Total Uranium	0.003	0.002	0.003	0.002	**3.32**
	Thorium-230	0.029	0.023	0.021	0.020	
	Radium-226	0.018	0.019	0.016	0.027	
	Polonium-210	0.391	0.342	0.602	0.651	
	Actinium-227	0.212	0.280	0.280	0.168	
	Protactinium-231	0.049	0.064	0.064	0.039	
0129-RP	Total Uranium	0.006	0.004	0.005	0.003	**7.16**
	Thorium-230	0.266	0.293	0.184	0.104	
	Radium-226	0.207	0.136	0.158	0.132	
	Polonium-210	0.317	0.358	0.635	0.684	
	Actinium-227	1.072	0.979	0.536	0.396	
	Protactinium-231	0.247	0.225	0.123	0.091	

ND = not detected; analyte concentration below detection limit

These analytical results are used to calculate the effective dose from the inhalation of radioparticulates. The annual dose associated with the stations closest to the site operations (0102, 0105, 0114, and 0129) is higher compared to the remaining stations. All stations saw an increase in annual dose (up to 1.4 mrem) compared to the previous quarter's annual dose.

3.1.5 Total Effective Dose

The Project must ensure the annual total effective dose from gamma radiation and radioparticulates from Project activities does not exceed 100 mrem above background. The MEI annual total effective dose for this quarter was 26.98 mrem, which is well below the DOE limit. This value was calculated by subtracting the background dose of 82 mrem from the MEI annual gamma radiation dose of 105 mrem and then adding the radioparticulate total dose of 3.98 mrem from location 0102, the closest radioparticulate station to the MEI. Nearly all of the dose to the MEI is due to direct gamma radiation. The dose to the lens of the eye, skin, and extremities is the same as a full body dose and is below the regulatory limit of 1500 mrem in a year to the lens of the eye and 5000 mrem in a year to the skin or extremities. Figure 7 shows total effective dose measured at the Moab site since 2018.

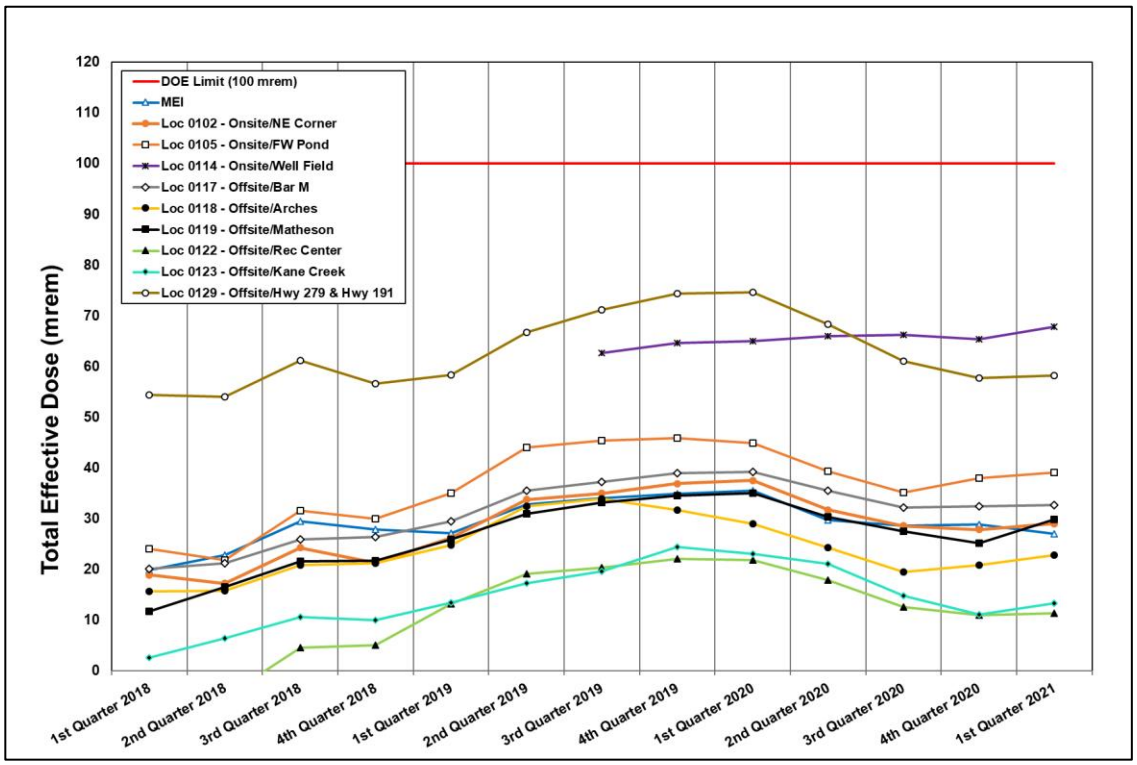

Figure 7. Total Effective Dose Measured at Moab Locations Since 2018

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. Two on-site and two off-site stations are also equipped with air sampling pumps to measure air radioparticulates. After mill tailings disposal began in the second quarter of 2009, the Crescent Junction monitoring location 0306 became the MEI. Due to disposal cell excavation activities in third quarter 2020, station 0303 was removed. One radon and direct gamma station was added to the northern site boundary fence and labeled as 0310.

3.2.1 Meteorological Analysis

Meteorological data were collected from the on-site meteorological station and downloaded from the Vista Data Vision online database, where meteorological data are uploaded from the site. Hourly averages were analyzed. Figure 8 displays the wind rose for this quarter, with the wedges on the wind rose showing which direction the wind is coming from. In first quarter 2021, the winds were variable with the prevailing wind out of the west/southwest. The site received 0.03 inches of precipitation during the first quarter 2021. Figure 9 presents the Crescent Junction average (based on data collected from 2010 through 2020) in addition to the 2020 and 2021 cumulative precipitation. The average temperature for the quarter was 35°F. The lowest recorded temperature for the quarter was 11°F, and the highest was 68°F.

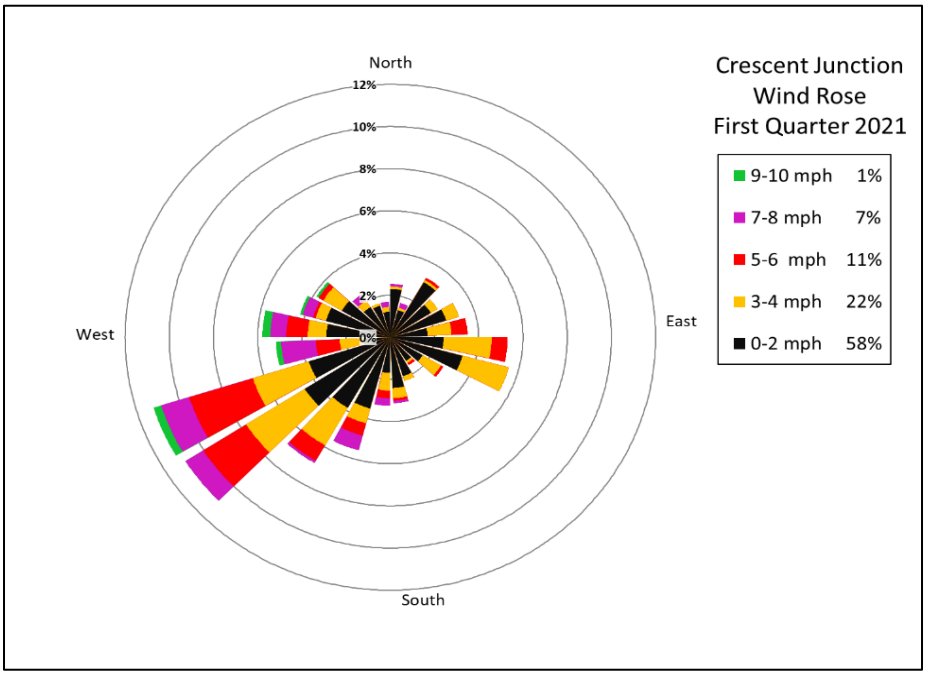

Figure 8. Crescent Junction Wind Rose for Fourth Quarter 2020

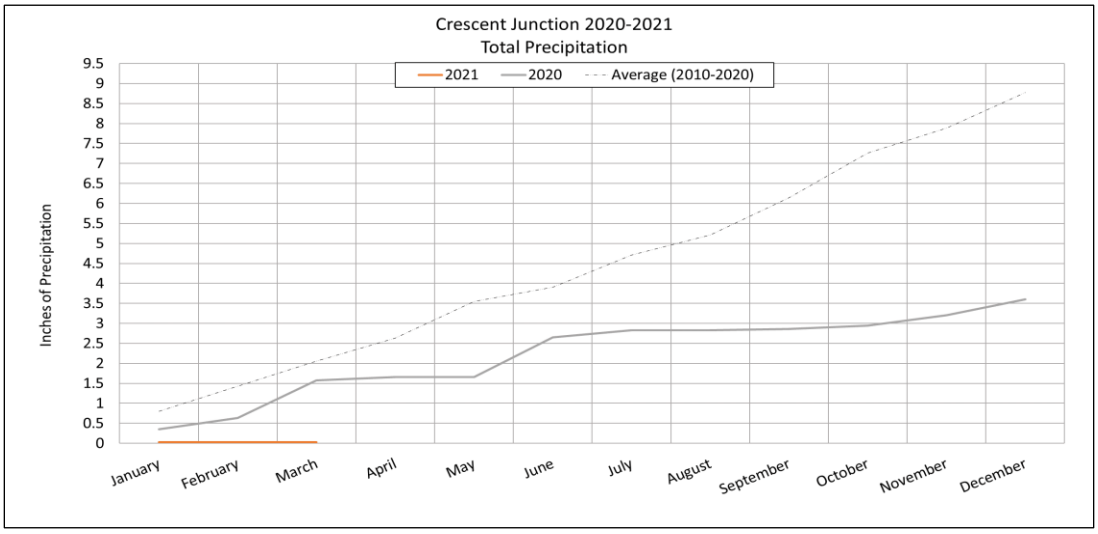

Figure 9. Crescent Junction Average, 2020, and First Quarter 2021 Cumulative Precipitation

3.2.2 Radon

Based on three years of data from 2006 to 2009, the background concentration of radon in the Crescent Junction area was established as 0.9 pCi/L. Therefore, the Project must limit radon emissions at the Crescent Junction site boundary (withdrawal area) to 3.9 pCi/L. None of the on- or off-site stations exceeded the limit of 3.9 pCi/L in the first quarter 2021. Locations 0301 and 0305 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.

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

Station Number	Second Quarter 2020 (pCi/L)	Third Quarter 2020 (pCi/L)	Fourth Quarter 2020 (pCi/L)	First Quarter 2021 (pCi/L)	Annual Average Concentration Based on Four Quarters (pCi/L)
On-site Locations					
0301	0.3	0.5	0.7	0.6	**0.5**
0302	0.4	0.7	1.1	0.7	**0.7**
0303	0.8	NS	NS	NS	**NA**
0304	0.4	0.8	1.0	0.8	**0.8**
0305	0.3	0.6	0.8	0.5	**0.5**
0308	1.2	2.2	4.4	2.1	**2.5**
0309	1.0	1.4	2.8	1.8	**1.7**
0310	NS	0.7	1.0	0.7	**NA**
Off-site Locations					
0306 (MEI)	0.2	0.6	0.8	0.5	**0.5**
0307	0.2	0.4	0.7	0.5	**0.5**

Background has not been subtracted from annual values.

NS = No Sample collected from this location

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

Compared to the previous quarter, the quarterly radon concentrations at all stations decreased as much as 2.3 pCi/L. The Crescent Junction locations with the highest annual average radon concentrations during the first quarter are shown on Figure 10, which displays the annual average concentrations results for these locations since the first quarter of 2018.

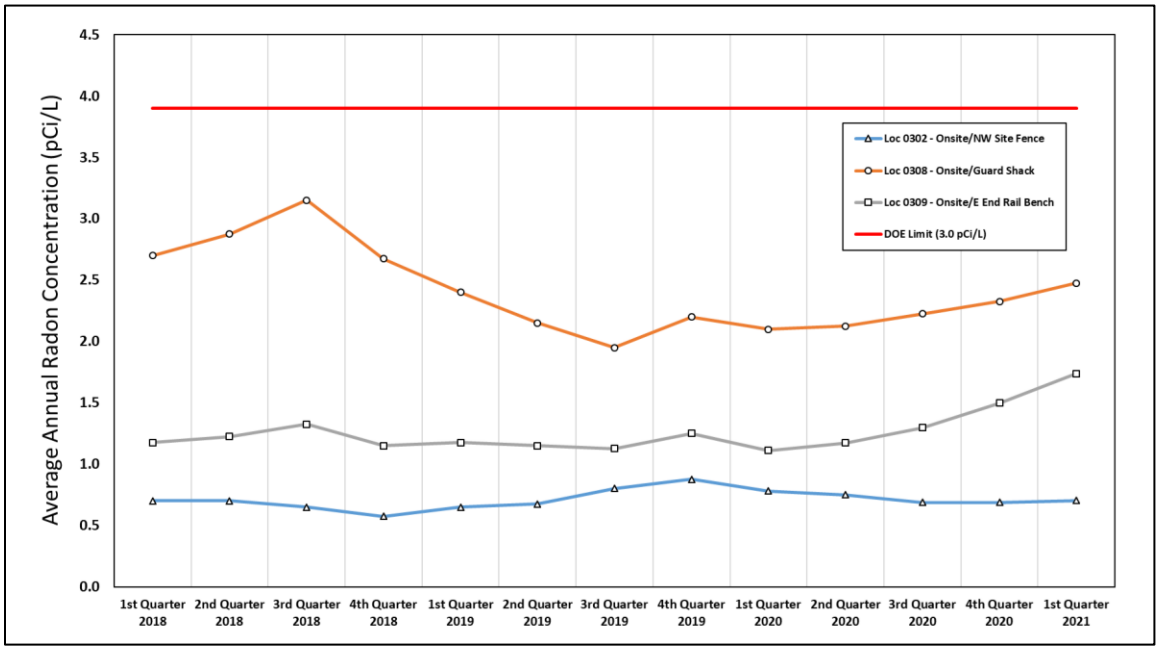

Figure 10. Crescent Junction Locations with Highest First Quarter 2021 Average Annual Radon Concentrations

3.2.3 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 three years of data collected from 2006 to 2009. Table 5 shows quarterly and annual results for the past year, including background for on- and off-site locations. The annual gamma dose represents the dose an individual would receive from occupying a location for an entire year.

This quarter's analytical results compared to the previous quarter's indicated that the gamma radiation dose increased at all on- and off-site location as much as six mrem, except one on-site location, which indicated no change. 0301 TLD was unable to be retrieved during sample collection. Therefore, the 0301 duplicate was used to report results for that location.

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

Station Number	Second Quarter 2020 (mrem)	Third Quarter 2020 (mrem)	Fourth Quarter 2020 (mrem)	First Quarter 2021 (mrem)	Annual Total Dose Based on Four Quarters (mrem)
On-site Locations					
0301	28	27	27	30	**112**
0302	29	26	28	31	**114**
0303	54	NS	NS	NS	**NA**
0304	29	27	29	32	**117**
0305	30	26	28	32	**116**
0308	29	29	30	31	**119**
0309	29	28	27	33	**117**
0310	NS	27	29	29	**NA**
Off-site Locations					
0306 (MEI)	27	26	25	30	**108**
0307	30	27	30	31	**118**

Background has not been subtracted from annual values

NS = No Sample collected from this location

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

3.2.4 Radioparticulates

The effective background dose from inhalation of radioparticulates at the Crescent Junction site was not determined. Therefore, 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 3.1.4). All Crescent Junction locations saw an increase in annual dose, as much as 0.767 mrem. Table 6 shows radioparticulate effective doses for the Crescent Junction site for the past year.

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

Station Number	Isotope	Second Quarter 2020 (mrem)	Third Quarter 2020 (mrem)	Fourth Quarter 2020 (mrem)	First Quarter 2021 (mrem)	Annual Total Dose Based on Four Quarters (mrem)
On-site Locations						
0308-RP	Total Uranium	0.003	0.003	0.003	0.003	**4.15**
	Thorium-230	0.037	0.120	0.077	0.069	
	Radium-226	0.048	0.097	0.092	0.092	
	Polonium-210	0.309	0.366	0.562	0.684	
	Actinium-227	0.303	0.559	0.373	0.049	
	Protactinium-231	0.070	0.129	0.086	0.011	
0309-RP	Total Uranium	0.003	0.005	0.005	0.003	**5.49**
	Thorium-230	0.109	0.115	0.104	0.141	
	Radium-226	0.150	0.128	0.172	0.216	
	Polonium-210	0.293	0.456	0.586	0.651	
	Actinium-227	0.443	0.396	0.536	0.536	
	Protactinium-231	0.102	0.091	0.123	0.123	
Off-site Locations						
306-RP MEI	Total Uranium	0.002	0.002	0.002	0.002	**2.78**
	Thorium-230	0.016	0.015	0.013	0.015	
	Radium-226	0.015	0.037	0.039	0.030	
	Polonium-210	0.244	0.358	0.505	0.627	
	Actinium-227	0.133	0.280	0.131	0.154	
	Protactinium-231	0.031	0.064	0.030	0.035	
0307-RP	Total Uranium	0.003	0.002	0.002	0.002	**2.60**
	Thorium-230	0.019	0.013	0.008	0.013	
	Radium-226	0.013	0.019	0.017	0.009	
	Polonium-210	0.277	0.334	0.488	0.521	
	Actinium-227	0.179	0.350	0.168	ND	
	Protactinium-231	0.041	0.080	0.039	ND	

ND = not detected; analyte concentration below detection limit

3.2.5 Total Effective Dose

The annual total effective dose to the Crescent Junction MEI was 18.28 mrem, which is well below the annual limit of 100 mrem. This is calculated by subtracting the background dose of 92.5 mrem from the MEI (location 0306) gamma radiation dose of 108 mrem, and then adding the radioparticulate dose of 2.78 mrem for the MEI. Figure 11 is a plot of the total effective dose from the four Crescent Junction locations since 2018. In Figure 11, the background was subtracted from the total effective dose calculations, therefore, the DOE limit is shown as 100 mrem. Nearly all of the dose to the MEI is due to direct gamma radiation. The dose to the lens of the eye, skin, and extremities is the same as a full body dose and is below the regulatory limit of 1500 mrem in a year to the lens of the eye and 5000 mrem in a year to the skin or extremities.

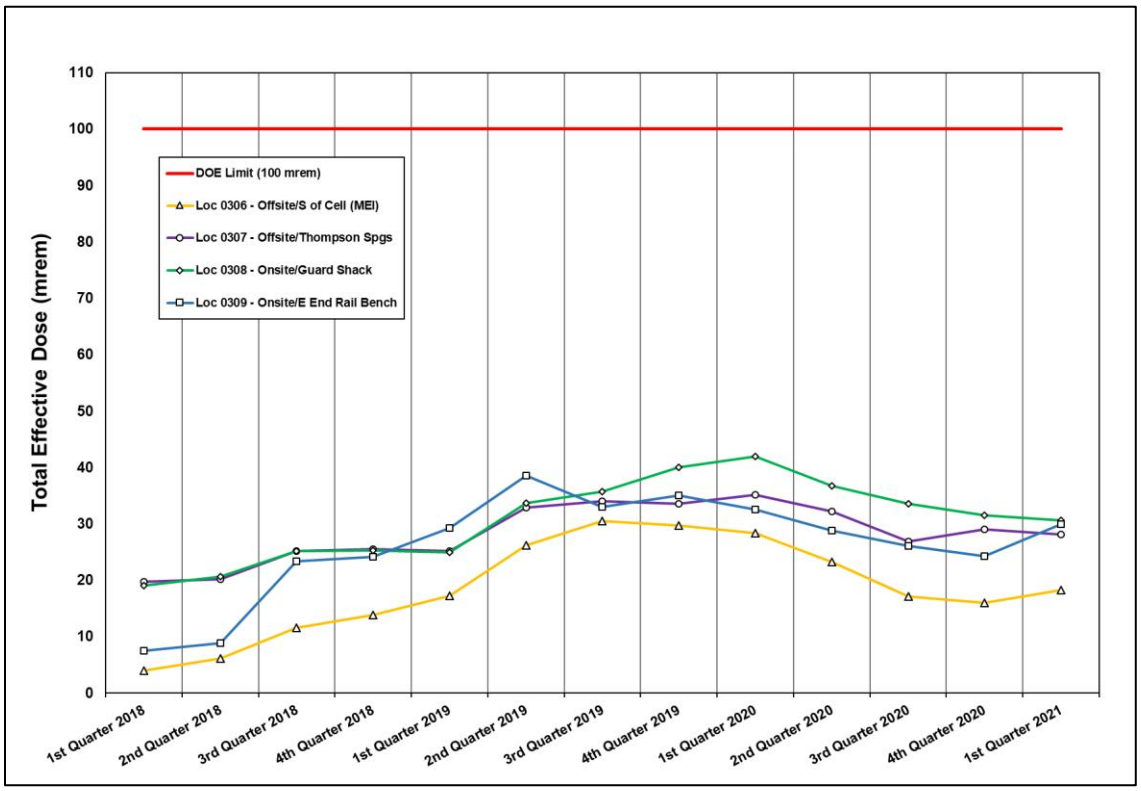

Figure 11. Total Effective Dose Measured at Crescent Junction Locations Since 2018

4.0 Data Assessment

Radon detectors, thermoluminescent dosimeters used for continuous dose measurements, and radioparticulate sample filters were sent to qualified off-site laboratories for analyses in accordance with the *Moab UMTRA Project Environmental Air Monitoring Sampling and Analysis Plan* (SAP) (DOE-EM/GJTAC2219). Qualified Project personnel evaluated the analytical data received for consistency with other data points and Quality Assurance/Quality Control samples.

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, per the SAP.

As Table 7 displays, the five locations that included duplicate radon samples were within 0.7 pCi/L of each other. The five locations equipped with duplicate gamma detectors were all within 2 mrem of each other. 0301 TLD was unable to be retrieved during sample collection. Therefore, the 0301 duplicate was used to report results for that location. These radon and gamma duplicate results are within the acceptable ranges, and the data are considered valid based on these results.

Table 7. Duplicate Results for First Quarter 2021

Location	Result	Duplicate Result
Moab		
Radon:	pCi/L	pCi/L
0102	2.0	1.3
0108	2.9	2.8
0111	0.7	0.62
Gamma:	mrem	mrem
0102	29	29
0108	48	46
0129	34	34
Crescent Junction		
Radon:	pCi/L	pCi/L
0308	2.1	2.4
0310	0.7	0.65
Gamma:	mrem	mrem
0301	NS	30
0305	32	31

Control samples measured the dose for gamma and radon while being shipped from the site to the respective analytical laboratories. Transit values for direct gamma was at or below background levels and was not subtracted from quarterly values. The Radonova lab subtracts the average transit exposure from the reported radon concentrations. The radon transit values are shown in Table 8.

Table 8. Shipment Control Sample Results for First Quarter 2021

Sample	Result
Radon:	pCi/L
In-transit 1	7 +/- 9
In-transit 2	9 +/- 9
In-transit 3	8 +/- 11

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 2021.

4.3 Summary

Data collected during the first quarter of 2021 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 Fourth Quarter 2019 Environmental Air Monitoring Report* (DOE-EM/GJ3028).

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. 4, "Radiation Protection of the Public and the Environment.