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Moab UMTRA Project 3rd Quarter 2025 Environmental Radiological Monitoring Report (July through September 2025)

Revision 8

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Moab UMTRA Project
3Q2025 Environmental Radiological Monitoring Report

Revision 8

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Revision History

Revision	Date	Description
0	July 2024	Initial issue. Report for 1Q2024 with name revision from Environmental Air Monitoring to Environmental Radiological Monitoring. Begins permanent document number DOE-EM/GJRAC3130.
1	August 2024	Corrected errors in several calculations, reviewed entire document.
2	October 2024	Added explanation of why MEI locations were moved and Representative Person removed. Corrected values in Tables 2, 3, and 4. Corrected TED for CJ based on change in Table 4.
3	November 2024	2Q2024 Initial Report.
4	February 2025	3Q2024 Initial Report.
5	May 2025	4Q2024 Initial Report.
6	June 2025	1Q2025 Initial Report.
7	October 2025	2Q2025 Initial Report.
8	January 2026	3Q2025 Initial Report

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Acronyms and Abbreviations

BKGD	Background
CJ	Crescent Junction
DOE	Department of Energy
KWRS	Ken's Weather Reporting System
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MDC	minimum detectable concentration
MEI	maximally exposed individual
MESa	Moab Environmental Sampling database
met	meteorology
mrem	millirem
O	Order
OSL	optically stimulated luminescence
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
UMTRA	Uranium Mill Tailings Remedial Action

1.0 Introduction

The purpose of this Report is to present the results of environmental air and direct gamma monitoring at the U.S. Department of Energy (DOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) Project sites during the third calendar quarter of 2025 (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.

2.0 Regulatory Requirements

This Report demonstrates compliance with DOE Order (O) 458.1, Admin Chg 5, "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 millirem (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. For the Project, the TED is the sum of the direct gamma radiation (minus background) and radioactive particulate material (radioparticulate) exposure. This DOE limit excludes doses from background radiation, radon gas and its decay products in air, occupational doses, and medical exposures.

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 the Moab and Crescent Junction (CJ) Project sites.

3.0 Radiological Monitoring and Results

The Moab UMTRA Project monitors the following:

- Radon, using alpha-track detectors.
- Direct gamma radiation, using optically stimulated luminescence (OSL) dosimeters; and
- Radioparticulates, using air sampling equipment.

Off-site monitoring stations for the Moab site are shown on Figure 1. On-site Moab stations are shown on Figure 2. All monitoring stations for the Crescent Junction site are shown in Figure 3.

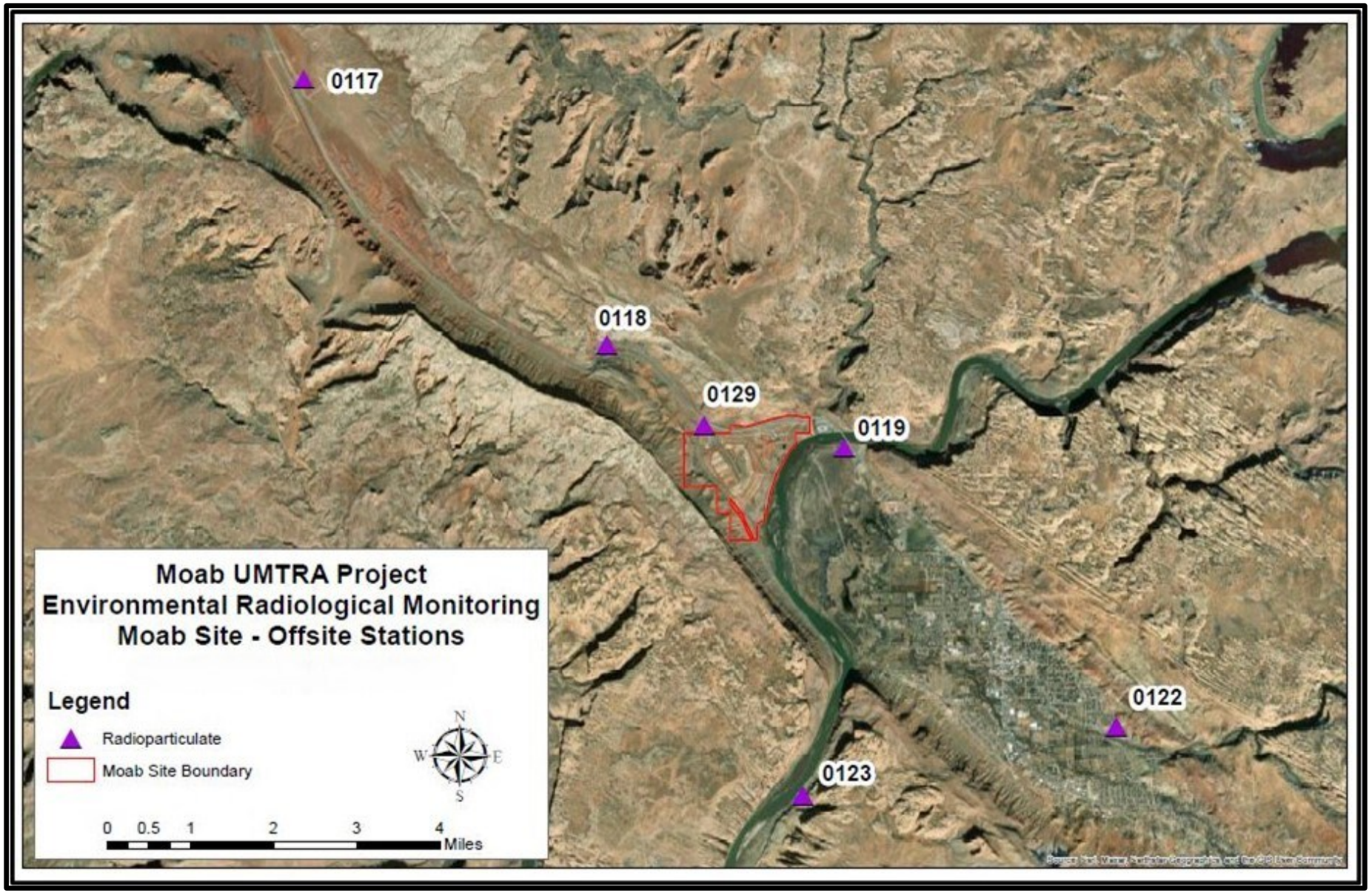

Figure 1. Moab Off-Site Individual Environmental Radiological Monitoring Locations

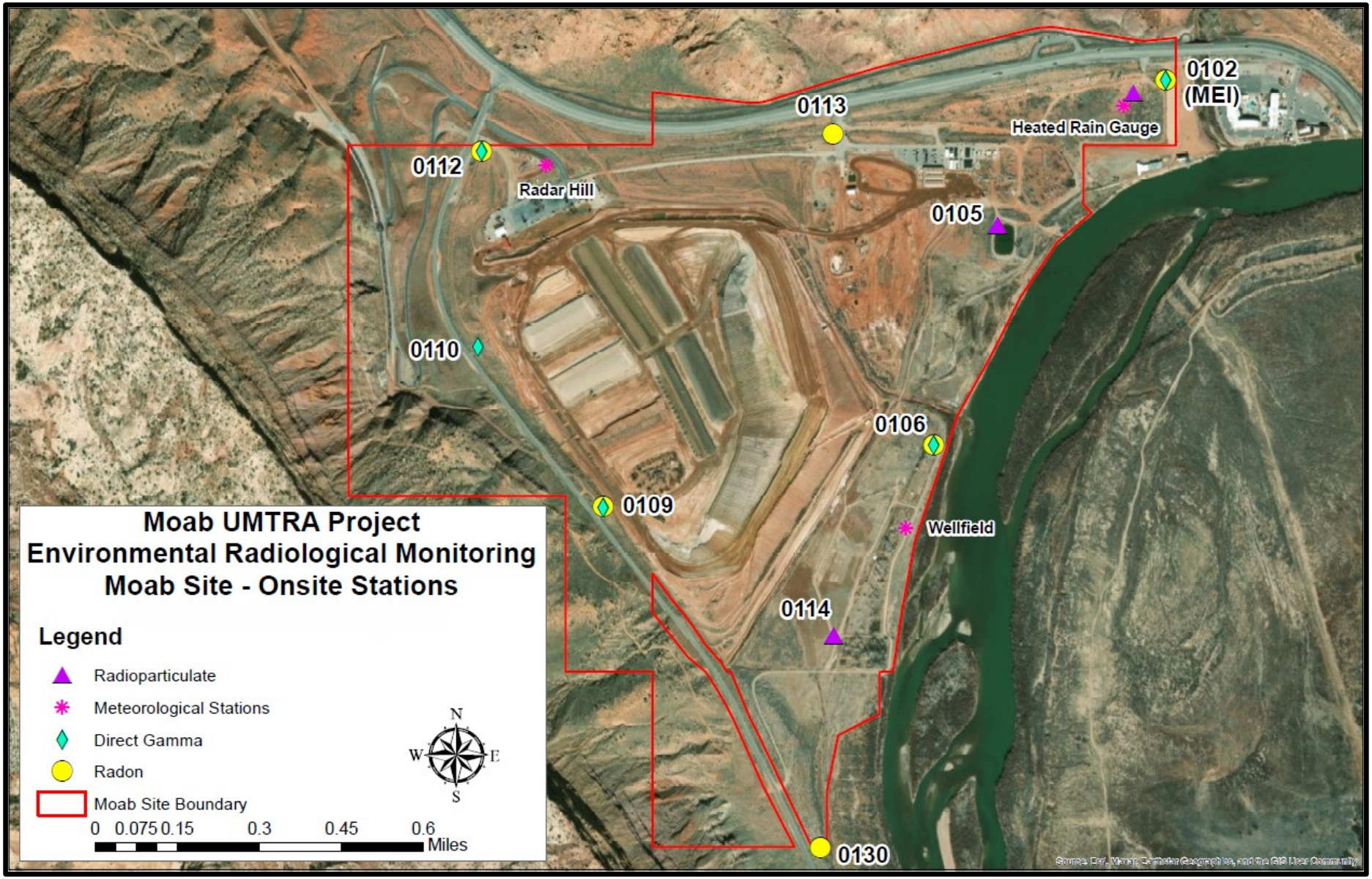

Figure 2. Moab On-Site Environmental Radiological Monitoring Locations

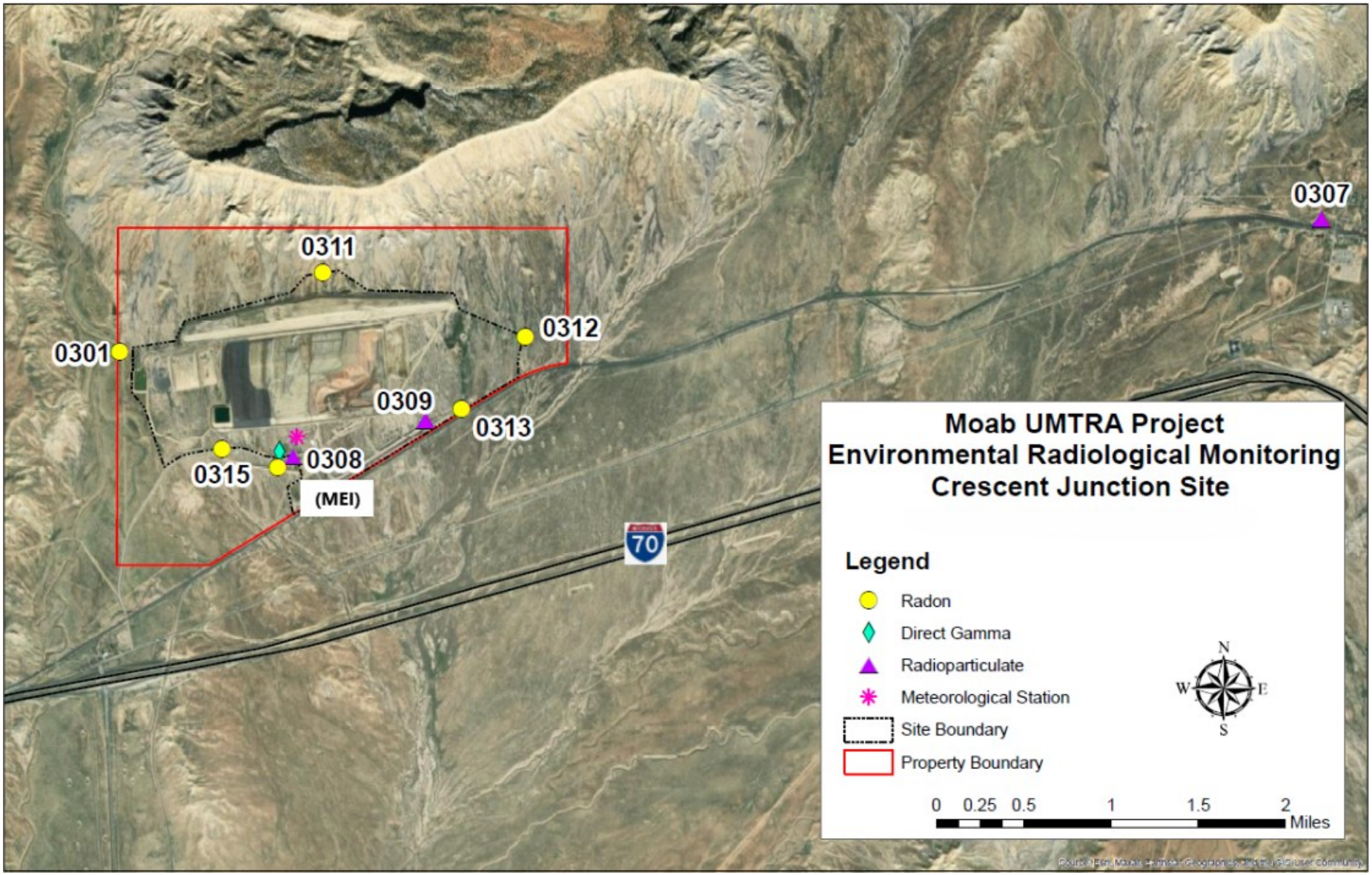

Figure 3. Crescent Junction Site Environmental Monitoring Locations

3.1 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, Rn-222, 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 (including in the Moab project tailings) 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. As a noble gas, radon does not stay in the lungs when breathed in. Although, it can produce radiation dose to lung tissue while it is in the lungs when present in air we breathe.

The radon monitoring network consists of 12 total radon monitors along the site boundaries: 6 monitors at the Moab site and 6 monitors at the Crescent Junction site. Background radon for both the Moab and Crescent Junction project sites is 0.6 pCi/L.

Moab Site Results

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	4th Quarter 2024 (pCi/L)	1st Quarter 2025 (pCi/L)	2nd Quarter 2025 (pCi/L)	3rd Quarter 2025 (pCi/L)	Past 4 Quarters Average (pCi/L) (Background subtracted)
0102 (MEI)	1.90	1.00	0.51	0.57	**0.40**
0130	2.20	1.10	0.76	0.57	**0.56**
0109	1.60	0.78	0.51	0.84	**0.33**
0112	1.80	0.78	0.97	0.81	**0.49**
0113	2.60	1.10	1.40	1.20	**0.98**
0106	4.50	3.20	1.40	0.97	**1.92**

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

Crescent Junction Site
Table 2 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.

Table 2. Quarterly and Average Radon Concentrations for the Crescent Junction Site for the Past Four Quarters

Station Number	4th Quarter 2024 (pCi/L)	1st Quarter 2025 (pCi/L)	2nd Quarter 2025 (pCi/L)	3rd Quarter 2025 (pCi/L)	Past 4 Quarters Average (pCi/L) (Background subtracted)
0301	0.68	0.38	0.14	0.41	**BKGD**
0308 (MEI)	1.90	1.10	0.81	0.92	**0.58**
0311	0.70	0.32	0.19	0.32	**BKGD**
0312	1.10	0.49	0.57	0.65	**0.10**
0313	2.10	1.40	0.78	1.10	**0.75**
0315	1.10	0.65	0.59	0.59	**0.13**

The Project's annual average radon emission at the Crescent Junction site boundary is below the limit of 3.0 pCi/L. The Project is compliant with DOE O 458.1, 4f.

3.2 Direct Gamma

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

R1 – T = Quarterly Total Dose (mrem)
Where:
R1: Reported dose from vendor
T: Transit dose (dose received during shipping of samples)

Total dose is calculated for each direct gamma station quarterly along with a total for the past four quarters.

NOTE: The background removed in this calculation includes only transit dose.

Moab Site Results
Doses from the direct gamma monitoring can be found in Table 3 below.

Table 3. Direct Gamma Doses for the Maximally Exposed Individual (MEI) and Other Locations at the Moab Site for the Past Four Quarters

Station Number & Description	Direct Gamma Dose Calculation	4th Quarter 2024 (mrem)	1st Quarter 2025 (mrem)	2nd Quarter 2025 (mrem)	3rd Quarter 2025 (mrem)	Total Dose Based on Four Quarters (mrem)
0102 (MEI)	Reported Dose from Vendor	**28.7**	**28.7**	**32.5**	**35.1**	**Total Dose Based on Four Quarters (mrem)**
	Transit dose subtracted [1]	**26.3**	**30.3**	**27.9**	**34.6**	
	Total Dose	**2.4**	**BKGD**	**4.6**	**0.5**	**7.5**
0112	Reported Dose from Vendor	**33.4**	**40.6**	**38.0**	**41.2**	**Total Dose Based on Four Quarters (mrem)**
	Transit dose subtracted [1]	**26.3**	**30.3**	**27.9**	**34.6**	
	Total Dose	**7.1**	**10.3**	**10.1**	**6.6**	**34.1**
0110	Reported Dose from Vendor	**124.9**	**106.5**	**122.7**	**112.4**	**Total Dose Based on Four Quarters (mrem)**
	Transit dose subtracted [1]	**26.3**	**30.3**	**27.9**	**34.6**	
	Total Dose	**98.6**	**76.2**	**94.8**	**77.8**	**347.4**
0109	Reported Dose from Vendor	**121.0**	**127.0**	**137.3**	**138.1**	**Total Dose Based on Four Quarters (mrem)**
	Transit dose subtracted [1]	**26.3**	**30.3**	**27.9**	**34.6**	
	Total Dose	**94.7**	**96.7**	**109.4**	**103.5**	**404.3**
0106	Reported Dose from Vendor	**44.2**	**43.4**	**42.2**	**43.4**	**Total Dose Based on Four Quarters (mrem)**
	Transit dose subtracted [1]	**26.3**	**30.3**	**27.9**	**34.6**	
	Total Dose	**17.9**	**13.1**	**14.3**	**8.8**	**54.1**

The Project estimates a 50% occupancy factor, which is conservative, resulting in a person receiving 50% of the reported dose from the vendor. The two locations (0109 and 0110) are referenced in a white paper (Determining Occupational Factors on State Route 279 Adjacent to the Moab UMTRA Project). The document assumes a 20% occupancy factor for those two locations. Given this information, the Moab site is compliant with DOE O 458.1.

Crescent Junction Site Results

Results for direct gamma from the Crescent Junction site can be found in Table 4 below. Only the MEI station measures direct gamma at the Crescent Junction site.

Table 4. 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	4th Quarter 2024	1st Quarter 2025	2nd Quarter 2025	3rd Quarter 2025	Total Dose Based on Four Quarters (mrem)
		(mrem)	(mrem)	(mrem)	(mrem)	
0308 (MEI)	Reported Dose from Vendor	29.7	35.3	33.6	33.5	
	Transit dose subtracted 1	26.3	30.3	27.9	34.6	
	Total Dose	3.4	5.0	5.7	BKDG	14.1

Based on the total dose from direct gamma measurements, the Project is in compliance with DOE O 458.1.

3.3 Radioparticulates

Radioparticulates 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 result in an internal radiation dose. Dose from inhalation of radioparticulates, along with direct gamma, are used to calculate TED.

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 radioparticulate 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, which is naturally occurring, they are considered part of the emissions from the Project. 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 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.

Moab Site Results

Table 5 provides the dose from inhalation of radioparticulates for the second quarter 2025 and the previous three 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.

NOTE: In this quarter, the actinium-227 and potactinium-231 results were not included in the calculations, because the Total Propagated Uncertainty was greater than the results.

Table 5. Radioparticulate Doses for Moab Site for the Past Four Quarters

Station Number & Description	4th Quarter 2024 (mrem)	1st Quarter 2025 (mrem)	2nd Quarter 2025 (mrem)	3rd Quarter 2025 (mrem)	Past 4 Quarters Total (mrem)
0102 (MEI)	0.43	0.30	0.17	0.17	**1.07**
0105	0.50	0.39	0.23	0.43	**1.55**
0114	0.38	0.57	0.36	0.49	**1.80**
0117	0.16	0.19	0.14	0.15	**0.64**
0118	0.38	0.27	0.25	0.32	**1.22**
0119	0.36	0.30	0.11	0.17	**0.94**
0122	0.32	0.22	0.15	0.14	**0.83**
0123	0.32	0.21	0.21	0.23	**0.97**
0129	0.52	0.55	0.73	0.83	**2.63**

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

Crescent Junction Results

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 (assumed to be in equilibrium).

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

Station Number & Description	4th Quarter 2024 (mrem)	1st Quarter 2025 (mrem)	2nd Quarter 2025 (mrem)	3rd Quarter 2025 (mrem)	Past 4 Quarters Total (mrem)
CJ Stations					
0307	0.27	0.20	0.15	0.21	**0.83**
0308 (MEI)	0.41	0.35	0.21	0.23	**1.2**
0309	0.53	0.51	0.32	0.74	**2.1**

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

3.4 Total Effective Dose

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

$$(\gamma + P_1) * 0.5 = \text{TED (mrem)}$$

Where:

γ: Direct Gamma Dose with background subtracted (mrem)
P_1: Radioparticulate Dose (mrem)
0.5: 50% occupancy rate for the MEI

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

(7.50 mrem/yr + 1.07 mrem/yr) * 0.5 = **4.29 mrem/yr**

The TED for the MEI at Moab is below the 100 mrem/year limit and is in compliance with DOE O 458.1.

Crescent Junction Site MEI Dose
For the Crescent Junction MEI, the TED for the past four quarters is calculated using the MEI TED formula above:

(14.10 mrem/yr + 1.20 mrem/yr) * 0.5 = **7.65 mrem/yr**

(Used MEI Station #0308 data for radioparticulate dose calculation for entire year.)

The TED for the MEI at Crescent Junction is below the 100 mrem/year limit and is in compliance with DOE O 458.1.

4.0 Meteorological Monitoring and Analysis

For both sites, meteorological data are collected from onsite meteorological (met) stations where data is uploaded to Ken's Weather Reporting System (KWRS), a site-specific online database created by the Project's Technical Assistance Contractor (TAC).

Moab and Crescent Junction met stations measure wind speed and direction, temperature, and precipitation. Precipitation is collected primarily with a heated rain gauge, and a manual rain gauge is used for back-up purposes. Data is downloaded from KWRS, and hourly averages are analyzed. Refer to the *Moab UMTRA Project Meteorology Station Sampling and Analysis Plan* (DOE-EM/GJTAC3075) and the *Moab UMTRA Project TAC Environmental Air Monitoring Sampling and Analysis Plan* (DOE-EM/GJTAC2219) for more information and will be updated to remedial action contractor (RAC) documents soon.

Moab Site

In the third quarter 2025, the winds were predominantly out of the southeast at speeds from zero to 15+ miles per hour (mph). Figure 4 displays the wind rose for this quarter, with the wedges showing the frequency, speed, and direction the wind was coming from.

The average temperature for the quarter was 82° F. The lowest recorded temperature for the quarter was 50° F and the highest was 105° F. The Moab Site received 1.49 inches of precipitation during the quarter.

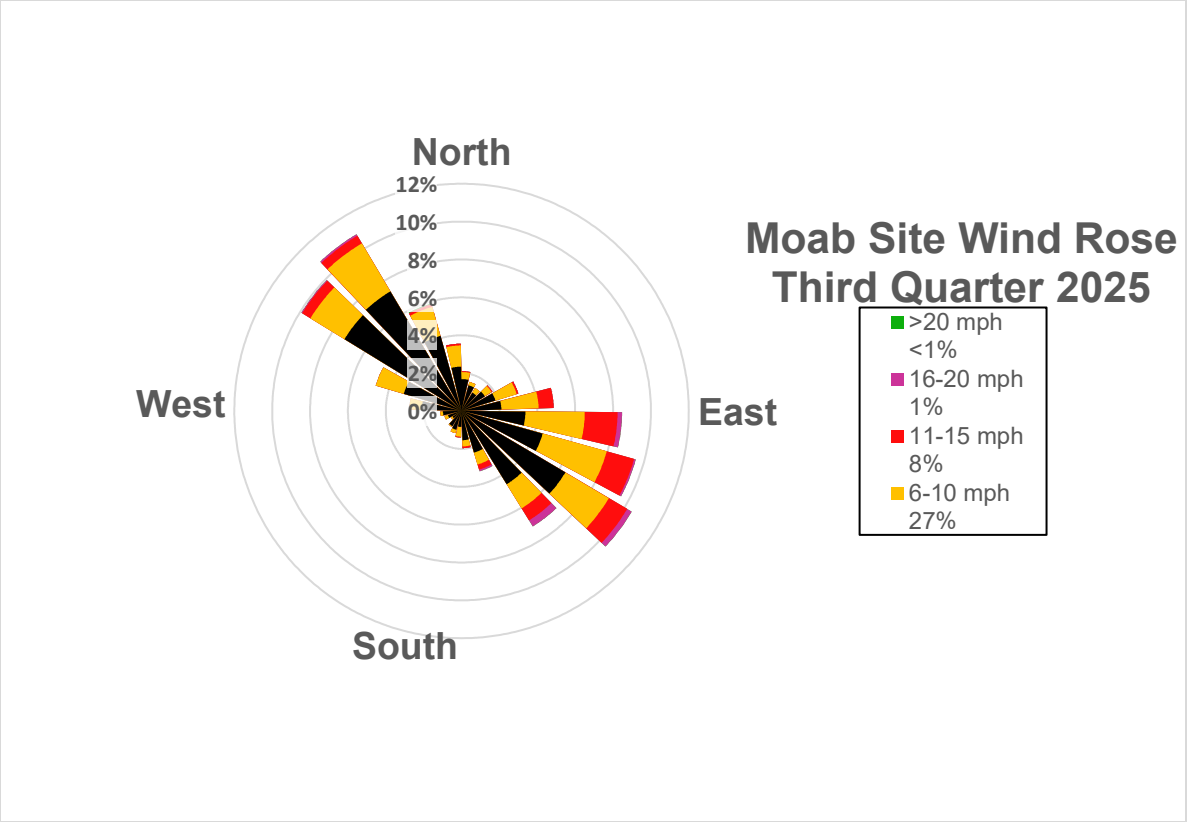

Figure 4. Moab Wind Rose for Third Quarter 2025

Crescent Junction Site

The onsite meteorological station at the Crescent Junction site was used to analyze wind, precipitation, and temperature data during this quarter.

In the third quarter, 2025, the prevailing winds were variable, ranging at speeds from zero to 20 mph. The predominant winds were more from the south and southeast direction with occasional stronger winds coming from the southeast direction (Figure 5).

The average temperature for the quarter was 78° F. The lowest recorded temperature for the quarter was 48° F and the highest was 101° F. The site received 2.05 inches of precipitation.

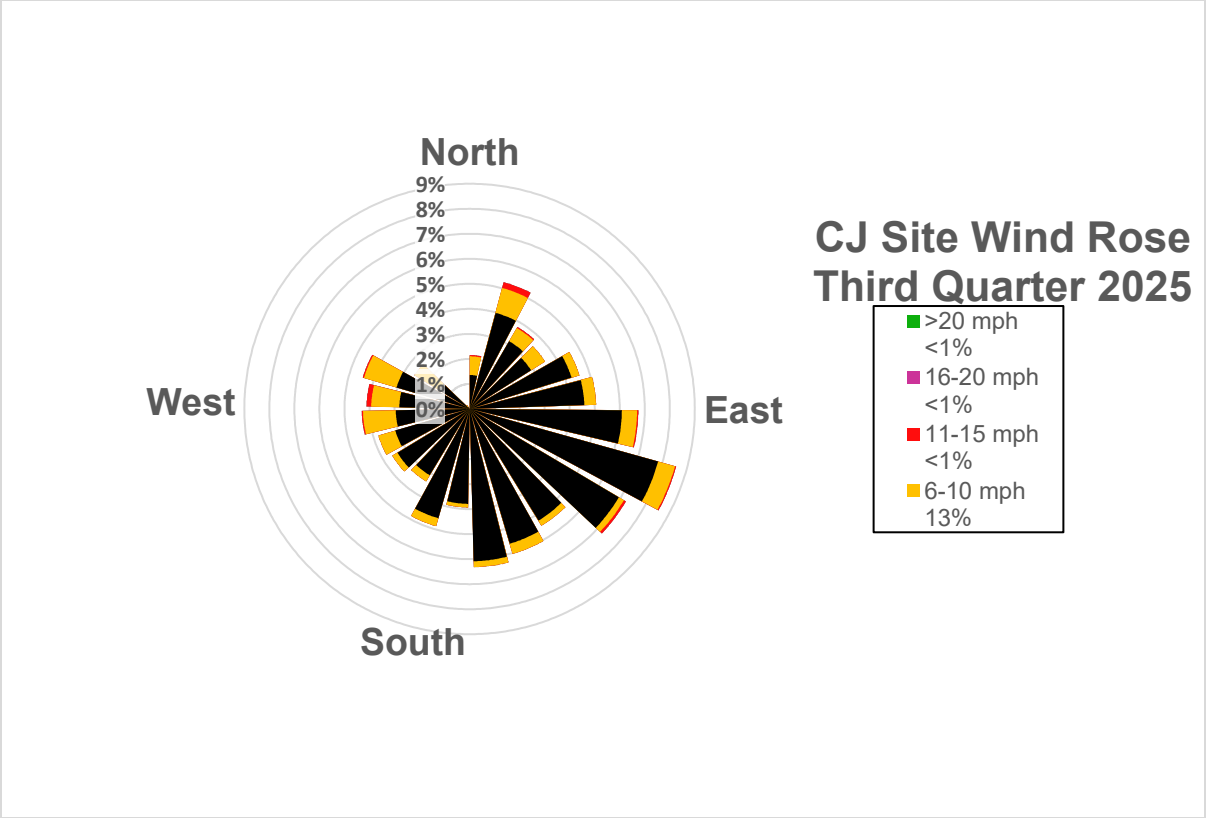

Figure 5. Crescent Junction Wind Rose for Third Quarter 2025

5.0 Data Quality

Radon measuring devices, optically stimulated luminescence (OSL) 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.

All sample and vendor data has been entered into the Moab Environmental Sampling (MESa) database for easy review.

5.1 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.

5.2 Suspected Anomalies

All analytical data are reviewed for anomalous or outlying data points. Monitoring data is 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 was noted for this quarter.

6.0 Conclusion

This third quarter 2025 report provides documentation of compliance with DOE O 458.1 limits for dose to the public and demonstrates the dedication of the Moab UMTRA Project to the environment and public health and safety.

7.0 References

DOE (U.S. Department of Energy), *Guidance for Preparation of the 2022 Department of Energy Annual Site Environmental Reports* (March 2023).

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 Meteorology Station Sampling and Analysis Plan* (DOE-EM/GJTAC3075).

DOE (U.S. Department of Energy) Order 458.1, Admin Chg. 5, "Radiation Protection of the Public and the Environment".

(Ron Daily, January 2025) White Paper, *Determining Occupational Factors on State Route 279 Adjacent to the Moab UMTRA Project*. (Moab UMTRA Project Health Physics Plan DOE-EM/GJRAC3003).