DOE-EM/GJRAC3096

Moab UMTRA Project Environmental Air Monitoring Data Quarterly Report for the Moab and Crescent Junction, Utah, Sites Third Quarter (July – September 2022)

Revision 0

February 2023

U.S. Department of Energy

Office of Environmental Management

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Moab UMTRA Project
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Review and Approval

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Revision History

Revision	Date	Description
0	February 2023	Initial issue. Changing document designation from TAC to RAC.

Contents

Figures

Tables

Acronyms and Abbreviations

DOE	Department of Energy
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MDC	minimum detectable concentration
MEI	maximally exposed individual
met	Meteorology
mrem	millirem
O	Order
pCi	picocurie
pCi/L	picocurie per liter
RAC	Remedial Action Contractor
RRM	Residual Radioactive Material
SAP	Sampling Analysis Plan
TAC	Technical Assistance Contractor
TED	total effective dose
TLD	thermoluminescent dosimeter
UMTRA	Uranium Mill Tailings Remedial Action
VDV	Vista Data Vision
WL	Working level

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 third calendar quarter of 2022 (July-September). 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.

On 1 Oct 2022, a contract change occurred at the Moab UMTRA Project. One result of this change was the performance of environmental air monitoring, including the generation of this quarterly report, was moved from the Technical Assistance Contractor (TAC) to the Remedial Action Contractor (RAC). This is the first air monitoring report under the RAC scope of work.

2.0 Regulatory Requirements

This Report demonstrates compliance with DOE Order (O) 458.1, Admin Chg. 4, "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 TED 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 TED 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 MEIs for each of the Moab and Crescent Junction Project sites.

3.0 Radiological and Meteorological Monitoring

The Moab UMTRA Project will monitor the following:

- radon, using radon measuring devices.
- direct gamma radiation, using thermoluminescent dosimeters (TLD) that measure dose to the public.
- radioparticulates, using environmental air sampling equipment.

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 sites are shown on Figure 3.

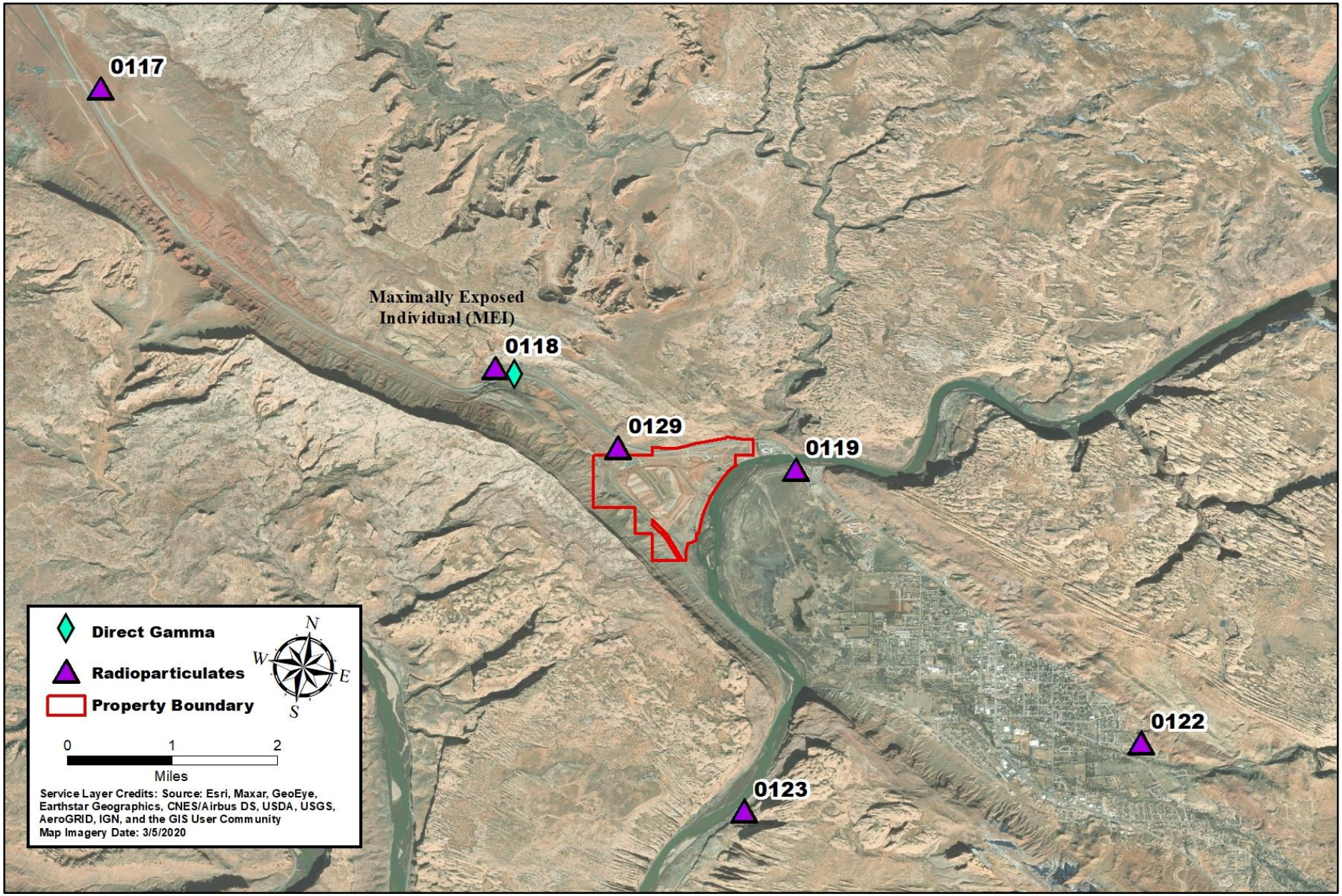

Figure 1. Moab Off-site Environmental Air Monitoring Locations

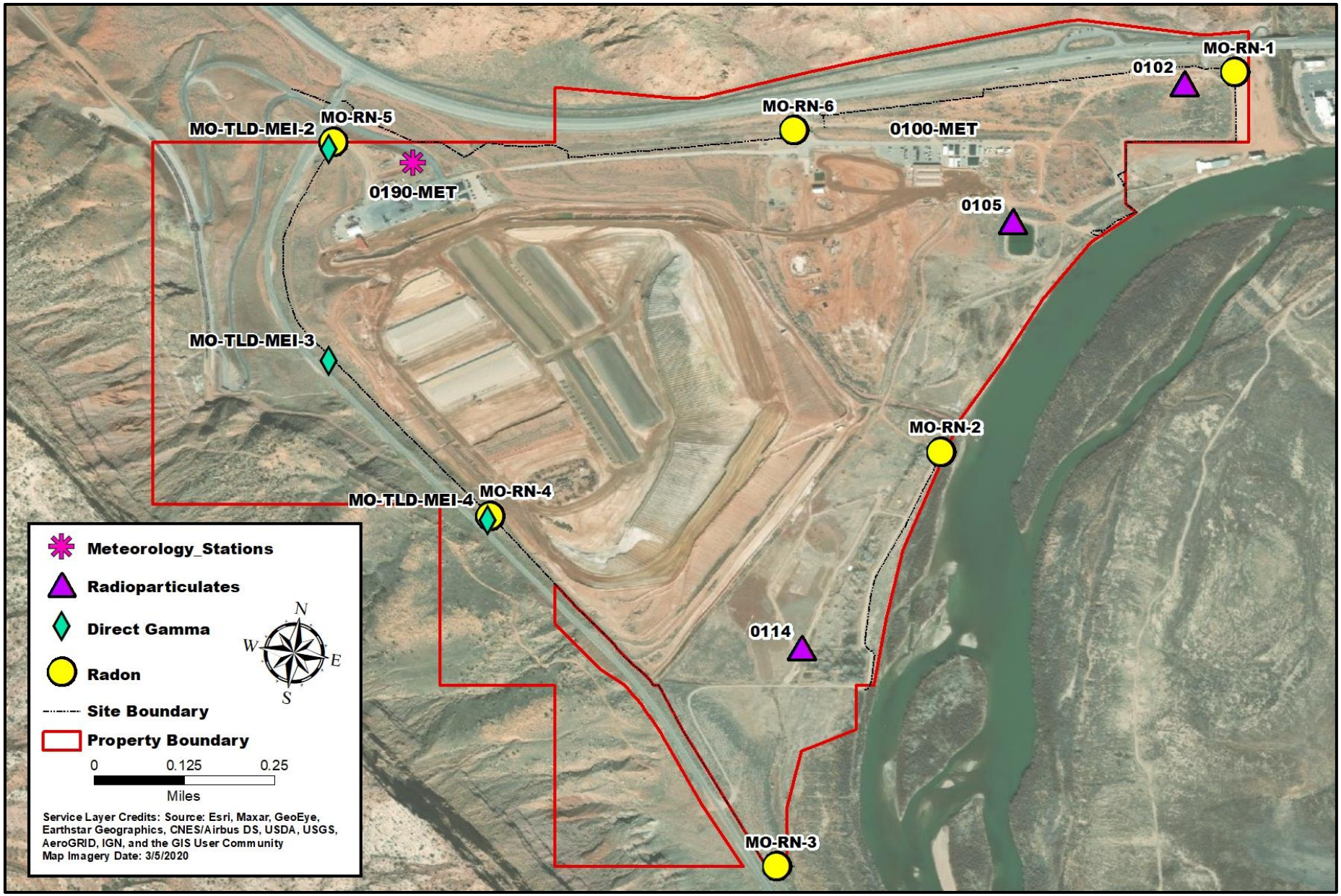

Figure 2. Moab On-site and Maximally Exposed Individual Environmental Air Monitoring Locations

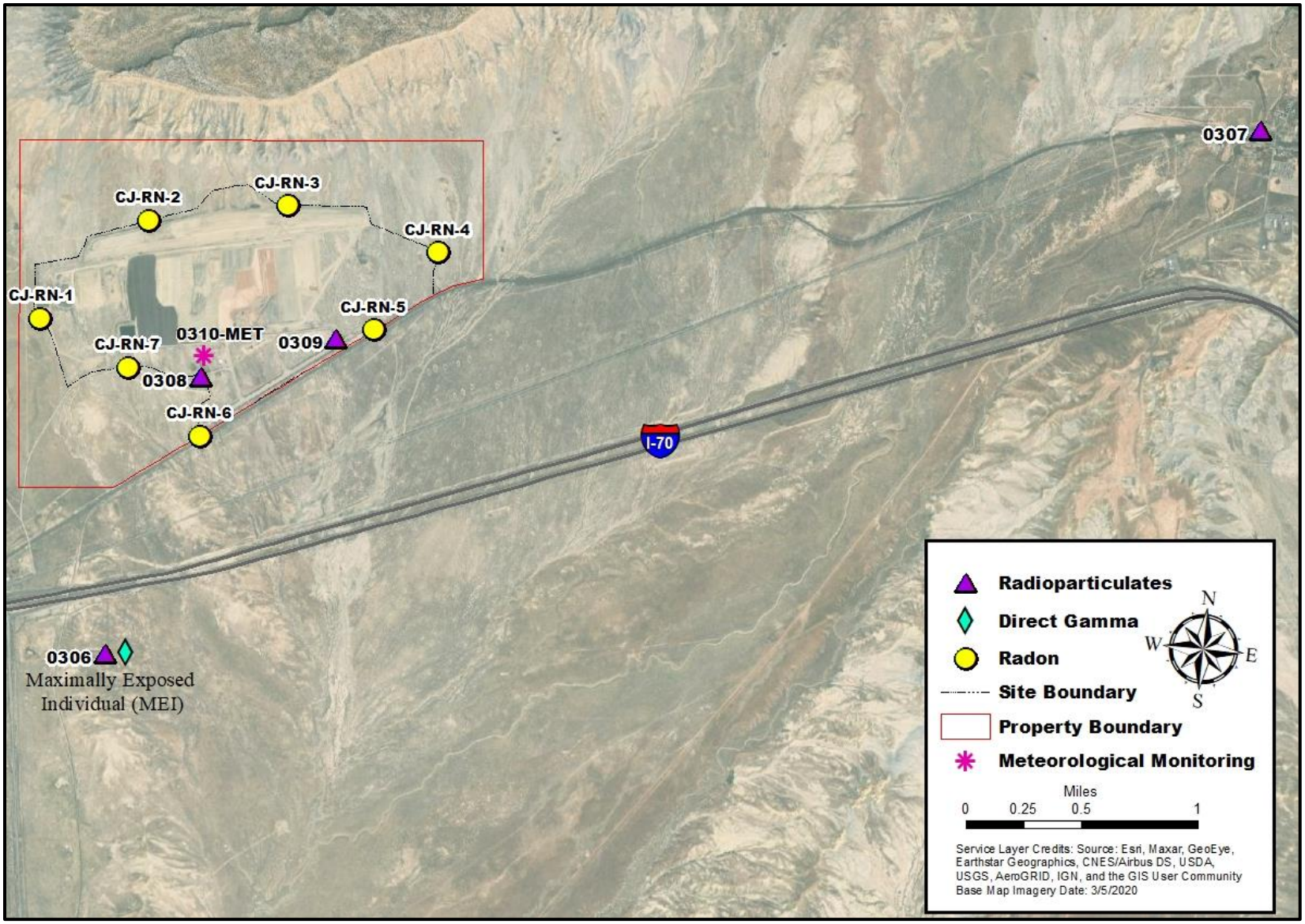

Figure 3. Crescent Junction Site Environmental Air Monitoring Locations

3.1 Meteorology

Meteorological data were collected from the on-site meteorological stations and downloaded from the Vista Data Vision (VDV) online database, where meteorological data are uploaded from the Site. Hourly averages are analyzed. Meteorology (met) stations are serviced annually. Moab and Crescent Junction met stations measures wind speed and direction, temperature, and precipitation. Precipitation is collected with both a heated rain gauge and a manual rain gauge.

3.2 Radon

Radon is a radioactive, colorless, odorless, tasteless noble gas, which occurs naturally in minute quantities as an intermediate step in the normal radioactive decay chains through which thorium and uranium decay into various short-lived radioactive elements and lead. Radon is the immediate decay product of radium. The most stable isotope, 222Rn, has a half-life of only 3.8 days, making it one of the rarest elements. Since thorium and uranium are two of the most common radioactive elements on Earth, while also having three isotopes with half-lives on the order of several billion years, radon will be present on Earth long into the future despite its short half-life. The decay of radon produces many other short-lived nuclides, known as "radon daughters", ending at stable isotopes of lead.

The Radon network consists of 13 total radon monitors along the site boundaries: 6 monitors at the Moab site and 7 monitors at the Crescent Junction site (DOE O 458.1 4f). Background radon for both the Moab and Crescent Junction project sites is 0.6 pCi/L.

3.3 Direct Gamma

Gamma radiation is produced by the disintegration of radioactive atomic nuclei and in the of certain.

Direct Gamma is monitored for the Project's Maximum Exposed Individuals (MEIs) at Moab and Crescent Junction. The MEI for the Moab Project Site is Arches National Park, and the MEI for Crescent Junction is a resident located within one mile of the site.

As a best management practice, the Project also monitors direct gamma for a representative person at the Moab Site. The representative person for the Moab Project Site is a hypothetical person that rides a bike past the Site along State Route 279. It is not possible or practical to monitor if a person has the assumed living habits in the scenario presented in this representative person evaluation. However, considering the high recreational activity of the area, it is not unreasonable to assume that somebody in the local community would take part in an activity that would cause them to receive a dose from the Site while in this area. The representative person scenario has been updated as of this report. Results can be found in Section 6.2 and TED is reported in Section 6.4 of this document.

Background direct gamma is 84 mrem for Moab and 92.5 mrem for Crescent Junction, based on three years of data collected from 2006 to 2009.

Direct gamma is calculated for each station by using the following equation:

R1 – T – BKG = Quarterly Total Dose (mrem)

R1: Report dose from vendor
T: Transit dose (dose received during shipping of samples)
BKG: Background

Total dose is calculated for each station quarterly and a total for the past four quarters. See Section 6.2 for direct gamma results.

3.4 Radioparticulates

Radioparticules are small particles of radioactive material, which can become airborne during project activities such as excavation and loading of RRM, or by wind. Breathing these particles can results in a radiation dose.

The radioparticulate monitoring network for the Moab site consists of nine continuous air samplers: six off site (Figure 1) and three on site (Figure 2). The radioparticulates monitoring network for the Crescent Junction site consists of four stations: two off site and two on site (Figure 3). The radionuclides of concern on the Project are those inherent in the process of extracting uranium during the milling process when the mill was operational. However, because the radionuclides are part of the uranium decay series, they are considered part of the emissions from the mill tailings pile. Therefore, all radioparticulates measured at the Project's monitoring stations are assumed to be from the Project.

The uranium milling operations at the Moab site created mill tailings from the processing of extracting the uranium from the ore. The tailings, along with radioactively inert crushed rock, water, residual milling chemicals, and process-related wastes are collectively known as residual radioactive material (RRM). The physical properties of the RRM vary from a clay-like material to a sandy material. These physical properties cause the material to have a low potential to adhere to other surfaces under dry conditions; however, when moist or wet, the material will adhere to those surfaces. Dry RRM is prone to wind dispersion, especially during disturbances, such as moving the material around the pile or loading it into containers.

4.0 Moab Meteorological Analysis

Meteorological data were collected from the on-site meteorological station (0190-Met) and downloaded from the Vista Data Vision (VDV) online database, where meteorological data are uploaded and stored for the Site. Figure 4 displays the wind rose for this quarter, with the wedges on the wind rose showing the direction the wind was coming from. In third quarter 2022, the winds were predominantly out of the southeast and northwest. The average temperature for the quarter was 82^{o}F. The lowest recorded temperature for the quarter was 49^{o}F, and the highest was 107^{o}F. The Site received 2.05 inches of precipitation during third quarter 2022. It is noted that the meteorological station lost connection to VDV on 8/15/2022. Data from the manual rain gauge was used from 8/15/2022 through 9/30/2022 to calculate precipitation total for this quarter. Figure 5 presents the Moab long-term average (based on data collected from 2011 through 2021) along with 2021 and 2022 cumulative precipitation.

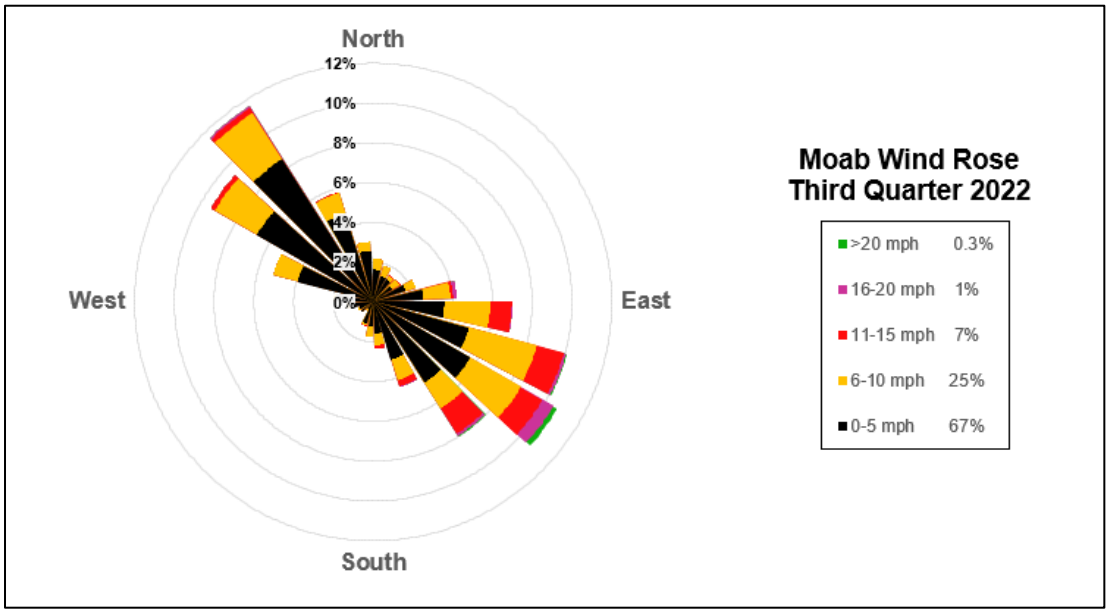

Figure 4. Moab Wind Rose for Third Quarter 2022

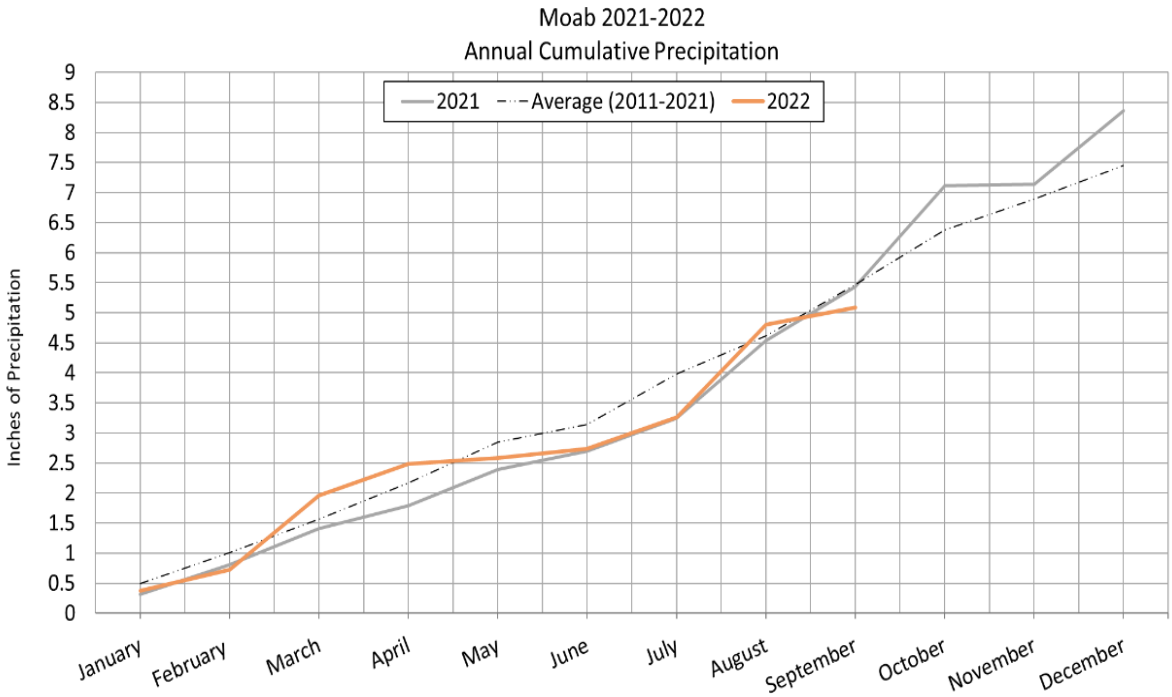

Figure 5. Moab Annual Cumulative Precipitation for 2021, 2022 Through Third Quarter, and Long-Term Average

5.0 Moab Radiological Results

5.1 Radon

Table 1 shows quarterly and average radon results for the past four quarters at the Moab site boundary. The background value of 0.6 pCi/L has been subtracted from the past four quarters average.

Table 1. Quarterly and Average Radon Concentrations for the Moab Site for the Past Four Quarters

Station Number	Fourth Quarter 2021 (pCi/L)	First Quarter 2022 (pCi/L)	Second Quarter 2022 (pCi/L)	Third Quarter 2022 (pCi/L)	Past 4 Quarters Average (pCi/L) (Background Subtracted)
MO-RN-1	2.50	2.30	0.68	0.72	**0.95**
MO-RN-2	5.30	4.60	1.60	1.80	**2.71**
MO-RN-3	3.10	1.90	0.66	0.96	**1.06**
MO-RN-4	1.80	1.40	1.10	1.90	**0.95**
MO-RN-5	2.20	1.30	0.76	1.20	**0.77**
MO-RN-6	3.90	2.80	1.30	1.60	**1.80**

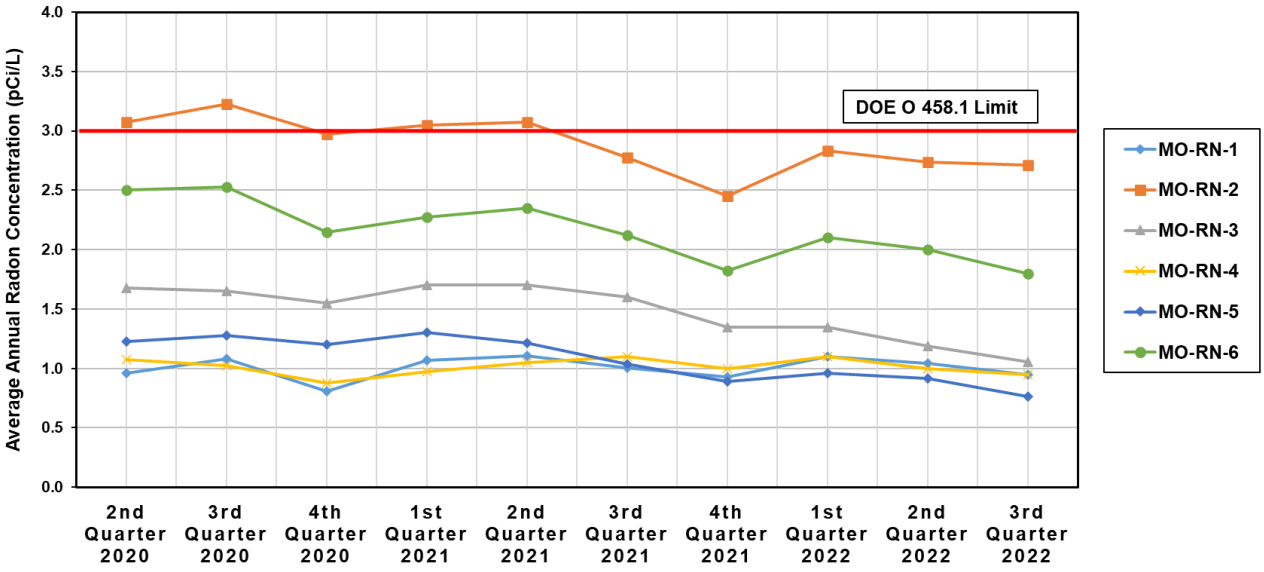

Figure 6. Moab Average Radon Concentrations for Past Ten Quarters

The Project's measured annual average radon emission at the Moab site boundary is below the limit of 3.0 pCi/L (DOE O 458.1 4F).

5.2. Direct Gamma

Direct gamma is used to calculate dose for the MEI and the representative person. Results can be found in Table 2 below.

Table 2. Direct Gamma Doses for the Maximally Exposed Individual (MEI) and Representative Person at the Moab Site for the Past Four Quarters

Station Number & Description	Direct Gamma Dose Calculation	Fourth Quarter 2021 (mrem)	First Quarter 2022 (mrem)	Second Quarter 2022 (mrem)	Third Quarter 2022 (mrem)	Total Dose Based on Four Quarters (mrem)
MO-TLD-MEI-2 (formerly 112) (Potash Rd) (REP 1)	Report Dose from Vendor	51.0	27	65.5	104.0	
	Transit dose subtracted	24.0	-15	-42.0	-24.0	
	Background subtracted	20.5	-20.5	-20.5	-20.5	
	Total Dose	7.5	<Background	3.0	59.5	70.0

Station Number & Description	Direct Gamma Dose Calculation	Fourth Quarter 2021 (mrem)	First Quarter 2022 (mrem)	Second Quarter 2022 (mrem)	Third Quarter 2022 (mrem)	Total Dose Based on Four Quarters (mrem)
MO-TLD-MEI-3 (formerly 110) (Potash Rd) (REP 2)	Report Dose from Vendor	104.0	60.0	128.0	82	
	Transit dose subtracted	-24.0	-15.0	-42.0	-24.0	
	Background subtracted	-20.5	-20.5	-20.5	-20.5	
	Total Dose	59.5	24.5	65.5	37.5	184.0

Table 2. Direct Gamma Doses for the Maximally Exposed Individual (MEI) and Representative Person at the Moab Site for the Past Four Quarters (continued)

Station Number & Description	Direct Gamma Dose Calculation	Fourth Quarter 2021 (mrem)	First Quarter 2022 (mrem)	Second Quarter 2022 (mrem)	Third Quarter 2022 (mrem)	Total Dose Based on Four Quarters (mrem)
MO-TLD-MEI-4 (formerly 109) (Potash Rd) (REP 3)	Report Dose from Vendor	117.0	68.0	145.0	32.0	
	Transit dose subtracted	-24.0	-15.0	.42.0	-24.0	
	Background subtracted	-20.5	-20.5	-20.5	-20.5	
	Total Dose	72.5	32.5	82.5	<Background	187.5
Station Number & Description	Direct Gamma Dose Calculation	Fourth Quarter 2021 (mrem)	First Quarter 2022 (mrem)	Second Quarter 2022 (mrem)	Third Quarter 2022 (mrem)	Total Dose Based on Four Quarters (mrem)
MO-TLD-MEI (formerly 118) Arches	Report Dose from Vendor	27.0	16.0	44.0	28	
	Transit dose subtracted	-24.0	-15.0	-42.0	-24.0	
	Background subtracted	-20.5	-20.5	-20.5	-20.5	
	Total Dose	<Background	<Background	<Background	<Background	<Background

Although two stations are above the 100 mrem public limit (DOE O 458.1), the residency status of the individual must be considered. This dose represents 100% occupancy of this location for a year. For the representative person, it is a hypothetical person riding past the Site on a bicycle and not occupying this location. See Section 6.4 for TED of the representative person, which is well below the DOE O 458.1 limit. The MEI dose is below background. Given this information, the Moab site is within compliance of DOE O 458.1.

5.3 Radioparticulates

Table 2 provides the dose from inhalation of radioparticulates for the third quarter and the past four quarters at the Moab site. Filters were analyzed at an approved laboratory for concentrations of total uranium, actinium-227, thorium-230, radium-226, and polonium-210. Actinium-227 and protactinium-231 are assumed to be in equilibrium. Therefore, the concentration of protactinium-231 is calculated by multiplying the actinium-227 concentration lab results by a correction factor of 0.32, which is consistent with the *Moab UMTRA Project Health Physics Plan* (DOE-EM/GJ3003).

Polonium-210 was excluded from the calculations for the first quarter 2022 due to the lab flagging the result as a false high reading. Polonium-210 was also excluded from stations 102, 105, 122, 123 and 129 from the first quarter 2022. False high readings occur when concentrations are below the detection limit. Therefore, first and second quarter 2022 results are lower than previous quarters.

In this quarter, the actinium results were below the minimum detectable concentration (MDC) and were not included in the calculations. Also in this quarter, the laboratory that processed radioparticulate samples was changed due to the original laboratory no longer performing these analyses.

Table 3. Radioparticulate Dose for Moab Site for the Past Four Quarters

Station Number & Description	Fourth Quarter 2021 (mrem)	First Quarter 2022 (mrem)	Second Quarter 2022 (mrem)	Third Quarter 2022 (mrem)	Past 4 Quarters Total (mrem)
On Site Locations					
0102 (NE corner)	0.53	0.14	0.12	0.79	**1.58**
0105 (By freshwater pond)	0.68	0.12	0.21	0.66	**1.68**
0114 (Wellfield)	0.65	0.14	1.10	0.99	**2.88**
Off Site Locations					
0117 (Bar M)	0.45	0.01	0.27	0.58	**1.32**
0118-MEI (Arches NP)	0.57	0.07	0.45	0.62	**1.70**
0119 (Matheson Wetlands)	0.57	0.06	0.22	0.44	**1.29**
0122 (Recycling Center)	0.31	0.03	0.10	0.63	**1.08**
0123 (Kane Creek)	0.41	0.06	0.10	0.55	**1.12**
0129 (Potash Rd)	0.87	0.25	1.12	1.1	**3.34**

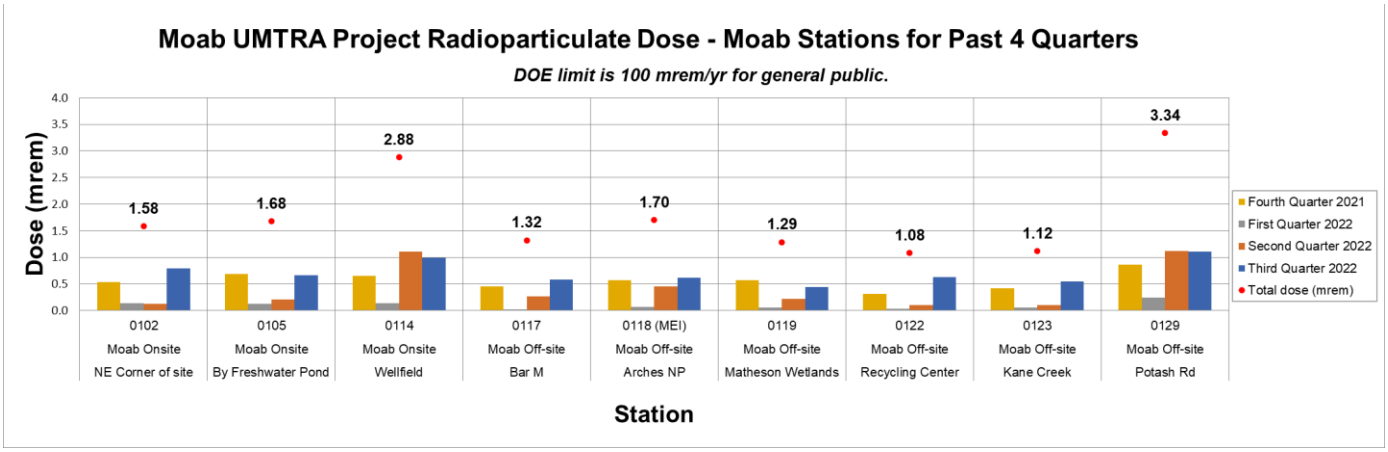

Figure 7. Quarterly and Total Radioparticulate Doses for Moab Stations for the Past Four Quarters

All radioparticulate dose results from the Moab site are below the DOE O 458.1 limit of 100 mrem/year for the general public.

5.4 Total Effective Dose

Total Effective Dose (TED) for the Project is calculated for the MEI and representative person by using the following equation:

$$\gamma + P_1 = \text{TED (mrem)}$$

γ: Direct Gamma Dose with background subtracted (mrem)
P_1: Radioparticulate Dose (mrem)

For the MEI, the TED for the past four quarters is calculated as the following:

0 mrem/yr (below background) + 1.70 mrem/yr = **1.70 mrem/yr**

Representative Person
For the representative person, the TED for the past four quarters is calculated with the following scenario:

- Recreational bicycling 2 days/week for 18 weeks/year.
- Estimated round trip travel distance along the State Route 279 is 2.8 miles.
- It takes 14 minutes round trip to travel 2.8 miles.
- 2 days x 18 weeks x 14 minutes = 504 minutes/year
- Total minutes in one year: 365 days x 24 hrs x 60 minutes = 525,600 minutes/year

Dose Received During Trip

Applicable Monitoring Stations:

MO-TLD MEI 2 (112) = 70 mrem/yr
MO-TLD MEI 3 (110) = 184 mrem/yr
MO-TLD MEI 4 (109) = 187.5 mrem/yr

Average Dose per year from these three stations = 147 mrem/yr

This is calculated by the following:

147.2 mrem/yr / 525,600 min/yr = 0.0002 mrem/min
0.0003 mrem/min x 504 min occupancy time = **0.14 mrem/yr for representative person**

Because there are no radioparticulate monitoring stations along Route 279, the representative person TED is based solely on direct gamma.

Both TEDs are below the 100 mrem/year limit and the Moab site is in compliance with DOE O 458.1, including the dose to the lens of the eye, skin, and extremities.

6.0 Crescent Junction Meteorological Analysis

Meteorological data were collected from the on-site meteorological station and downloaded from the VDV online database, where meteorological data are uploaded and stored for the Site. Figure 8 displays the wind rose for this quarter, with the wedges on the wind rose showing which direction the wind was coming from. In third quarter 2022, the prevailing winds were variable with the prominent winds being from the northeast and southwest. The site received 2.92 inches of precipitation. Figure 9 presents the Crescent Junction long-term average precipitation (based on data collected from 2011 through 2021) and the 2021 and 2022 accumulative precipitation. The average temperature for the quarter was 78°F. The lowest recorded temperature for the quarter was 48°F, and the highest was 102°F.

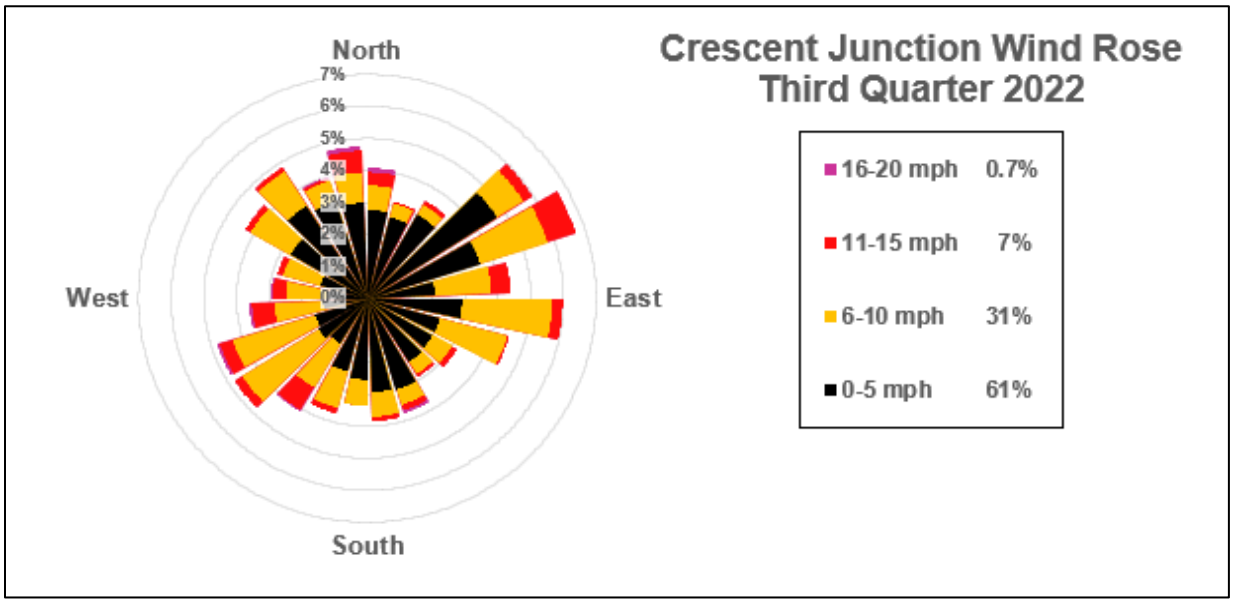

Figure 8. Crescent Junction Wind Rose for Third Quarter 2022

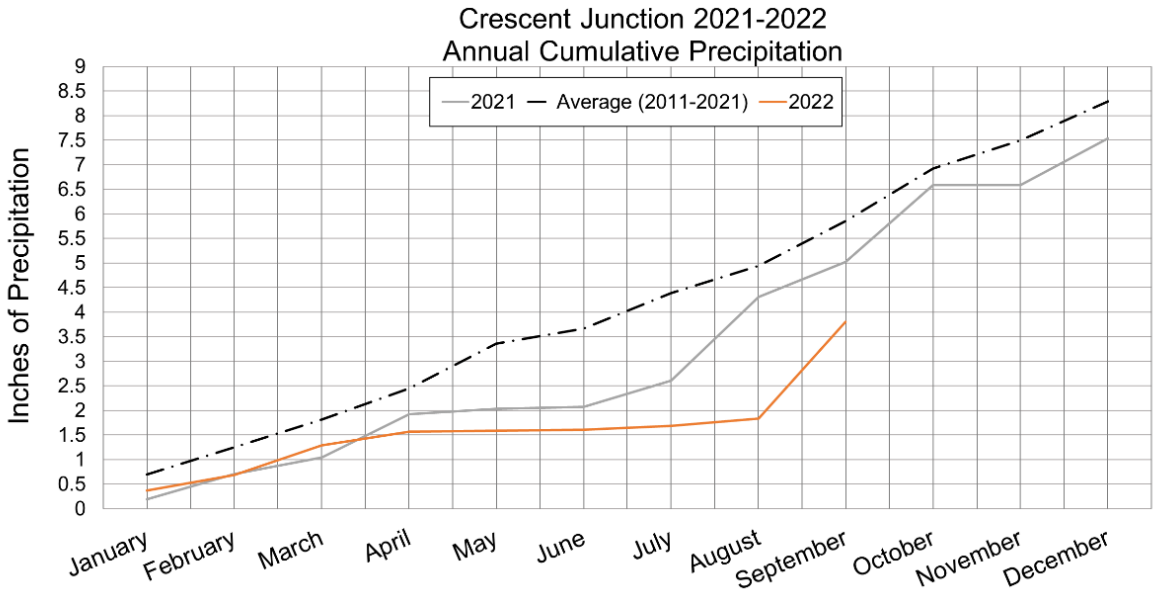

Figure 9. Crescent Junction Annual Cumulative Precipitation for 2021, 2022 Through Third Quarter, and Long-term Average

7.0 Crescent Junction Radiological Results

7.1 Radon

Table 3 shows quarterly and average radon results for the past four quarters at the Crescent Junction site boundary. Background value of 0.6 pCi/L has been subtracted from the average of the past four quarters. The average for CJ-RN-6 and CJ-RN-7 is based on the past three quarters data since there is no data for the fourth quarter of 2021.

Table 4. Radon Concentrations for the Crescent Junction Site for the Past Four Quarters

Station Number	Fourth Quarter 2021 (pCi/L)	First Quarter 2022 (pCi/L)	Second Quarter 2022 (pCi/L)	Third Quarter 2022 (pCi/L)	Past 4 Quarters Average (pCi/L) (Background Subtracted)
CJ-RN-1	0.70	0.57	0.19	0.43	**<Background**
CJ-RN-2	0.89	0.81	0.30	0.54	**<Background**
CJ-RN-3	0.68	0.86	0.32	0.43	**<Background**
CJ-RN-4	0.92	0.84	0.26	0.42	**<Background**
CJ-RN-5	2.70	1.35	0.58	0.74	**0.74**
CJ-RN-6	ND	1.95	0.65	0.98	**1.19**
CJ-RN-7	ND	1.40	0.65	0.97	**1.01**

ND = No Data

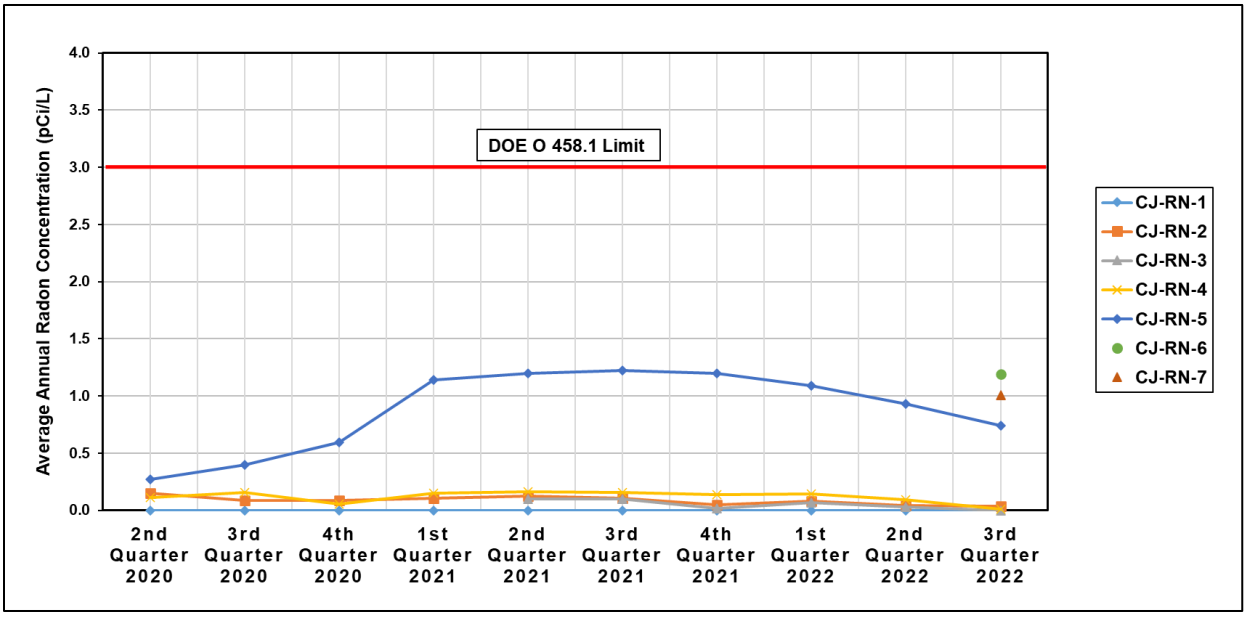

Figure 10. Crescent Junction Average Radon Concentrations for Past Ten Quarters

The Project's annual average radon emission at the Crescent Junction site boundary is below the limit of 3.0 pCi/L (DOE O 458.1 4F).

7.2. Direct Gamma.

Results for direct gamma from the Crescent Junction site can be found in Table 5 below. Only the MEI station collects direct gamma at the Crescent Junction site.

Table 5. Direct Gamma Doses for the Maximally Exposed Individual (MEI) at the Crescent Junction Site for the Past Four Quarters

Station Number & Description	Direct Gamma Dose Calculation	Fourth Quarter 2021 (mrem)	First Quarter 2022 (mrem)	Second Quarter 2022 (mrem)	Third Quarter 2022 (mrem)	Total Dose Based on Four Quarters (mrem)
CJ MEI	Report Dose from Vendor	39	18	28	27	
	Transit dose subtracted	24.0	-15	-42.0	-24.0	
	Background subtracted	23.1	-23.1	-23.1	-23.1	
	Total Dose	< Background	< Background	< Background	< Background	< Back-ground

The direct gamma result for Crescent Junction MEI is below background radiation.

7.3 Radioparticulates

Table 6 provides the quarterly and average of past four quarters dose from inhalation of radioparticulates at the Crescent Junction site. Filters were analyzed at an approved laboratory for concentrations of total uranium, actinium-227, thorium-230, radium-226, and polonium-210. Actinium-227 and protactinium-231 are assumed to be in equilibrium. Therefore, the concentration of protactinium-231 is calculated by multiplying the actinium-227 concentration lab results by a correction factor of 0.32, which is consistent with the *Moab UMTRA Project Health Physics Plan* (DOE-EM/GJ3003).

Polonium-210 was excluded from the calculations for the first quarter 2022 due to the lab flagging the result as a false high reading. Polonium-210 was also excluded from stations 102, 105, 122, 123 and 129 from the first quarter 2022. False high readings occur when concentrations are below the detection limit. Therefore, first and second quarter 2022 results are lower than previous quarters.

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

Station Number & Description	Fourth Quarter 2021 (mrem)	First Quarter 2022 (mrem)	Second Quarter 2022 (mrem)	Third Quarter 2022 (mrem)	Past 4 Quarters Average Total (mrem)
On Site Locations					
0308 (Guard Station)	0.48	0.11	0.31	0.76	**1.67**
0309 (Southeast boundary)	0.63	0.25	0.54	0.67	**2.08**
Off Site Locations					
0306 (MEI) (South of site, by Hwy 191)	0.40	0.06	0.03	0.49	**0.98**
0307 (Thompson Springs)	0.41	0.03	0.27	1.03	**1.74**

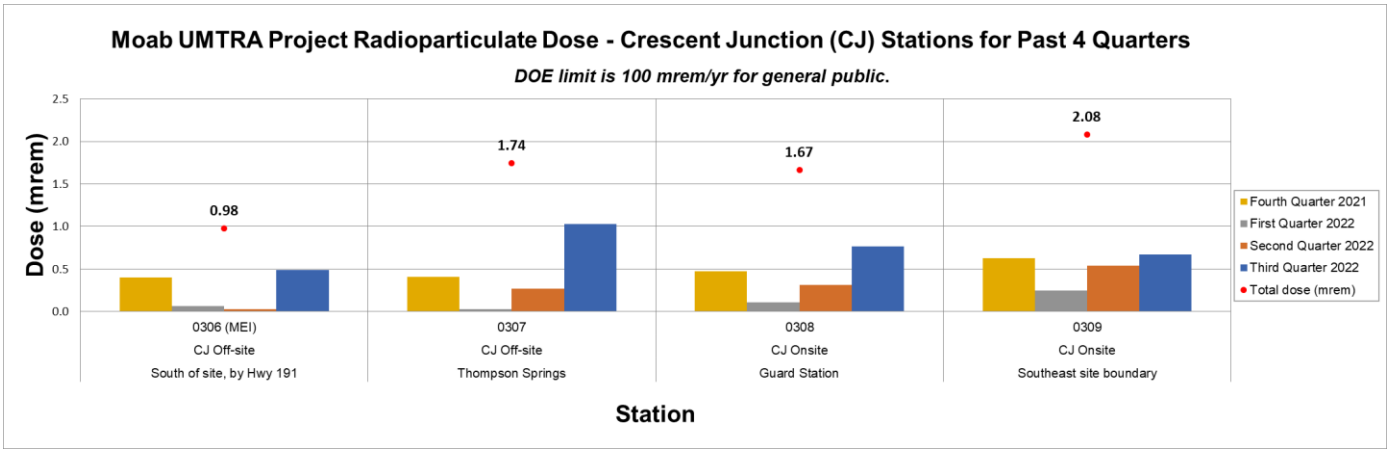

Figure 11. Quarterly and Total Radioparticulate Dose for Crescent Junction Stations for Past Four Quarters

All radioparticulate dose results from the Crescent Junction site are below the DOE O 458.1 limit of 100 mrem/year for the general public.

7.4 Total Effective Dose

Total Effective Dose (TED) for the Project is calculated for the MEI by using the following equation:

$$\gamma + P_1 = \text{TED (mrem)}$$

γ: Direct Gamma Dose with background subtracted (mrem)
P_1: Radioparticulate Dose (mrem)

For the MEI, the TED for the past four quarters is calculated as the following:

0 mrem/yr (below background) + 0.98 mrem/yr = **0.98 mrem/yr**

The TED for the MEI at Crescent Junction is below the 100 mrem/year limit and is in compliance with DOE O 458.1, including the dose to the lens of the eye, skin, and extremities.

8.0 Data Quality

Radon measuring devices, thermoluminescent dosimeters (TLD) used for gamma dose measurements, and radioparticulate sample filters were sent to approved 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.

8.1 Station Duplicates

Duplicate monitoring samples for radon and direct gamma were collected at both sites. Qualified personnel analyzed results and there were no significant variances between results.

8.2 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. Any anomalous data would be investigated and documented. No anomalous data were noted for this quarter.

9.0 Conclusion

This third quarter 2022 report provides documentation of the compliance to DOE O 458.1 and demonstrates the dedication of the Moab UMTRA Project to the environment and general public health and safety.

10.0 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 Health Physics Plan* (DOE-EM/GJ3003).

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 2021 (October-December 2021)* (DOE-EM/GJTAC3074).

DOE (U.S. Department of Energy), *Moab UMTRA Project Environmental Air Monitoring Data Quarterly Report for the Moab and Crescent Junction, Utah, Sites First Quarter 2022 (January-March 2022)* (DOE-EM/GJTAC3077).

DOE (U.S. Department of Energy) Order 458.1, Admin Chg. 4, "Radiation Protection of the Public and the Environment.