DOE-EM/GJ3139

# Moab UMTRA Project
# Annual Site Environmental Report for Calendar Year 2024

Revision 2

September 2025

U.S. Department of Energy

Office of Environmental Management

*Prepared by the Remedial Action Contractor under contract number 89303322DEM000073*
*for the U.S. Department of Energy Office of Environmental Management, Grand Junction, Colorado.*

# Moab UMTRA Project
# Annual Site Environmental Report for Calendar Year 2024

## Revision 2

## Review and Approval

9/23/2025

X Ken Kisiel

Kenneth C. Kisiel
RAC Environmental Compliance Manager
Signed by: KENNETH KISIEL (Affiliate)

9/23/2025

X Tim Mason

Tim Mason
RAC ESH&Q Manager
Signed by: TIMOTHY MASON (Affiliate)

9/23/2025

X Greg D. Church

Greg Church
RAC Program Manager
Signed by: GREGORY CHURCH (Affiliate)

# Revision History

| Revision | Date | Description |
|---|---|---|
| 0 | August 2025 | Initial issue. |
| 1 | September 2025 | Edits in response to DOE comments. |
| 2 | September 2025 | Updates to Tables 1 and 2. |

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## Figures



## Tables

## Acronyms and Abbreviations

| | |
|---|---|
| AARST | American Association of Radon Scientists and Technologists |
| AEA | Atomic Energy Act |
| ALARA | As Low As Reasonably Achievable |
| ASER | Annual Site Environmental Report |
| ASL | Approved Supplier List |
| ASME | American Society of Mechanical Engineers |
| Bgs | below ground surface |
| Bkgd | background |
| BLM | Bureau of Land Management |
| CA | Contamination Area |
| CAA | Clean Air Act |
| CFR | Code of Federal Regulations |
| CWA | Clean Water Act |
| DNR | Department of Natural Resources |
| DOE | U.S. Department of Energy |
| DOECAP | Department of Energy Consolidated Audit Program |
| DOE O | DOE Order |
| DOT | Department of Transportation |
| EDE | Effective Dose Equivalent |
| EISA | Energy Independence and Security Act |
| EM | Environmental Management |
| EO | Executive Order |
| EPA | U.S. Environmental Protection Agency |
| EPCRA | Emergency Planning and Community Right-to-Know Act |
| EPEAT | Electronic Product Environmental Assessment Tool |
| ESA | Endangered Species Act |
| FEIS | Final Environmental Impact Statement |
| FFCA | Federal Facilities Compliance Act |
| FIFRA | Federal Insecticide, Fungicide, and Rodenticide Act |
| ft | feet |
| GCAP | Groundwater Compliance Action Plan |
| IA | interim action |
| ISMS | Integrated Safety Management System |
| ISO | International Organization for Standardization |
| KWRS | Ken's Weather Reporting System |
| km | kilometers |
| lb | pounds |
| LL | Lessons Learned |
| MBTA | Migratory Bird Treaty Act |
| MEI | Maximally Exposed Individual |
| mg/L | milligrams per liter |
| MOA | memorandum of agreement |
| MOU | memorandum of understanding |
| mrem | millirem |
| mSv | millisievert |
| N | nitrogen |
| N/A | not applicable |
| NELAP | National Environmental Laboratory Accreditation Program |
| NEPA | National Environmental Policy Act |

| | |
|---|---|
| NESHAP | National Emissions Standards for Hazardous Air Pollutants |
| NHPA | National Historic Preservation Act |
| NOI | notice of intent |
| NPDES | National Pollutant Discharge Elimination System |
| NPS | National Park Service |
| NQA | Nuclear Quality Assurance |
| NRPP | National Radon Proficiency Program |
| NS | not sampled |
| ORP | Oxidation-Reduction Potential |
| pCi/L | picocuries per liter |
| PFAS | polyfluoroalkyl substance |
| PNNL | Pacific Northwest National Laboratory |
| QA | Quality Assurance |
| QAP | Quality Assurance Program |
| QSL | Optically Stimulated Luminescence |
| RAC | Remedial Action Contractor |
| RCRA | Resource Conservation and Recovery Act |
| REM | Roentgen Equivalent Man |
| RICR | Remote Independent Conformance Review |
| RRM | Residual Radioactive Material |
| RRR | Rim to Rim Restoration |
| SDWA | Safe Drinking Water Act |
| SHPO | State Historic Preservation Office |
| SME | Subject Matter Expert |
| SR | State Route |
| Sv | Sievert |
| SWPPP | Stormwater Pollution Prevention Plan |
| TAC | Technical Assistance Contractor |
| TED | Total Effective Dose |
| TSCA | Toxic Substances Control Act |
| U | Uranium |
| UAC | Utah Administrative Code |
| UDEQ | Utah Department of Environmental Quality |
| UMTRA | Uranium Mill Tailings Remedial Action |
| UMTRCA | Uranium Mill Tailings Radiation Control Act |
| UPDES | Utah Pollutant Discharge Elimination System |
| US-191 | U.S. Highway 191 |
| USC | United States Code |
| USGS | United States Geological Survey |
| yr | year |

# Executive Summary

The Annual Site Environmental Report (ASER) serves as the principal document for communicating environmental protection performance information to the public. It is also the primary mechanism for documenting compliance with U.S. Department of Energy's (DOE's) requirements for radiation protection of the public and environment at its sites.

The scope of the Moab Uranium Mill Tailings Remedial Action (UMTRA) Project is to relocate uranium mill tailings and other contaminated materials from a former uranium-ore processing facility and from off-site properties known as vicinity properties in Moab, Utah, to an engineered disposal cell constructed near Crescent Junction, UT.

This ASER presents information pertaining to environmental activities conducted on the DOE UMTRA Project during calendar year 2024. This report includes Project activities conducted at the Moab site located near Moab, Utah, and the Crescent Junction, Utah, disposal site, located approximately 30 miles north of the Moab site.

In 2024 the Project had six major environmental programs that pertain to this ASER including: Environmental Compliance, Integrated Work Management System (ISMS), Environmental Radiological Protection Program and Dose Assessment, Environmental Non-Radiological programs, Groundwater, and Quality Assurance (QA). Brief descriptions of these programs are provided below.

**Environmental Compliance Program**
The Project must operate in compliance with various federal environmental statutes, some of which are enforced at the state level through permits. During 2024, the Project remained in compliance with all regulations and permits, and there were no notices of violation. Section 2.0, Compliance Summary, addresses principle regulatory requirements and their implementation status on the Project.

**Integrated Safety Management System**. The Project's ISMS is structured to consider environmental aspects of all work activities. The Project's work planning integrates training and awareness of key environmental aspects, objectives and impacts into the core functions of the contractor's ISMS to ensure continuous improvement.

**Environmental Radiological Protection Program and Dose Assessment**
The Project monitors radiological emissions and radiation dose rates to ensure DOE activities are protective of the public and the environment. The environmental monitoring network consists of on-site and off-site monitoring locations. The Project monitors concentrations of radon gas and selected airborne radioparticulates, as well as the radiation dose from direct gamma radiation. Samples for radon and radioparticulates in 2024 were analyzed quarterly from up to 22 locations between the Moab and Crescent Junction sites. The total radiation dose to the public did not exceed the DOE Order 458.1 dose limits from any radiological releases or direct gamma radiation in 2024. Section 4.0 addresses the population dose and dose to the maximum exposed individual (MEI).

**Environmental Non-Radiological Program Information**
Non-radiological environmental programs include stormwater, fugitive dust, oil storage, and meteorological monitoring programs. The Moab site also has a Revegetation and Weed Control Program, which aims to stabilize and improve soil conditions, revegetate previously remediated

areas with resilient, native vegetation, and control common and noxious weed species. Fire Protection Management and Planning is also covered. Section 5.0 addresses the Environmental Non-radiological Program Information.

**Groundwater Program**
The Groundwater Program at the Moab site is designed to limit ecological risk from contaminated groundwater discharging to the Colorado River. River protection is accomplished through a multifaceted approach. An interim action (IA) groundwater remediation system includes extraction of contaminant mass, primarily ammonia and uranium, near the uranium mill tailings pile and injection of fresh water closer to the river to protect critical habitat areas for endangered fish species. Groundwater and surface water monitoring measures IA system performance. During 2024, operation and monitoring of the IA system continued, and no suitable habitat formed.

The groundwater program continues to develop a final Groundwater Compliance Action Plan to determine a long-term strategy. Section 6.0 addresses the Groundwater Program.

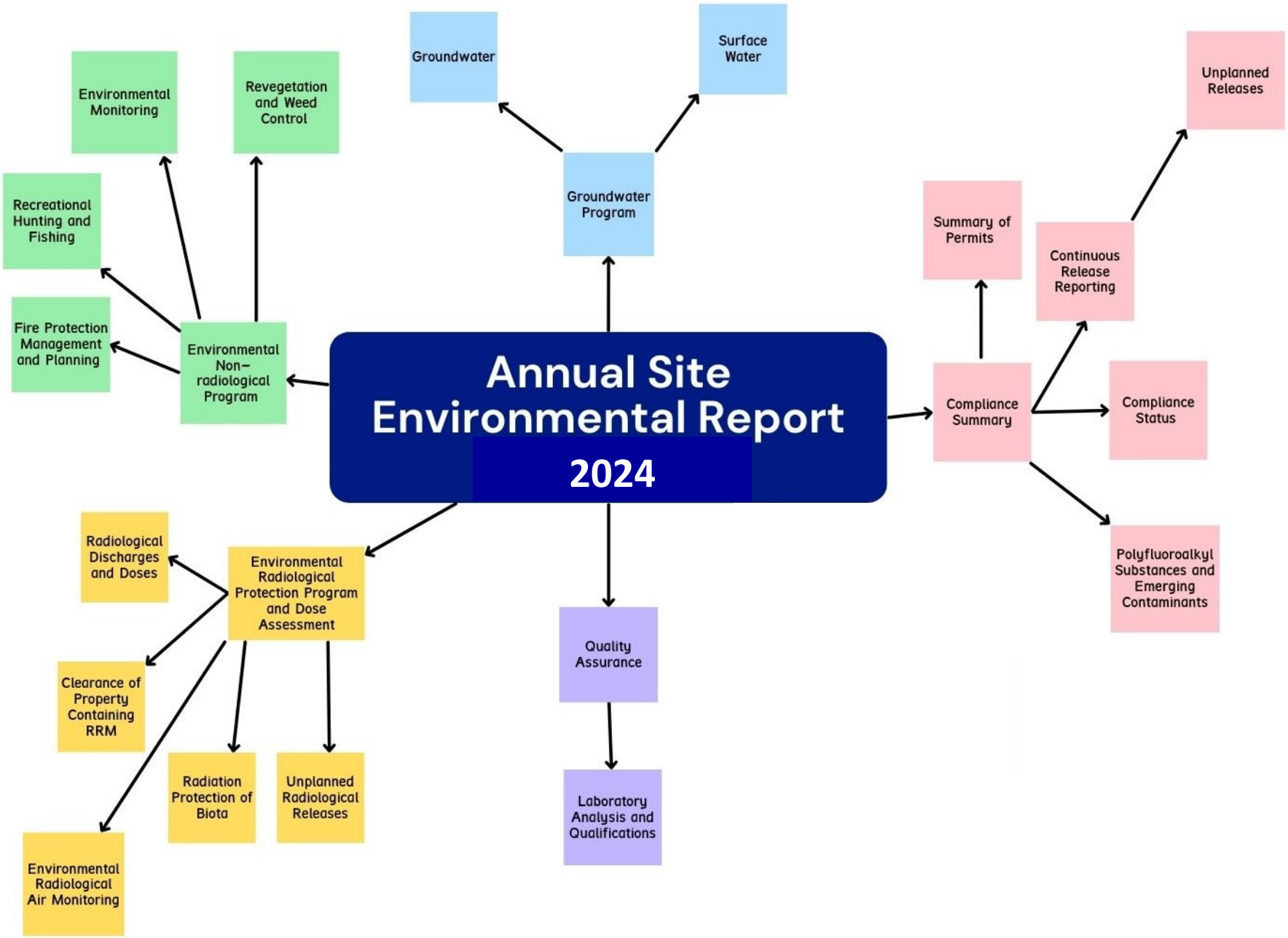
**Quality Assurance Program**
The Project ensures the quality of its environmental data through implementation of contractor Quality Assurance (QA) Plans, which include validation of data collection and sample analysis. Section 7.0 addresses the Moab Site QA Program.

**Key Activities in 2024**
The Project shipped1,026,599 tons of residual radioactive material (RRM) from the Moab site to the Crescent Junction disposal site during 2024. This brought the cumulative total through 2024 to 15,203,853 tons or approximately 95% of the tailings pile, originally estimated at approximately 16 million tons total.

**Document Availability**
This document may be viewed in its entirety on the DOE Moab Project website at *www.energy.gov/em/moab/moab-umtra-homepage* and in the public reading room in the Grand County Public Library in Moab. Hard copies may be obtained by contacting the Moab Federal Cleanup Director at (970) 257-2161 or at the address below.

U.S. Department of Energy
200 Grand Avenue, Suite 500
Grand Junction, CO 81501

Comments or questions regarding this document may also be directed to the Project at (800) 637-4575. Members of the public who wish to comment on this document or who have questions are encouraged to contact DOE at the above phone number or by email at *publicaffairs@moabem.doe.gov.*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# 1.0 Introduction

## 1.1 Site Locations

The Department of Energy (DOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) Project site is located about three miles northwest of Moab in Grand County, Utah (Figure 1). The 480-acre site is bordered on the north and west by sandstone cliffs. U.S. Highway 191 (US-191) parallels the northern site boundary, and State Route 279 transects the western portion of the property. Arches National Park has a common property boundary with the Moab site north of US-191. The Colorado River forms the eastern boundary. The Moab Wash, an ephemeral stream, runs northwest to southeast through the site and joins the Colorado River. The Scott M. Matheson Wetlands Preserve lies directly across the river from the site. Figure 2 shows Moab site features.

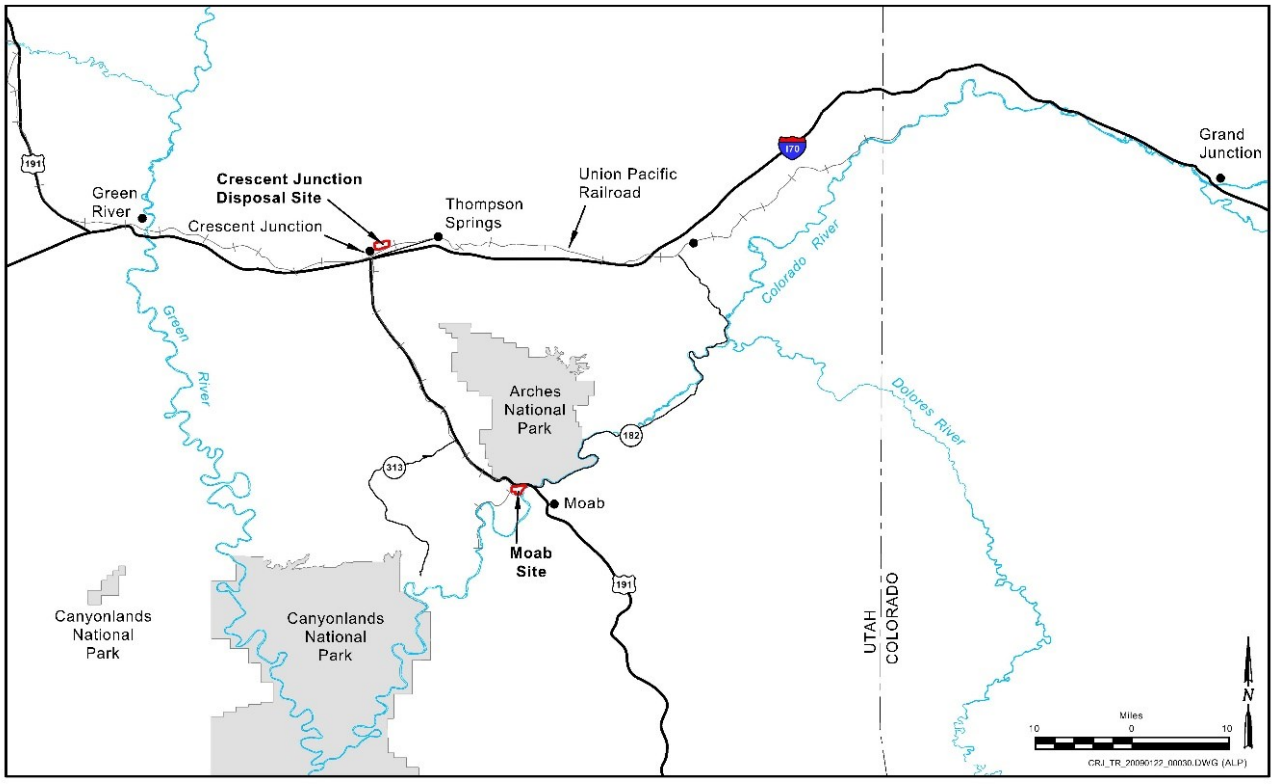


*Figure 1. Location of Moab and Crescent Junction Sites*

The Crescent Junction disposal site is also located in Grand County, northeast of the junction of Interstate 70 and US-191, approximately 30 miles north of the Moab site (Figure 1). It is the location for disposal of the Moab site RRM. Through a series of temporary withdrawals of public domain land and a permanent land transfer by the Department of the Interior, DOE currently owns 500 acres of land and has another 936 acres in a 20-year withdrawal (beginning in 2009) near Crescent Junction for the disposal cell and surrounding support areas. Figure 3 shows Crescent Junction site features.

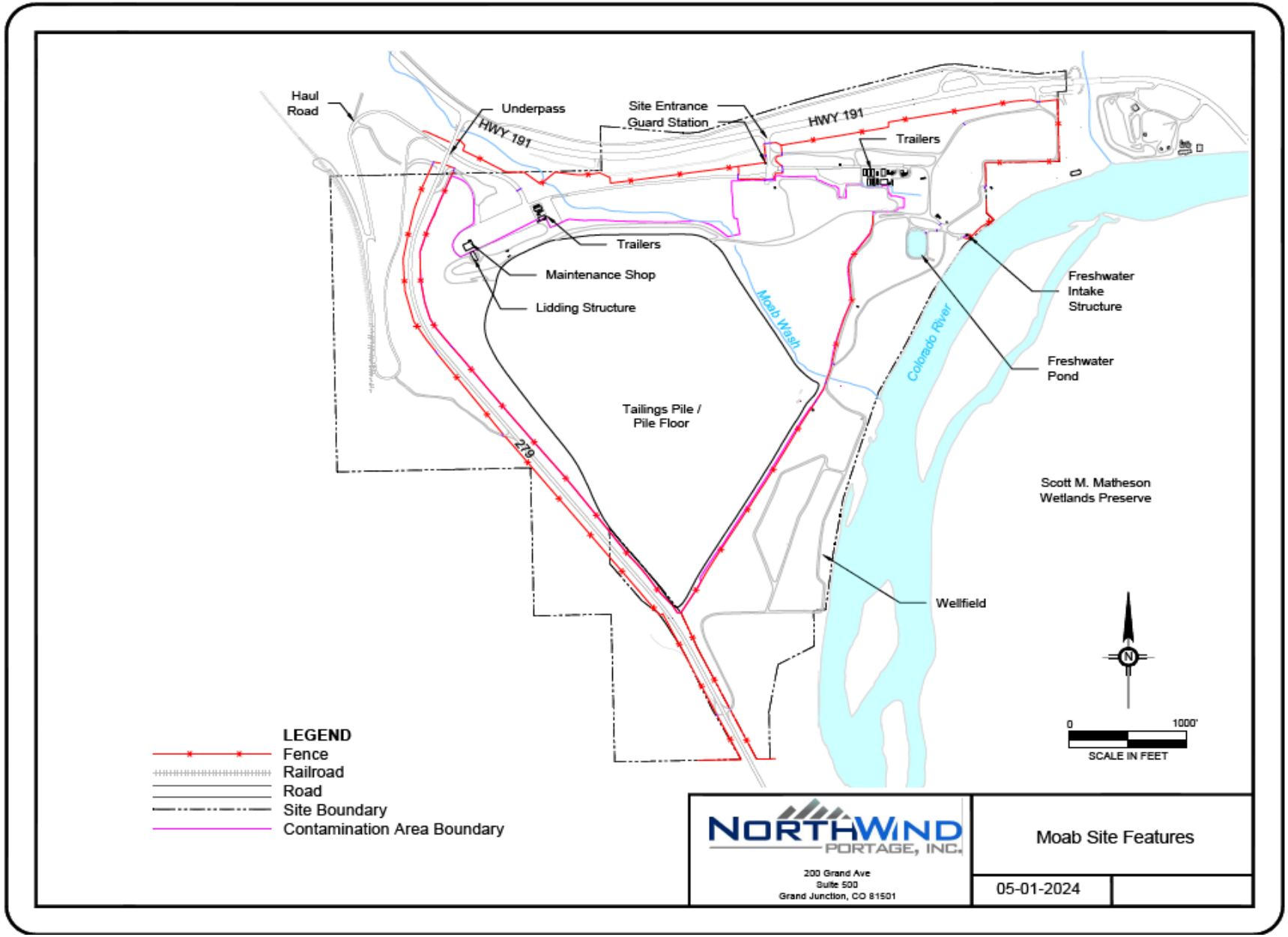


*Figure 2. Moab Site Features*

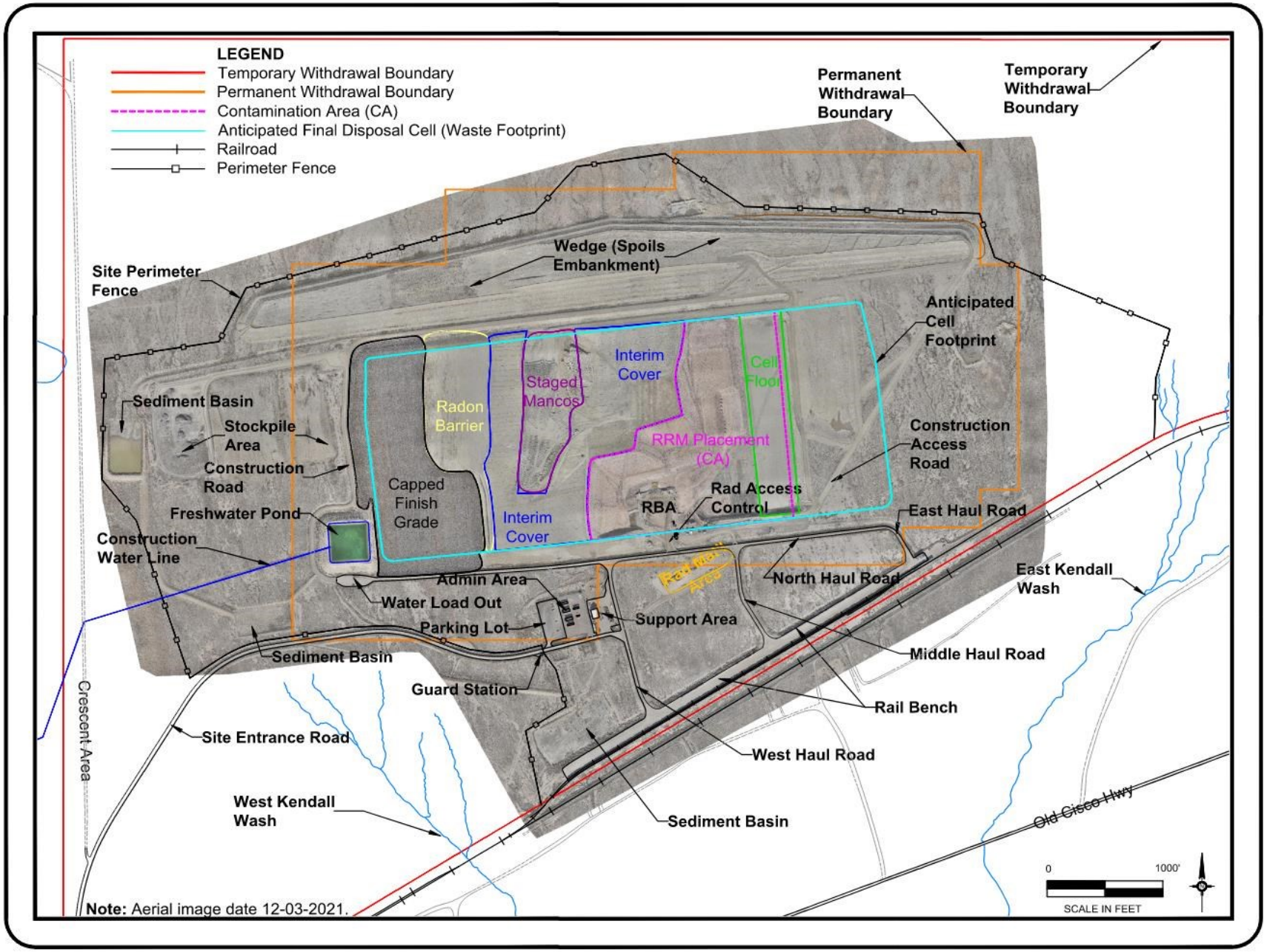


*Figure 3. Crescent Junction Site Features*

## 1.2 Site History

The Moab mill operated under various private owners from 1956 through 1984. The tailings created by the milling operations were pumped to an unlined impoundment in the western portion of the property. The tailings accumulated over time, forming a pile up to 90 feet thick. The eastern toe of the pile lies 750 feet from the Colorado River. When processing operations ceased, an estimated 16 million tons (12 million cubic yards) of residual radioactive material (RRM) were present in the pile, which occupied about 130 acres at the site. An interim cover was placed on the pile in 1995.

Congress enacted the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398), and in October 2001, ownership and cleanup responsibility for the Moab site were transferred from the Atlas Minerals Corporation to the DOE. The Project is managed by the DOE Office of Environmental Management (EM) located in Grand Junction, Colorado (see Figure 1). The legislation stipulated that the Moab site undergo remediation as a Title I site under Title 42 United States Code Section 7901 (42 USC 7901), the Uranium Mill Tailings Radiation Control Act (UMTRCA).

In July 2005, DOE published the *Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties, Utah, Final Environmental Impact Statement* (FEIS) (DOE/EIS-0355). The FEIS presented the preferred remediation alternatives. In September 2005, DOE issued the *Record of Decision for the Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties, Utah* (6450-01-P), which detailed the selection of the preferred alternatives and basis for that decision. The first phase of the disposal cell was constructed in 2008; RRM shipments to the cell began in April 2009.

## 1.3 Project Mission

The Project's mission is to safely relocate uranium mill tailings and other process-related wastes, collectively known as residual radioactive material (RRM), from the former uranium ore-processing facility (mill site), and off-site contaminated properties known as vicinity properties in Moab, to an engineered disposal cell constructed near Crescent Junction. The RRM is primarily transported by rail. The mission also includes active remediation of contaminated groundwater at the Moab site.

## 1.4 Primary Operations and Project Activities

Primary operations and Project activities at the sites include:

- Excavating and conditioning RRM at the Moab site.
- Transporting RRM to the Crescent Junction disposal cell by rail.
- Excavating the Crescent Junction disposal cell.
- Placing and compacting RRM from the Moab site and vicinity properties in the cell.
- Placing interim and final cell cover layers.
- Operating an Interim Action (IA) groundwater remediation system at the Moab site, including groundwater extraction and freshwater injection.
- Monitoring contaminants of concern in air, soil, groundwater, and surface water.
- Revegetating and controlling weeds in previously remediated areas at the Moab site.

**Key Activities in 2024**

The Project shipped 1,026,599 tons of residual radioactive material (RRM) from the Moab site to the Crescent Junction disposal site during 2024. The cumulative total through 2024 was 15,203,853 tons or approximately 95% of the tailings pile, originally estimated at approximately 16 million tons total.

The Project completed construction of the queue waterline.

The Crescent Junction site began receiving rock deliveries in May of 2023. This rock is being staged in anticipation for usage in the final cover of the disposal cell. Rock deliveries continued in 2024. Changes to the site were added to the Stormwater Pollution Prevention Plan.

## 1.5 Environmental Setting

**Meteorology**
At the Moab site, the 2024 average annual temperature was approximately 60ºF. January was the coldest month, with the lowest temperature recorded being 18ºF. July was the warmest month, the highest temperature being 108ºF. The total rainfall in 2024 was approximately 8.38 inches.

At the Crescent Junction site, the 2024 average annual temperature was approximately 57ºF. January was the coldest month, with the lowest temperature recorded for the month being 11ºF. July was the warmest month with the highest temperature being 103ºF. The total rainfall in 2024 was approximately 8.24 inches.

**Geology and Hydrology**
The primary hydrogeologic unit present at the Moab site consists of unconsolidated alluvium on the valley floor flanked by consolidated sandstones and shale on the canyon walls. The Moab site is susceptible to flooding from the Colorado River during runoff of spring snowmelt in the Rocky Mountains and from thunderstorms in the drainage basin of the Moab Wash.

The Colorado River generally reaches a maximum flow between late May and early June. Groundwater underlying the site moves from northwest to southeast, discharging to the Colorado River during base flows.

The Crescent Junction site is on a gently south-sloping surface of unconsolidated alluvium underlain by consolidated Mancos Shale. The site lies at the base of the Book Cliffs to the north. Surface drainage flows to ephemeral washes located to the south of the site that ultimately drain to the Green River. Groundwater underlying the Crescent Junction site occurs intermittently in sand lenses in the alluvium and in fractures in the Mancos Shale.

## 1.6 Area Demographics

Moab is the Grand County government seat and the principal city of southeastern Utah, with a population of 5,366 (2024 estimate, U.S. Census Bureau, *https://data.census.gov*). In addition to Moab, the communities of Crescent Junction and Thompson Springs, also in Grand County, are affected by relocation of RRM to the Crescent Junction site.

The population of Grand County is 9,669 (2024 estimate, U.S. Census Bureau). Grand County's major economic base is tourism. Southeastern Utah has the nation's largest concentration of national and state parks, monuments, and recreation areas.

# 2.0 Compliance Summary

UMTRCA required the promulgation of cleanup standards now codified by the U.S. Environmental Protection Agency (EPA) at Title 40 Code of Federal Regulation Part 192 (40 CFR 192), "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," and assigned the U.S. Nuclear Regulatory Commission to oversee the cleanup and issue licenses for the completed disposal cells.

RRM at the Moab site contains contaminants in concentrations that could be hazardous to the environment and public health and that exceed EPA standards. Remediation of the Moab site and disposal at the Crescent Junction site are conducted in compliance with these standards. RRM, specifically defined in 40 CFR 192.01, "Definitions," is "waste (which the Secretary determines to be radioactive) in the form of tailings resulting from the processing of ores for the extraction of uranium and other valuable constituents of the ores; and activities." RRM requiring cleanup at the Moab site includes uranium mill tailings, contaminated soil, debris from dismantling the mill buildings and associated structures, equipment, remnants of processing ponds, disposal trenches, and other wastes.

## 2.1 Compliance Status

The Project is committed to protecting the environment while conducting its mission. It operated without any notices of environmental violations during 2024. The site monitors two facilities listed on the EPA's Enforcement & Compliance History Online (ECHO) database: Atlas Minerals Company; 3 miles north of Moab on Highway 191, Moab, Utah 84532; Facility Registry Service (FRS) ID 110010668599; and Moab UMTRA Project at Crescent Junction, 0.15 County Road 223, Thompson, Utah 84540; FRS ID 110044903655. Table 1 summarizes federal and state environmental regulations and their implementation status on the Project.

The Project prepared this ASER to document the radiological and non-radiological condition of site environments, effluents and emissions, and any associated trends and is submitted to DOE Headquarters and released to interested stakeholders and regulatory agencies in compliance with Environment, Safety and Health Reporting (DOE O 231.1B).

## 2.2 Continuous Release Reporting

Not applicable to the Project.

## 2.3 Unplanned Releases

The Project did not experience any unplanned releases in 2024.

## 2.4 Polyfluoroalkyl Substances (PFAS) and Emerging Contaminants

In accordance with the *PFAS Strategic Roadmap: DOE Commitments to Action 2022-2025*, a historical records search was conducted to determine possible past use of PFAS-containing products at the Moab UMTRA site. It was identified that a fire suppression system that contained PFAS was present in at least one of the since-decommissioned mill buildings. The contaminants of concern at the site do not include any emerging contaminants including perfluoro octane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perchlorates, or 1,4-dioxane.

*Table 1. Principle Regulatory Requirements and Status for the Moab Project*

| Federal or State Requirement | What it Covers | 2024 Implementation Status |
|---|---|---|
| **Environmental Restoration and Waste Management** | | |
| Resource Conservation and Recovery Act (RCRA), Federal Facilities Compliance Act (FFCA) | RCRA governs the generation, storage, handling, and disposal of hazardous wastes. RCRA gives Environmental Protection Agency (EPA) authority to control hazardous waste from "cradle to grave." In 1992, RCRA was amended by the FFCA, which required DOE to take several actions to manage mixed waste handled at its facilities. | All waste generated within the CA is considered RRM, the cleanup and management of which is regulated by UMTRCA, not RCRA; however, waste generated outside the CA is considered non-RRM and, therefore, can be regulated by RCRA.<br><br>During 2024, no RCRA wastes were generated outside the CA. The Project maintains a Very Small Quantity Generator (VSQG) status. |
| National Environmental Policy Act (NEPA) | NEPA requires federal agencies to follow a prescribed process to anticipate impacts on the environment of proposed major federal actions and alternatives. DOE compliance by use of the National Environmental Policy Act Implementing Procedures. | NEPA reviews have been periodically conducted to ensure proposed Project activities are within the original bounds of the FEIS. During 2024, site operations were conducted in accordance with NEPA.<br><br>Several Categorical Exclusions were completed in 2024, which included groundwater, Queue waterline extension, and the background radium investigation. |
| Toxic Substance Control Act (TSCA) | TSCA was enacted to regulate the manufacturing and distribution of certain chemical substances and/or mixtures. TSCA specifically addresses the importation, use, and disposal of asbestos, polychlorinated biphenyls, radon, and lead-based paint. | All waste generated within the CA is considered RRM, the cleanup and management of which is regulated by UMTRCA, not TSCA; however, waste generated outside the CA is considered non-RRM and, therefore, can be regulated by TSCA.<br><br>During 2024, no TSCA wastes were generated outside the CA. |

*Table 1. Principle Regulatory Requirements and Status for the Moab Project (continued)*

| Federal or State Requirement | What it Covers | 2024 Implementation Status |
|---|---|---|
| **Environmental Restoration and Waste Management** | | |
| Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) | FIFRA governs the distribution, sale, and use of pesticides. This act categorizes pesticides as either restricted or general use. | During 2024, only three herbicides were used onsite (Milestone®, Telar® and Garlon3A®). Other herbicides are present onsite and are safely stored. All pesticides onsite are general use. |
| **Radiation Protection** | | |
| DOE O 458.1 Admin Chg 4, "Radiation Protection of the Public and the Environment" | DOE O 458.1 is the key DOE order for public radiation protection. The order establishes requirements for DOE operations to protect members of the public and the environment from undue risk from radiation. | During 2024, the Project monitored radiological emissions. Project activities did not result in any dose to the public that exceeded the limits in DOE O 458.1. |
| DOE O 435.1, "Radioactive Waste Management" | This order was implemented to ensure all DOE radioactive waste is managed in a manner that protects workers, public health and safety, and the environment. | The Moab Project is not a LLW facility and did not ship offsite to a LLW facility, therefore DOE O 435.1 is not applicable. |
| Atomic Energy Act of 1954 (AEA) | The AEA requires the management, processing, and utilization of radioactive materials in a manner that protects public health and the environment. UMTRCA amended the AEA and authorized the EPA to establish health and environmental standards for the disposal of uranium mill waste. | During 2024 the Project continued to dispose uranium mill waste in accordance with UMTRCA. |
| **Air Quality and Protection** | | |
| Clean Air Act (CAA) | CAA establishes the requirements for facility air quality and air emissions. | The CAA is enforced at the state level through fugitive dust control plans prepared for both sites. |
| Utah Administrative Code (UAC) R307-205-8, "Emission Standards; Fugitive Emissions and Fugitive Dust; Tailings Piles and Ponds" | This state administrative code establishes minimum work practices and emission standards for sources of fugitive emissions and fugitive dust. Air entering the public domain must meet emission standards, for dust resulting from grading, excavating, depositing, natural erosion or other causes in association with such operation. | During 2024, EPA Method 9-certified individuals diligently monitored opacity and implemented controls outlined in the site fugitive dust control plans. |

*Table 1. Principle Regulatory Requirements and Status for the Moab Project (continued)*

| Federal or State Requirement | What it Covers | 2024 Implementation Status |
|---|---|---|
| **Water Quality and Protection** | | |
| 33 USC 1251, Clean Water Act (CWA) / National Pollutant Discharge Elimination System (NPDES) | Under the CWA, NPDES was designed to regulate and control pollutants from industrial wastewater and storm water discharges, both of which can have negative impacts on the quality of U.S. surface waters. The federal discharge requirements are implemented by the Utah Department of Environmental Quality (UDEQ), the Utah Pollutant Discharge Elimination System (UPDES), an equivalent state system. | As required by UPDES Storm Water General Permits (see Table 2), the Project prepared and continued to implement site storm water pollution prevention plans (SWPPP) and required inspections at each site (routine monthly and after a 24-hour event totaling 0.5" or greater precipitation). The Notice of Intents (NOI's) were renewed for 2024 with UDEQ for each site.<br><br>During 2024, no discharges were noted under UPDES. |
| Storm Water Management and Energy Independence and Security Act (EISA) | Under Section 438 of EISA, federal agencies have requirements to reduce storm water runoff from federal development projects to protect water resources. | The Moab UMTRA Project is EISA exempt. |
| 42 USC 300f, The Safe Drinking Water Act (SDWA) | SDWA establishes minimum drinking water standards and monitoring requirements. | The provisions of the SDWA are not directly relevant to the Project sites because neither groundwater nor surface water at or near the sites is used as a public drinking water supply. DOE did not engage in any activities that affected drinking water supply sources. Remediation wells are designated as a temporary withdrawal point. During 2024, a Temporary Change Application was received from the Utah Department of Natural Resources, Division of Water Rights (see Table 2). |
| **Other Environmental Statutes** | | |
| U.S. Department of Transportations (DOT) Special Permit | Authorizes the transportation in commerce of non-DOT-specification bulk packages containing RRM from the Moab site and vicinity properties to the Crescent Junction disposal cell. | During 2024, the Project remained in compliance with the Special Permit. |
| Uranium Mill Tailings Radiation Control Act (UMTRCA), Floyd D. Spence Act | Title I of UMTRCA requires DOE to establish a remedial action program and authorizes DOE to stabilize, dispose of, and control RRM, including contaminated groundwater, in accordance with cleanup standards promulgated in 40 CFR 192. UMTRCA is the primary law governing site cleanup and disposal for the Project. | During 2024, the Project excavated and disposed of RRM and contaminated groundwater in compliance with 40 CFR 192. |

*Table 1. Principle Regulatory Requirements and Status for the Moab Project (continued)*

| Federal or State Requirement | What it Covers | 2024 Implementation Status |
|---|---|---|
| **Other Environmental Statutes** | | |
| DOE O 231.1B Admin Chg 1, "Environmental, Safety and Health Reporting" | DOE O 231.1B requires timely collection, reporting, analysis, and dissemination of data on environmental issues that could adversely affect the health, safety, and security of the public or workers, the environment, DOE operations, or DOE credibility. | This ASER summarizes Project environmental activities and protection performance during 2024. |
| National Historic Preservation Act (NHPA) | Memorandum of Agreements (MOAs) are in place among DOE, the Utah State Historic Preservation Office, the Utah DOT, and the Bureau of Land Management for protection of cultural and historic resources at the Project sites. | Cultural resources in Crescent Junction were surveyed in October of 2024. No impacts were noted during 2024. |
| 40 CFR 112, Oil Pollution Prevention | The Project meets the criteria in 40 CFR 112 for oil storage quantities and its location near the Colorado River, the facility could reasonably be expected to discharge oil into or near the navigable waters of the United States. | The Project maintains a Spill Prevention, Control, and Countermeasures Plan (SPCC) and conducts quarterly visual inspections of oil storage containers. This plan covers both Moab and CJ sites. |
| Endangered Species Act (ESA) | The ESA prohibits activities that would jeopardize the continued existence of an endangered or threatened species or cause adverse modification to a critical habitat. | Moab's biological opinion includes an incidental take authorization (re-initiated in 2018) and Green River's biological opinion includes an incidental take authorization.<br><br>No known incidental take occurred at either location in 2024. |
| Executive Order (E.O.) 13751, "Safeguarding the Nation from the Impacts of Invasive Species" | E.O. 13751 calls on federal agencies to prevent the introduction, establishment, and spread of invasive species and to eradicate and control populations of invasive species that are established. | Invasive weeds are controlled with chemical, biological and mechanical methods. Section 5.2 summarizes the Project's invasive weed control efforts. |

*Table 1. Principle Regulatory Requirements and Status for the Moab Project (continued)*

| Federal or State Requirement | What it Covers | 2024 Implementation Status |
|---|---|---|
| **Other Environmental Statutes** | | |
| Migratory Bird Treaty Act (MBTA) | The MBTA implements various treaties and conventions among the U.S. and several other countries for the protection of migratory birds. Under the act, taking, killing, or possessing migratory birds, their body parts, nests, or eggs is unlawful. | During 2024, no endangered, threatened, or candidate species were noted on the Project sites. |
| 42 USC 11001, Emergency Planning and Community Right-to-Know Act (EPCRA) | EPCRA requires facilities with large quantities of hazardous or toxic chemicals, including petroleum products, to prepare emergency plans and report their inventories to EPA, the state, and local emergency planning groups. | The Project operated in accordance with emergency planning and annual reporting requirements and submitted Tier II Emergency and Hazardous Chemical Inventory Reports for 2024. |
| EO 11988, "Floodplain Management" | DOE's implementing regulations in 10 CFR 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements," identify the requirements of EO 11988 for actions that may affect floodplains. Portions of the Moab site fall within the 100-year floodplain of the Colorado River. | Activities conducted in the 100-year floodplain during 2024 were limited to seeding, mowing, irrigation, weed control, vegetative debris management and routine groundwater and surface water monitoring. None of these activities created adverse impacts or developments to the floodplain. |
| EO 11990, "Protection of Wetlands" | 10 CFR 1022 implements the requirements of EO 11990 for actions that may affect wetlands. | Project activities performed in 2024 that could enhance jurisdictional wetlands included storm water controls, revegetation, and erosion control. |

## 2.5 Summary of Permits

Table 2 shows the active environmental Project permits during 2024.

*Table 2. Active Permits for the Moab Project*

| Permits | Issuing Agency | No. of Permits |
|---|---|---|
| UPDES Construction General Permits: UTRC00000<br>1. Moab permit: UTR359185<br>2. Crescent Junction permit: UTR359187 | State of Utah, Department of Environmental Quality, Division of Water Quality | 2 |
| Temporary Change Application (No. 01-40 t49462 and t50824) to change points of diversion to support groundwater actions and a non-use application to extract water from the Colorado River | State of Utah, Department of Natural Resources, Division of Water Rights | 2 |

*Table 2. Active Permits for the Moab Project (continued)*

| Permits | Issuing Agency | No. of Permits |
|---|---|---|
| Green River Pipeline Easements for accessing pump station, settling pond and pipeline. | Private Landowner (Vetere family) | 2 |
| Special Permit SP-14283 Fourth Revision for DOE to transport RRM and party status for the RAC | U.S. DOT | 1 |
| Utah Special Fuel Permit (12446321-004-SFU), required for qualified motor vehicles or bulk storage of fuel | Utah State Tax Commission | 1 |
| Scientific Research and Collecting Permit ARCH-2021-SCI-0006 (Environmental Air Monitoring) | National Park Service | 1 |
| Asbestos Landfill Permit (MOA 021778) | State of Utah, Department of Environmental Quality, Division of Air Quality | 1 |
| Conditional Use Permit, Resolution #2006-2741 | Grand County Council | 1 |

# 3.0 Integrated Work Planning and Control

The Project's Integrated Work Planning and Control process identifies plans; approves, controls, monitors, and executes work; and captures opportunities for improvement. Environmental aspects are addressed in the first three core functions of Integrated Safety Management System (ISMS): define the scope of work, analyze the hazards, and develop and implement hazard controls. The ISMS includes environmental protection in the definition of safety. Once implemented, programs must be assessed, and any problems corrected to improve the effectiveness of the management system and to improve overall performance.

As part of the work planning process at the activity level, the Project utilizes an Environmental Aspects Checklist to consider environmental and human health impacts (adverse or beneficial) of new activities and any time an Integrated Work Plan is revised or updated. The Project determines the likelihood of an environmental aspect that could occur and the consequences if it does and then determines if the environmental aspect is significant, and if aspects have or could have a significant impact on the environment, the Project, or the Project's mission. The potential significant impacts of activities are then mitigated by controls identified in the Integrated Work Plan.

# 4.0 Environmental Radiological Protection Program and Dose Assessment

## 4.1 Minimizing Potential Dose to the Public and the Environment

**Dose Assessment**

Each year an estimate is made of the potential radiation dose to the public that is attributable to Moab UMTRA Project operations during that calendar year. Estimates are calculated to confirm that no individual could have received a dose that exceeds the limits for protection of the public, as established by DOE O 458.1 "Radiation Protection of the Public and the Environment". This section provides estimates of the maximum potential dose to the public and to plants and animals (biota) from 2024 UMTRA Project activities.

**2024 Highlights**

As in previous years, the estimated maximum potential dose from the Moab UMTRA Project site's locations to an off-site individual was well below the DOE public dose limits specified in DOE O 458.1 (see Section 4.7.3 Radiological Air Monitoring and Results). When compared to the national average public dose of radiation from natural and man-made sources (620 mrem annually total background), the Moab UMTRA Project is a very small fraction of additional radiation (4.25 mrem).

There has been a continuous reduction in environmental annual dose from the Moab UMTRA Project as the RRM is being transported from Moab to Crescent Junction.

**Total Dose from All Pathways.** The 2024 total estimated dose from the Project to an off-site resident was 4.25 mrem. The DOE annual public dose limit is 100 mrem from all pathways.

**Dose from the Air Pathway.** Annual air emissions of radioactivity are regulated by EPA and limited to 10 mrem per year at the maximally exposed off-site receptor. The total annual dose from airborne emissions was 2.68 mrem in 2024, well below the 10 mrem annual limit.

**Dose from the Water Pathway**. Dose from the surface water exposure pathway is not evaluated for the Moab UMTRA Project. The only potentially impacted surface water is the Colorado River, which is not a source of domestic water for Moab or other nearby downstream towns or cities. Groundwater is not considered an exposure pathway because no off-site public water supplies are drawn from aquifers potentially affected by the Moab UMTRA Project.

**Dose to Biota**. Biota dose modeling indicates the plants and animals living on or near the Moab UMTRA Project are not being exposed to doses in excess of the DOE biota dose standard, according to the "Radiological Impacts—Wildlife and Plants" section in the FEIS Appendix A.

## 4.2 Radiation Sources at the Moab UMTRA Project

The contaminated material at the Moab UMTRA Project site contains low levels of radioactive material, or residual radioactive material (RRM). This ore residue contains the radioactive decay products from the uranium chains (mainly the uranium-238 [U-238] decay chain) and heavy metals. The tailings also contain debris originating from dismantlement of the mill which is also considered RRM.

On average, there was approximately a 95% uranium extraction rate of the ore received at the Moab mill. The remaining leftover material is what makes up the mill tailings pile. The mill tailings (or RRM) are made up of the isotopes in Table 3 below, along with their average ratio by percentage. Samples from the tailings pile were analyzed by GEL Laboratories, an approved off-site laboratory. This study is not conducted every year. The last analysis was in 2018 but is still applicable. The ratios vary based on the quality of the ore being processed and its recovery percentage.

*Table 3. Moab UMTRA Project Mill Tailing Isotopes and Composition Percentages*

| Moab UMTRA Mill Tailings Isotopes | Percent concentration in Mill Tailings at the Moab Site |
|---|---|
| polonium-210 (Po 210) | 22.00% |
| radium-226 (Ra-226) | 20.86% |
| lead-210 (Pb-210[2]) | 19.70% |
| thorium-227 (Th-227) | 16.52% |
| thorium-230 (Th-230) | 12.10% |
| uranium (U-Nat, U-234, U-235, U-238) | 6.11% |
| radium-223 (Ra-223) | 1.26% |
| actinium-227 (Ac-227) | 0.89% |
| protactinium-231 (Pa-231) | 0.57% |

Members of the public are routinely exposed to natural and man-made sources of ionizing radiation. In 2006, an individual living in the U.S. was estimated to receive an average annual effective dose equivalent (EDE) of about 620 mrem (6.2 mSv) (National Council on Radiation Protection and Measurements [NCRP] Report 160, 2009). The average annual EDE is comprised of approximately 310 mrem/year is from natural background sources, such as cosmic radiation (from outer space); and terrestrial radiation and radon (from materials of the earth). The remainder is from man-made sources, such as consumer products and medical diagnostic procedures.

The estimated (all pathway) maximum individual dose from the Moab UMTRA Project in DOE Order 458.1 establishes requirements to protect the public and environment against undue risk from radiation. This order ensures DOE operations are conducted in a manner that limits any potential radiation exposures to ***A***s ***L***ow ***A***s ***R***easonably ***A***chievable (ALARA). ALARA is an approach to radiation protection that advocates controlling or managing radiation exposures to as low as technical and practical considerations permit, and as far below the applicable limits of the Order as practicable. Deliberate efforts are taken at every level of the work to minimize the time of exposure, to maximize the distance from the potential source, and to utilize shielding whenever possible. ALARA radiological controls protect the worker and, as a result, also protect the public and the environment.

## 4.3 Exposure Pathways

An exposure pathway consists of a route for contamination to be transported by an environmental medium from a source to a receptor. Typical potential exposure pathways include inhalation of gases and particulates, ingestion of locally grown food products and game, and exposure to external penetrating radiation emitted from contaminated materials. At the Moab UMTRA Project, the exposure pathways exclude ingestion and include inhalation and exposure to external penetrating radiation.

This section presents results of the calculated radiation dose to the public from Project operations in 2024. Compliance with DOE O 458.1 may be demonstrated by calculating the dose to the maximally exposed individual (MEI), which is the representative person or group from the public likely to receive the most radiation dose based on exposure pathways and parameters. See Section 4.7.3 (Radiological Air Monitoring and Results) for more details.

The Project established an MEI for each site. The maximum dose the public receives is calculated based on the MEI data and offsite monitoring locations. The DOE public dose limit is 100 millirems/year (mrem/yr) above background received through all the pathways, such as inhalation, ingestion, and direct radiation. A summary of the 2024 public radiation dose applicable to both the Moab and Crescent Junction sites compared to the DOE public dose limit is shown in Table 4.

*Table 4. Moab Project 2024 Public Radiation Dose*

| Exposure Pathways | Annual Individual Dose | | | Estimated Collective Population Dose (10,399 people live within 80 km radius) |
|---|---|---|---|---|
| | Critical Receptor (MEI dose) | Comparison to DOE Standards 100 mrem/yr. | Comparison to Natural Background Radiation | |
| **AIRBORNE RELEASE** | | | | |
| Total Airborne Dose | 2.68 mrem [1] (0.0268 mSv) | 2.68 mrem/yr | Airborne Natural Background Radiation not measured | 0.0027 person-rem (2.7E-5 person-Sv) |
| **DIRECT GAMMA READINGS** | | | | |
| Total Direct Gamma Dose (Utilizing OSL Dosimeter) | 5.80 mrem (0.058 mSv) | 5.80 mrem/yr | (84 mrem Moab) (92.5 mrem Crescent Junction) | 0.0058 person-rem (5.8E-5 person-Sv) |
| **Total Exposure All Pathways** | | | | |
| Total Direct Gamma and Airborne Dose | 8.48 mrem (0.085 mSv) | 8.48 mrem/yr | (84 mrem Moab) (92.5 mrem Crescent Junction) | 0.0085 person-rem (8.5E-5 person-Sv) |

[1] The maximum MEI dose for the Moab UMTRA Project (the Moab site only)
MEI = maximally exposed individual
Population within an 80 km radius is based on the Global Human Settlement Layer population grid 2024 = 10,399
mrem = millirem
mSv = millisievert

## 4.4 Clearance of Property Containing RRM

Remediation of Moab site contaminated soils from the off-pile areas (areas not associated with the tailings pile, including vicinity properties) is part of the Project scope to reduce potential health and environmental risks from historical uranium ore processing at the site. In 2024, DOE did not perform any off-pile or vicinity property remediation.

## 4.5 Radiation Protection of Biota

DOE O 458.1 requires protection of biota from adverse effects due to radiation and radioactive material released from DOE operations. Biotas are aquatic animals and terrestrial plants and animals that may be found at the Moab and Crescent Junction sites. The chemical composition (salt and pH) of the tailings pile materials and local soil conditions limit vegetative growth. There are similar conditions at the Crescent Junction site.

The estimated radiological dose to biota from RRM at the Project sites is indistinguishable from the dose from naturally occurring radioactive material found in the surrounding environment. Therefore, the Project does not currently monitor the effects of radiological doses to biota and has no plan to monitor these doses.

## 4.6 Unplanned Radiological Releases

No unplanned radiological releases occurred in 2024.

## 4.7 Environmental Radiological Monitoring

Before tailings removal and disposal operations began, DOE initiated environmental air monitoring at and near the Moab and Crescent Junction sites. This was performed to collect baseline data and assess the potential for radiation dose to members of the public that could result from site operations. The original contamination source at the Moab site (tailings pile) is reduced by approximately 5,000 tons/train, which also reduces the exposure potential to the public.

The Project's current environmental monitoring network measures radon, direct gamma radiation, and airborne radioparticulates at on-site and off-site locations. The Moab site monitoring locations for 2024 are shown in Figures 4 and 5. Figure 6 shows the Crescent Junction 2024 configuration after changes to the environmental monitoring network occurred. The 2024 naming structure is consistent with the names first assigned to these stations at the start of the project.

Environmental monitoring data are published in quarterly reports that are posted on the DOE Project website at *www.energy.gov/em/moab/moab-umtra-homepage* under Environmental Compliance and Plans. Reports are also available in the public reading room in the Grand County Library in Moab. Environmental monitoring data are also provided to the Grand County Moab Tailings Project Steering Committee liaison.

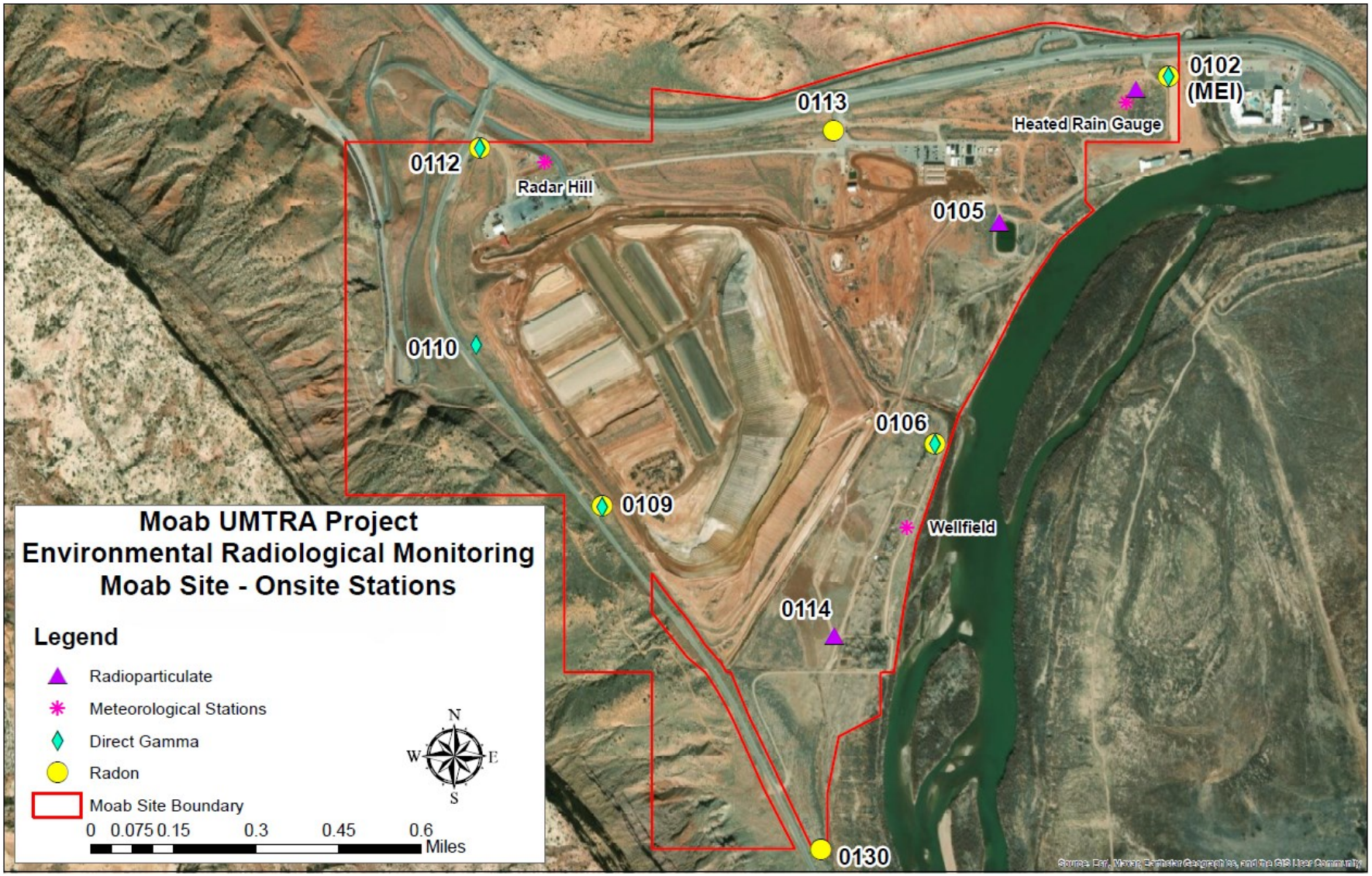


*Figure 4. Moab On-site Environmental Air Monitoring Locations for 2024*

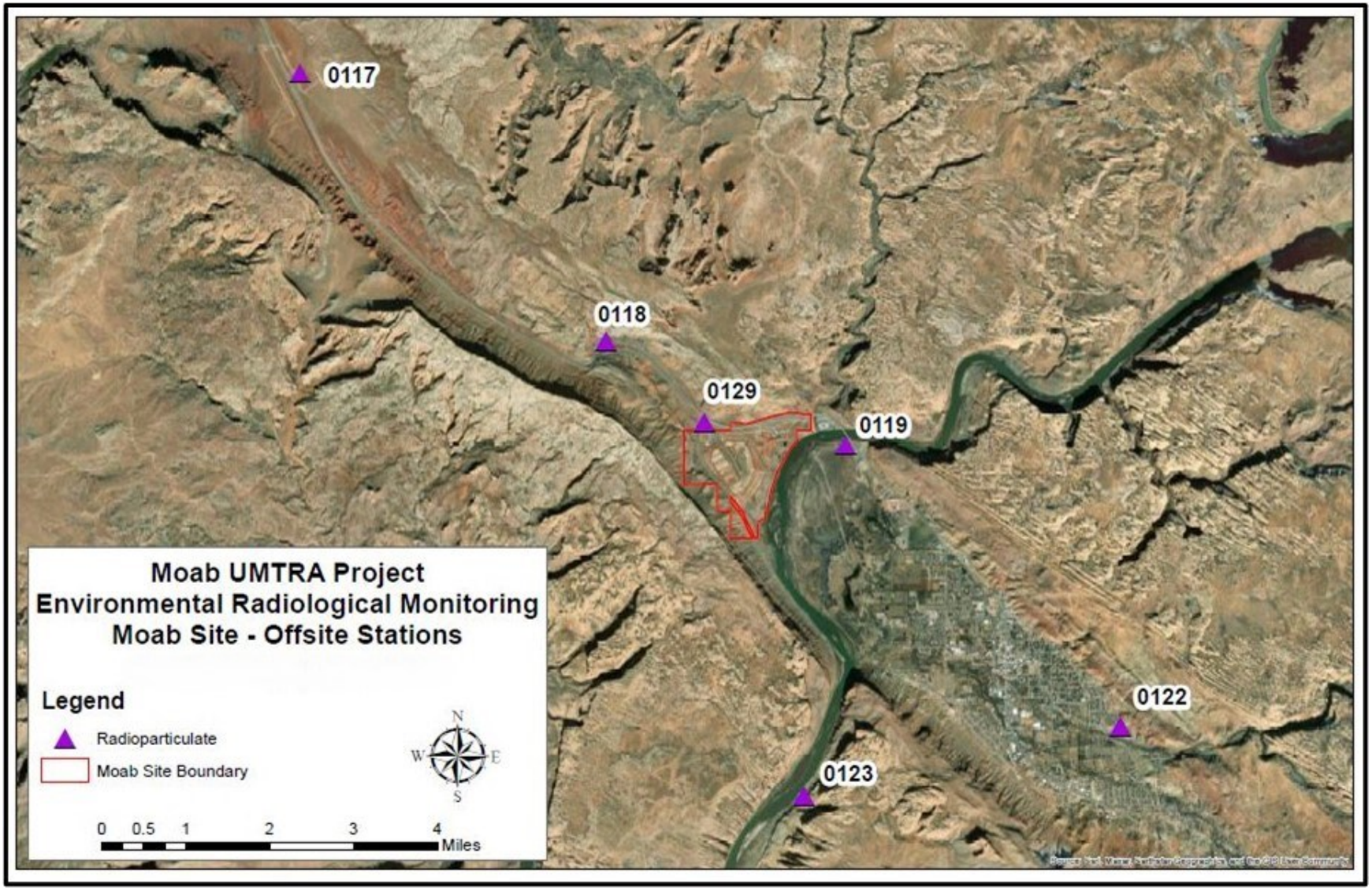


*Figure 5. Moab Off-site Environmental Air Monitoring Locations for 2024*

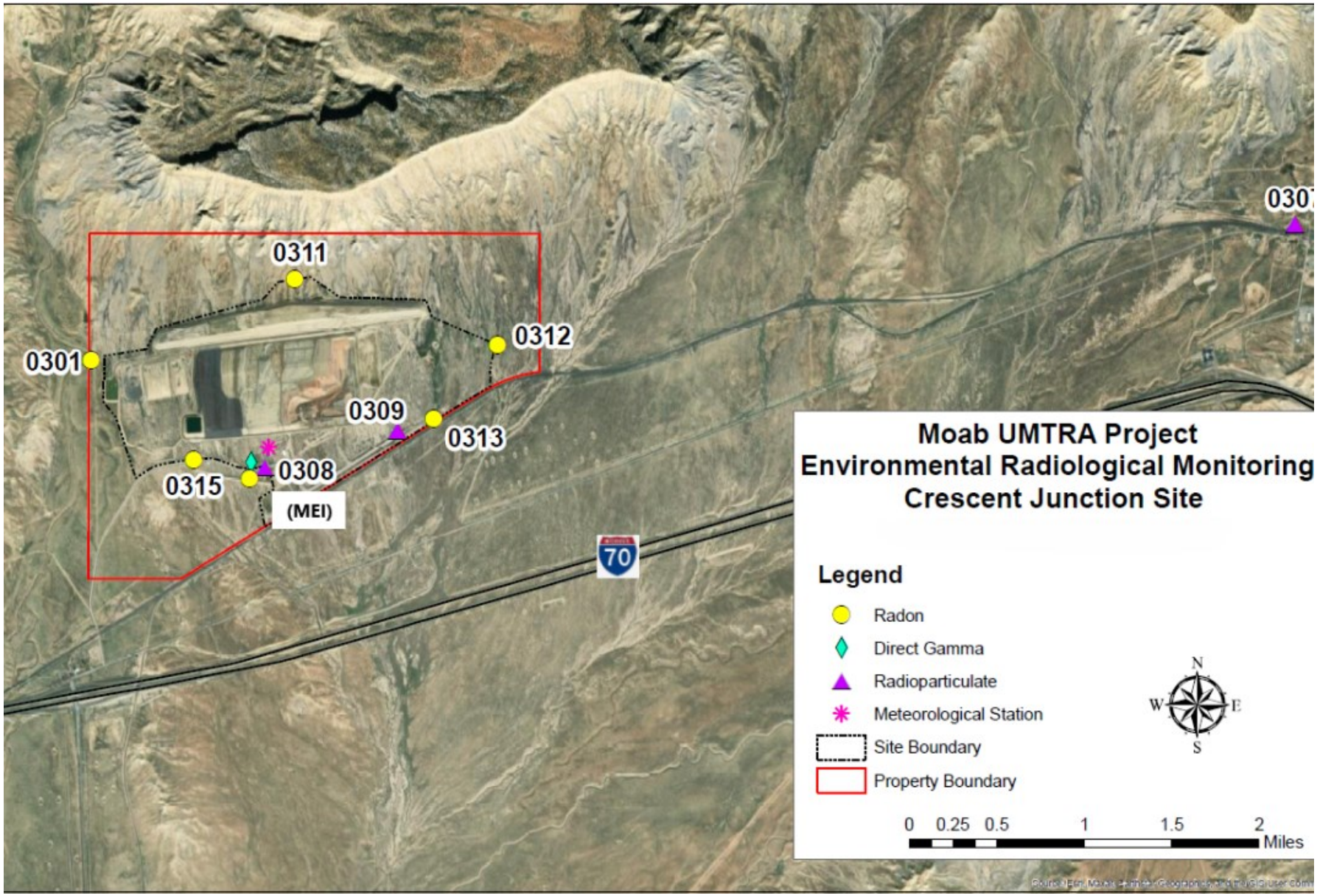


*Figure 6. Crescent Junction Site Environmental Air Monitoring Locations for 2024*

### 4.7.1 Regulatory Requirements

Environmental monitoring results are used to demonstrate compliance with DOE 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 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.

### 4.7.2 Radiological Air Monitoring and Results

**Radon**

Radon is a radioactive, colorless, odorless, tasteless noble gas, which occurs naturally in minute quantities 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. As a noble gas, radon does not remain in the lungs when breathed in, but it can produce a radiation dose to lung tissue for the short time it is in the lungs.

Radon was measured at 12 locations in 2024 (six at the Moab site and six at the Crescent Junction site) via alpha-sensitive detectors (e.g., radon cups) exposed for a period of approximately 90 days. After collection, the radon cups were sent to an off-site laboratory for analysis.

The background radon concentration for the Moab site is 0.6 pCi/L (previously 0.7 pCi/L in 2021) and the Crescent Junction site is also 0.6 pCi/L (previously 0.9 pCi/L in 2021). Both values were updated at the beginning of 2022. The reason for the adjustment was based on all continuing data being evaluated. Some locations (including the MEI's) were coming back from the laboratory with less than background results.

A summary of 2024 annual average radon concentrations (with background subtracted) are shown in Table 5 for the Moab and Crescent Junction sites. The measured levels are below the limit of 3.0 pCi/L. The Project is compliant with DOE O 458.1.

*Table 5. 2024 Annual Radon Average Concentrations for Moab and Crescent Junction Sites*

| Station Number | 2024 Average Radon Concentration (pCi/L) (Background subtracted) | Station Number | 2024 Average Radon Concentration (pCi/L) (Background subtracted) |
|---|---|---|---|
| **MOAB SITE** | | **CRESCENT JUNCTION SITE** | |
| **0102 (MEI)** | 0.44 | **0308 (MEI)** | 1.30 |
| **0106** | 1.88 | **0301** | <BKGD |
| **0130** | 0.67 | **0311** | 0.69 |
| **0109** | 0.56 | **0312** | <BKGD |
| **0112** | 0.55 | **0313** | 0.46 |
| **0113** | 0.84 | **0315** | 0.07 |

**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. Radioparticulates, along with direct gamma, are used to calculate the total effective dose (TED).

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.

Air filters were collected weekly and submitted as a composite sample on a quarterly basis. Samples are submitted to laboratories approved and either on the approved supplier list (ASL) or quality list in accordance with quality assurance requirements implemented on the project. The filters were analyzed at an approved laboratory for concentrations of total uranium, thorium-230, radium-226, polonium-210, and actinium-227. 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 results by a correction factor of 0.32, which is consistent with the *Moab UMTRA Project Health Physics Plan* (DOE-EM/GJ3003).

In 2024, air samplers measured radioparticulates at the following:

- At the Moab site: nine locations total (three on-site, six off-site, including one MEI; see Figures 4 and 5)
- At the Crescent Junction site: three locations in total (two on-site and one off-site, including one MEI; see Figure 6).

The radioparticulate data at the end of 2024 for the Moab and Crescent Junction sites are compiled in Table 6, which is considered dose from inhalation. Due to extensive changes of the air monitoring network and sampling methods, a 5-year summary is not included in this report.

*Table 6. 2024 Environmental Radioparticulate Effective Doses for the Moab and Crescent Junction Sites*

| Station Number & Description | 2024 Annual Radioparticulate Effective Dose (mrem/yr) |
|---|---|
| **Moab On-Site Locations** | |
| **0102 (MEI)** | 1.37 |
| **0105** | 2.09 |
| **0114** | 2.18 |
| **Moab Off-Site Locations** | |
| **0117** | 0.64 |
| **0118** | 1.74 |
| **0119** | 1.38 |
| **0122** | 0.93 |
| **0123** | 1.22 |
| **0129** | 2.82 |
| **CJ On-Site Locations** | |
| **0308 (MEI)** | 1.31 |
| **0309** | 1.84 |
| **CJ Off-site Locations** | |
| **0307** | 1.03 |

CJ = Crescent Junction
mrem = millirem

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

### 4.7.3 Direct Gamma Radiation

Gamma radiation is produced by the disintegration of radioactive atomic nuclei. Considered an external dose, direct gamma is used to calculate the TED along with radioparticulates.

Direct gamma is monitored for the Project's Maximally Exposed Individuals (MEIs) of the public at Moab and Crescent Junction. The MEI for the Moab Project Site is located at the east boundary of the site closest to the hotel complex (Figure 4). The MEI for Crescent Junction is located at the guard shack of the project. (Figure 6).

The annual background direct gamma dose is 84 mrem for Moab and 92.5 mrem for Crescent Junction, based on data collected from 2006 to 2009.

During 2024, direct gamma radiation was measured at five stations (four for Moab site and one for Crescent Junction) using Optically Stimulated Luminescence dosimeters (OSL) exposed for approximately 90 days. Crescent Junction is a remote site with only one residence 0.2 miles south of the site and unhabituated in all other directions, therefore only one station is necessary. The dosimeters are sent to an approved off-site laboratory for analysis.

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

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

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

Total dose is calculated for each direct gamma station quarterly and added together for an annual dose. See Table 7 for annual direct gamma results for both Moab and Crescent Junction sites.

*Table 7. 2024 Annual Direct Gamma Dose for Moab and Crescent Junction Sites*

| STATION NUMBER | 2024 DIRECT GAMMA ANNUAL DOSE (mrem) | COMMENTS |
|---|---|---|
| **MOAB SITE** | | |
| **0102** | 2.4 | Moab Site MEI |
| **CRESCENT JUNCTION SITE** | | |
| **0308** | 3.4 | Crescent Junction MEI |

MEI = Maximally Exposed Individual
CJ = Crescent Junction

The MEI doses from both sites are indistinguishable from background. Given this information, the Moab UMTRA Project is within compliance with DOE O 458.1.

### 4.7.4 Total Effective Dose

The (TED) for the Project is calculated for the MEI by using the following equation:

**(ɤ + P1) * 0.5 = TED (mrem)**

Where:
ɤ: Direct Gamma Dose with background subtracted (mrem)
P1: Radioparticulate Dose (mrem)
0.5: 50% occupancy rate for the MEI

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

**(2.40 mrem/yr + 1.37 mrem/yr) * 0.5 = 1.89 mrem/yr**

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

**(3.4 mrem/yr + 1.31 mrem/yr) * 0.5 = 2.36 mrem/yr**

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

# 5.0 Environmental Non-Radiological Program Information

## 5.1 Non-Radiological Environmental Monitoring

The Project manages storm water at the sites through controls specified in site-specific storm water pollution prevention plans (see Table 1) in accordance with the Clean Water Act (33 USC 1251) and the Utah Pollutant Discharge Elimination System (UPDES) General Permit for Discharges from Construction Activities, UPDES Permit No. UTRC00000. Monitoring includes routine monthly inspections and post-precipitation inspections for precipitation 0.5" or more in a storm event.

Fugitive dust and air opacity are monitored at the sites by Project personnel certified to EPA Method 9. In accordance with Utah Administrative Code R307-205-8, fugitive dust must not exceed 20% opacity at the site boundary. There were no opacity violations in 2024.
Oil storage containers are monitored for any oil leaks or spills under the *Moab UMTRA Project Spill Prevention, Control, and Countermeasure Plan* (DOE-EM/GJRAC1477) in accordance with 40 CFR 112 "Oil Pollution Prevention." Quarterly inspections are conducted at both sites.. No spills occurred in 2024 or reached any Waters of the US.

Meteorological data, including air temperature, relative humidity, wind speed, wind direction, and precipitation, are monitored at both sites. The data collected is stored and distributed site wide by a program developed by the TAC IT department (KWRS; Ken's Weather Reporting System). The Moab site currently has two meteorological monitoring stations and a heated rain gauge. Crescent Junction has two meteorological stations at or near the site (see Figures 4 and 6, respectively). These stations enable monitoring of site-specific meteorological conditions and events and provide a valuable resource for assessing impacts resulting from any unplanned release of airborne contamination.

## 5.2 Revegetation and Weed Control Program

Revegetation efforts are focused on two main goals in the first half of 2024: 1) maintaining native vegetation for dust suppression, and 2) managing non-native weed species. During the later portion of 2024 focus shifted to mowing and preparing the site for the Final Status Survey (FSS). The FSS will consist of soil sampling and related activities conducted for verification that the remediation standards in 40 CFR 192 have been met.

Promoting desirable native vegetation in 2024 includes the following:

- In the previously flood irrigated cottonwood plots in the wellfield where native seed mix, native shrubs and transplanted onsite inland salt grass were previously established the revegetation crew continued to maintain these areas including irrigation and timed mowing to promote native grasses.
- Continued to maintain desert willow (*Chilopsis linearis*) and three-leaf sumac (*Rhus trilobata*) along the Hwy 191 cottonwood hedgerow, along with 35 pollinator plants planted in the spring of 2023.
- Concluded a long-term repeat photo monitoring program in the wellfield revegetation areas. This project was concluded in 2024 after mowing these areas for the Final Status Survey sampling requirements.
- Continued to participate in the Southeast Utah Riparian Partnership (SURP), a local ecological restoration group consisting of different federal, state, and local agencies, led by Rim-to-Rim Restoration.

Managing non-native weed species in 2024 includes the following:

- Collaborated with the Utah Division of Natural Resources to successfully control encroaching noxious weeds (i.e., tamarisk and Russian knapweed) along a shared boundary.
- Based on the previous Watershed Restoration Initiative grant award, the Moab UMTRA Project was awarded herbicide from the State of Utah to treat noxious weeds.
- Staff treated noxious weed species in 12 out of 27 revegetation management zones, including Russian knapweed (*Centaurea repens*), tamarisk (*Tamarix ramosissima*), goathead (*Tribulus terrestris*), field bindweed (*Convolvulus arvensis*), and emerging Russian olive (*Elaeagnus angustifolia*;).
- Previously released biocontrol for Russian knapweed noxious weed control, stem gall wasps observed in multiple location on the site.
- Significantly reduced weed cover, specifically kochia, through mowing at appropriate times, allowing native bunch grasses to flourish.

Refer to the *Moab UMTRA Project Revegetation and Weed Control Plan,* (DOE-EM/GJRAC1655) for more details.

### 5.3 Fire Protection Management and Planning

No wildland fires occurred at the sites in 2024. Dead vegetation, weeds, and windblown materials are cleared near buildings and equipment to minimize fire hazards. Weed control and vegetative debris management are performed in other areas of the sites. Refer to the *Moab UMTRA Project Wildland Fire Management Plan* (DOE-EM/GJ2150).

### 5.4 Recreational Hunting and Fishing

No recreational hunting or fishing is allowed on the Project sites.

## 6.0 Groundwater Protection Program

Former uranium mill operations resulted in ammonia and uranium contamination of the groundwater underneath and downgradient of the tailings pile and of the mill/ore storage area. The main objectives of the Groundwater Program are to protect human health and the

environment by reducing the ammonia and uranium contaminant mass from the underlying groundwater system. The system also protects young-of-year endangered fish species seasonally from exposure to site contaminants in suitable habitats that may develop in Colorado River side channels. The groundwater Interim Action remediation system accomplishes these objectives by extracting contaminated groundwater near the tailings pile, injecting freshwater along the riverbank, and diverting river water directly to the habitat area when a suitable habitat forms.

Site-wide monitoring results show the extent of contaminant plumes has not significantly changed in the past five years. This is consistent with IA system extraction concentrations which have decreased since startup in 2004 and now approaching a near steady state, indicating a constant contaminant source term. Figures 7 and 8 show the ammonia and uranium plumes along with sample results at the Moab site, respectively. The ammonia concentration remain highest along the toe of the tailings pile, and elevated uranium concentrations were detected near the base of the tailings pile and near the vicinity of the former uranium mill, just northeast of the pile. Groundwater flows toward the southeast, discharging to the Colorado River during river base flows.

The IA remediation system operated effectively through 2024. Groundwater samples were collected to evaluate IA performance by calculating contaminant mass removal using extracted volumes and by reduced concentrations up and downgradient of freshwater injection wells. Surface water samples were also collected to evaluate any impacts to the Colorado River.

With the approach of site closure and the development of a Groundwater Compliance Action Plan (GCAP), the Moab site collaborated with personnel from the Pacific Northwest National Laboratory (PNNL) in performing field studies to address data gaps. Boat-tow geophysics were conducted, and the installation of an electro-resistivity tomography (ERT) system were performed to monitor the interaction of the Colorado River with site geology. Riverbed sampling and installation of temperature sensors were also installed to monitor ammonia discharge and groundwater/surface water interaction at the riverbank, respectively.

PFAS contamination is not a present concern at the Moab UMTRA Site. In 2023, a historical records search was conducted to determine possible past use and/or known releases of PFAS-containing products at the Moab UMTRA site. Though a fire suppression system that contained PFAS in a since-decommissioned mill building was identified, no known releases of PFAS containing products were found. No samples have been collected and analyzed for new or emerging contaminants on-site, including perfluoro octane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perchlorates, or 1,4-dioxane.

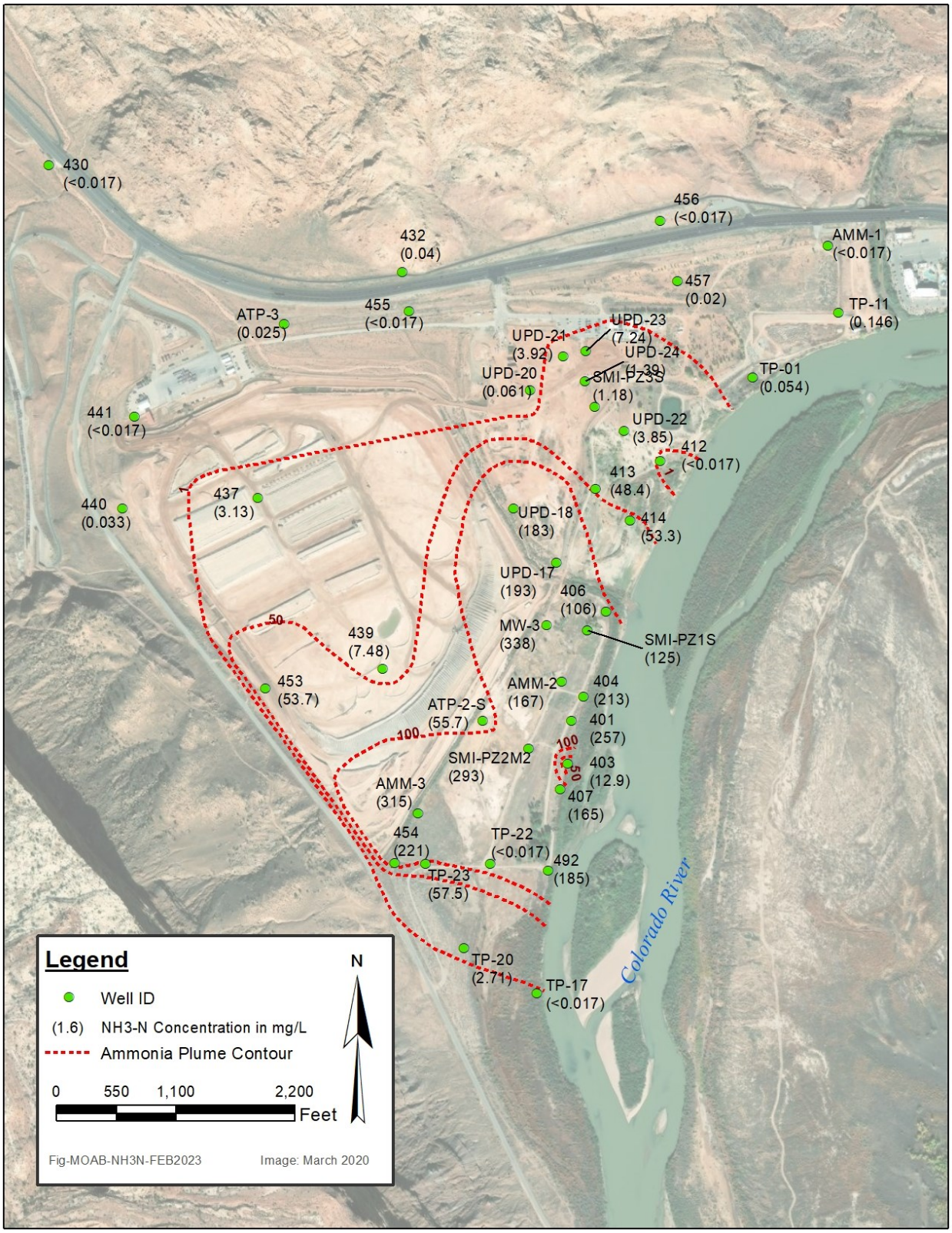


*Figure 7. 2024 Ammonia Plume Contours and Select Monitoring Well Sampling Locations*

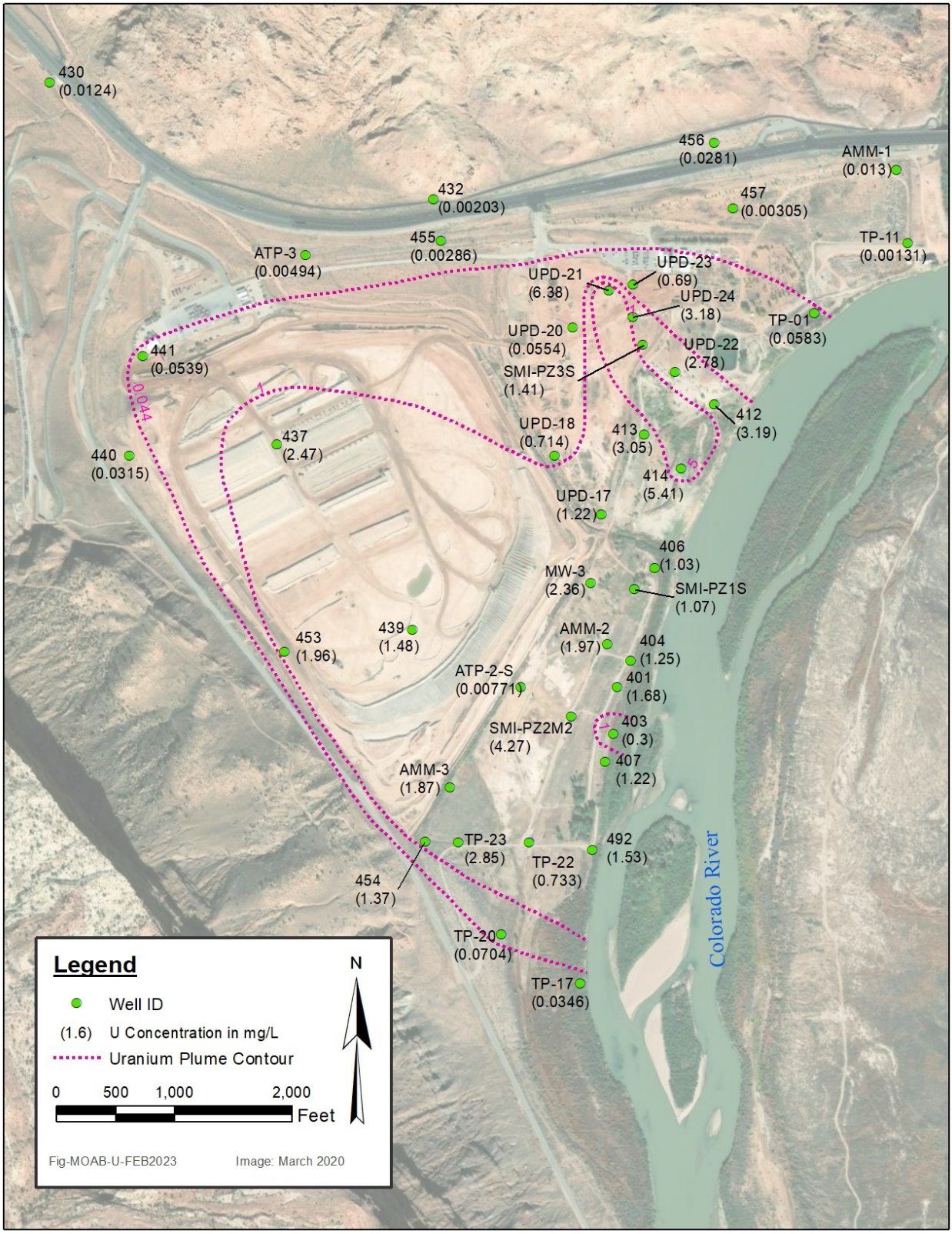


*Figure 8. 2024 Uranium Plume Contours and Select Monitoring Well Sampling Locations*

## 6.1 Groundwater

In 2024, the IA remediation system, including six (of eight) extraction wells and ten injection wells, operated to minimize contaminant discharge to the Colorado River (Figure 9). Extracted groundwater was pumped to a water storage tank, located on the northeastern side of the tailings pile, where it was used as dust control inside the contamination area.

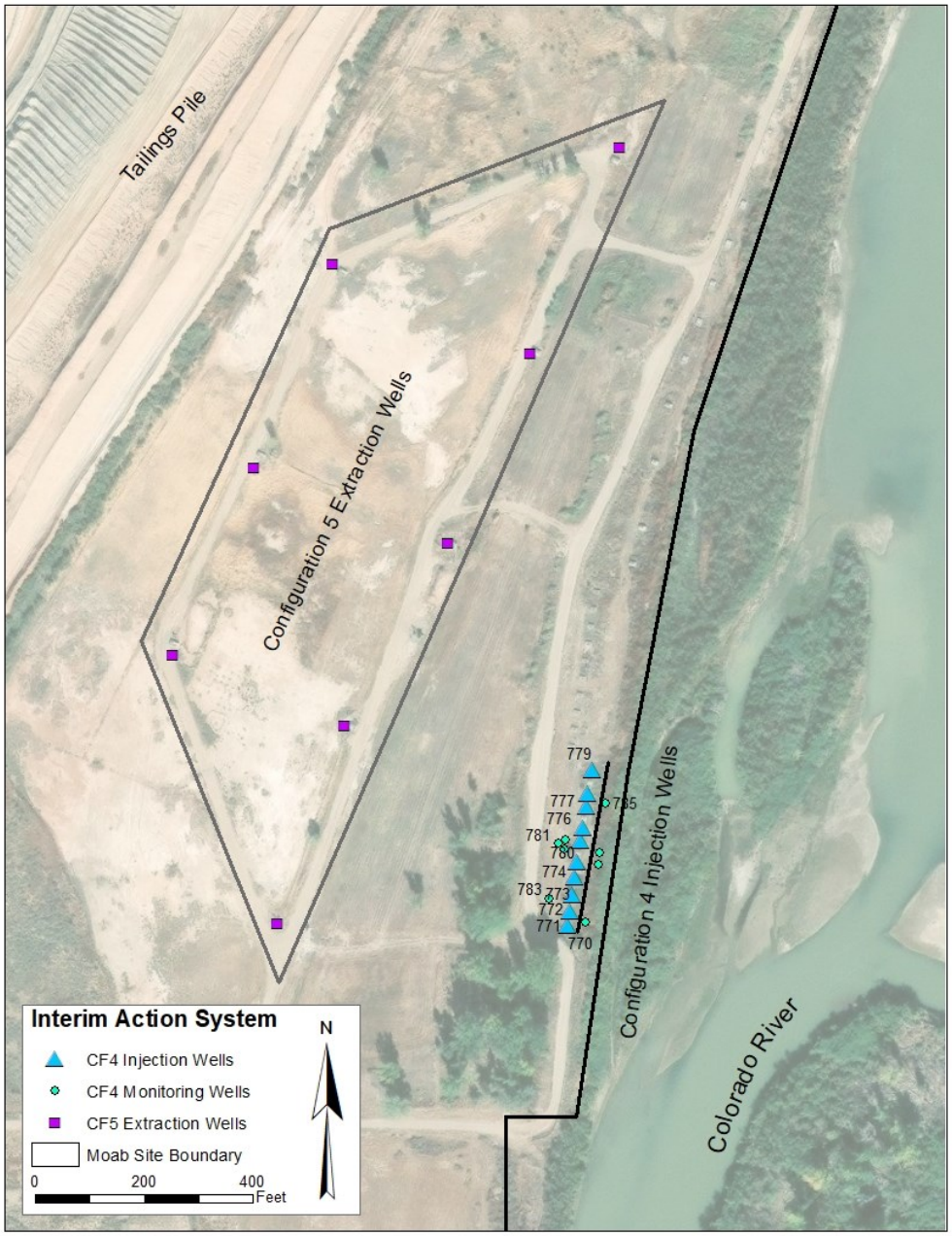


*Figure 9. Groundwater Extraction and Freshwater Injection System Well Locations*

Samples were collected directly from extraction wells during operation to calculate contaminant removal mass. Monitoring wells adjacent to injection wells were sampled to assess the impact injection would have on concentrations adjacent to the river. These samples were collected in April and October 2024 and were analyzed for ammonia and uranium, the two primary constituents of concern.

A site-wide sampling event was completed in January/February 2024 to assess contaminant plumes and surface water impact. As the project has moved toward closure and is developing a Groundwater Compliance Action Plan (GCAP), an expanded list of analytes (ammonia, arsenic, copper, manganese, selenium, sulfate, total dissolved solids, and uranium) has been retained to the site-wide sampling set to evaluate potential constituents of concern and aquifer salinity. Sample locations include monitoring wells upgradient of the tailings pile and mill site, within the footprint of the tailings pile and around the millsite, and downgradient along site boundaries. In addition, surface water samples were collected from the Colorado River. Figures 7 and 8 provide well locations and analytical results for ammonia and uranium from this event.

Table 8 shows the ammonia and uranium concentrations over the past five years at representative well locations ATP-3 (an observation well upgradient of the tailings pile), 0439 (an observation well within the footprint of the tailings pile), SMI-PZ2M2 (an observation well downgradient of the tailings pile adjacent to the extraction system) and 0403 (an observation well near the riverbank).

Groundwater contaminant concentrations are impacted by the Colorado River flows, especially in wells located along the riverbank. During peak flows (generally April through July), fresh water migrates into the subsurface and alters the aquifer geochemistry. Ammonia concentrations tend to decrease, while uranium concentrations increase due to the presence of oxygenated water. Once base flows are re-established (August through March), the contaminants tend to rebound to pre-runoff concentrations. River flows especially impact the groundwater concentrations detected in samples collected from well 0403 (located on the riverbank) and to a lesser extent well SMI-PZ2M2 (located approximately 420 ft from the riverbank).

Because the Colorado River experiences base flow most of the year, samples collected during this timeframe best represent the overall groundwater chemistry. For better comparison purposes and to display the concentration changes as the groundwater flows towards the river, Table 8 provides groundwater ammonia and uranium concentrations measured during the river base flows.

*Table 8. Representative Groundwater Well Sampling Results over Past Five Years*

| Year | Well ATP-3 (51 ft bgs)* Upgradient | | Well 0439 (36 ft bgs)* Tailings Pile | | Well SMI-PZ2M2 (56 ft bgs)* Extraction System | | Well 0403 (18 ft bgs)* Downgradient | |
|---|---|---|---|---|---|---|---|---|
| | Ammonia Total as N (mg/L) | U (mg/L) | Ammonia Total as N (mg/L) | U (mg/L) | Ammonia Total as N (mg/L) | U (mg/L) | Ammonia Total as N (mg/L) | U (mg/L) |
| 2020 | – | – | – | – | 500 | 2.7 | 99 | 0.92 |
| 2021 | 0.2 | 0.0046 | 19 | 1.7 | 400 | 2 | 63 | 0.71 |
| 2022 | 0.2 | 0.0024 | 0.2 | 1.5 | 450 | 2.6 | 18 | 0.96 |
| 2023 | 0.14 | 0.00236 | 0.94 | 1.51 | 290 | 3.63 | 53.5 | 1.05 |
| 2024 | 0.025 | 0.00489 | 7.48 | 1.48 | 293 | 4.27 | 12.9 | 0.3 |

*denotes sample depth

Well ATP-3 is upgradient of the tailings pile and not impacted by site operations. Sampling results indicate ammonia and uranium concentrations are generally at the detection limit or representative of natural concentrations. Wells 0439, SMI-PZ2M2, and 0403 have been affected by the tailings pile with elevated concentration. Ammonia concentrations in samples collected from these locations have fluctuated dynamically over the past five years due to the influence of

the Colorado River's seasonal flow variability. Uranium concentrations fluctuate less dynamically and remain above the 40 CFR 192 water quality standard of 0.044 milligrams per liter (mg/L).

Figure 10 summarizes 2024 sampling results in relation to applied standards, and Table 9 shows the average, median, ranges of results and associated regulatory standards of analytes in groundwater and surface water samples. Results associated with IA performance and contaminant plume monitoring were consistent with previous samples and contaminant plumes have shown little change in the last five years. Full data results from 2024 sampling events (along with previous years) are available on the Project website at www.energy.gov/em/moab/moab-umtra-homepage and in the Grand County Library public reading room in Moab.


*Figure 10. 2024 Groundwater Sample Collection/Analysis Summary*

*Table 9. 2024 Groundwater and Surface Water Sample Result Summary*

| Analyte | Standard (mg/L) | Range of Results (mg/L) | Average (mg/L) | Median (mg/L) |
|---|---|---|---|---|
| **Groundwater** | | | | |
| Ammonia Total as N | 3[F] | <0.017 – 343 | 80.3 | 3.92 |
| Arsenic | 0.05** | <0.005 – 0.292 | 0.016 | 0.005 |
| Copper | 1.3*** | <0.003 – 0.039 | <0.005 | <0.003 |
| Manganese | NA | <0.002 – 5.880 | 1.029 | 0.349 |
| Selenium | 0.01** | <0.006 – 0.783 | 0.093 | 0.028 |
| Sulfate | NA | 154 – 14,800 | 3548 | 2660 |
| TDS[†] | NA | 948 – 103,000 | 19801 | 6810 |
| Uranium | 0.044** | 0.001 – 6.380 | 1.127 | 0.690 |

*Table 9. 2024 Groundwater and Surface Water Sample Result Summary (continued)*

| Analyte | Standard (mg/L) | Range of Results (mg/L) | Average (mg/L) | Median (mg/L) |
|---|---|---|---|---|
| **Surface Water** | | | | |
| Ammonia Total as N | Variable* | 0.04 – 0.66 | 0.18 | 0.09 |
| Arsenic | 0.05** | <0.005 | <0.005 | <0.005 |
| Copper | 1.3*** | <0.003 | <0.003 | <0.003 |
| Manganese | NA | 0.010 – 0.049 | 0.02 | 0.01 |
| Selenium | 0.01** | <0.006 – 0.0111 | 0.007 | 0.006 |
| Sulfate | NA | 227 – 270 | 235 | 230 |
| TDS† | NA | 722 – 820 | 753 | 742 |
| Uranium | 0.044** | 0.005 – 0.014 | 0.007 | 0.006 |

* Variable based on pH and temperature. See Table 10.
** Standard based on Table 1 in *40 CFR 192*
*** Standard based on EPA Action Level
ŀProposed standard from *Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties, Utah, Final Environmental Impacts Statement*
† Total Dissolved Solids

## 6.2 Surface Water

The Colorado River is the primary surface water feature potentially impacted by groundwater contamination. Ammonia is a concern because of its toxicity to aquatic life. The purpose of the freshwater injection system is to create a hydraulic barrier and dilute contaminant concentrations discharging into the Colorado River. Approximately 3.3 million gallons of fresh water were injected into the subsurface adjacent to the Colorado River in 2024.

The surface water diversion system is designed to further protect aquatic life from elevated contaminant concentrations in river side channels adjacent to the site where suitable habitats may develop. During 2024 a suitable habitat did not develop in any side channels adjacent to the site. Therefore, it was not necessary to operate this system and no water was diverted.

Samples were collected from seven surface water locations on site, upriver, and downriver (see Figure 10) for laboratory analysis at base flow (February 2024) conditions. Table 10 provides information for the surface water locations and the EPA acute and chronic ammonia criteria. In 2024, no surface water samples exceeded EPA ammonia criteria. Additional data results from sampling events are available on the Project website at www.energy.gov/em/moab/moab-umtra-homepage.

*Table 10. 2024 Ammonia Concentrations in Site-wide Surface Water Samples Compared to EPA Criteria*

| Sample Location | Sample Date | Temperature (°C) | pH | Ammonia as N (mg/L) | Acute Criteria (mg/L)* | Chronic Criteria (mg/L)** |
|---|---|---|---|---|---|---|
| 0201 | 2/6/24 | 5.8 | 8.27 | 0.074 | 4.9 | 1.1 |
| 0218 | 2/6/24 | 5.4 | 8.72 | 0.057 | 2.3 | 0.57 |
| 0226 | 2/7/24 | 6.5 | 8.42 | 0.229 | 4.1 | 0.95 |
| CR1 | 2/6/24 | 5.4 | 8.40 | 0.042 | 4.1 | 0.95 |
| CR2 | 2/6/24 | 5.7 | 8.27 | 0.088 | 4.9 | 1.1 |
| CR3 | 2/7/24 | 7.7 | 8.31 | 0.658 | 4.9 | 1.1 |
| CR5 | 2/6/24 | 5.5 | 8.30 | 0.108 | 4.9 | 1.1 |

*U.S. EPA Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater State (Effective April 2013), Table N.4., Temperature and pH-Dependent Values, Acute Concentration of Total Ammonia as N (mg/L)
**U.S. EPA Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater State (Effective April 2013).

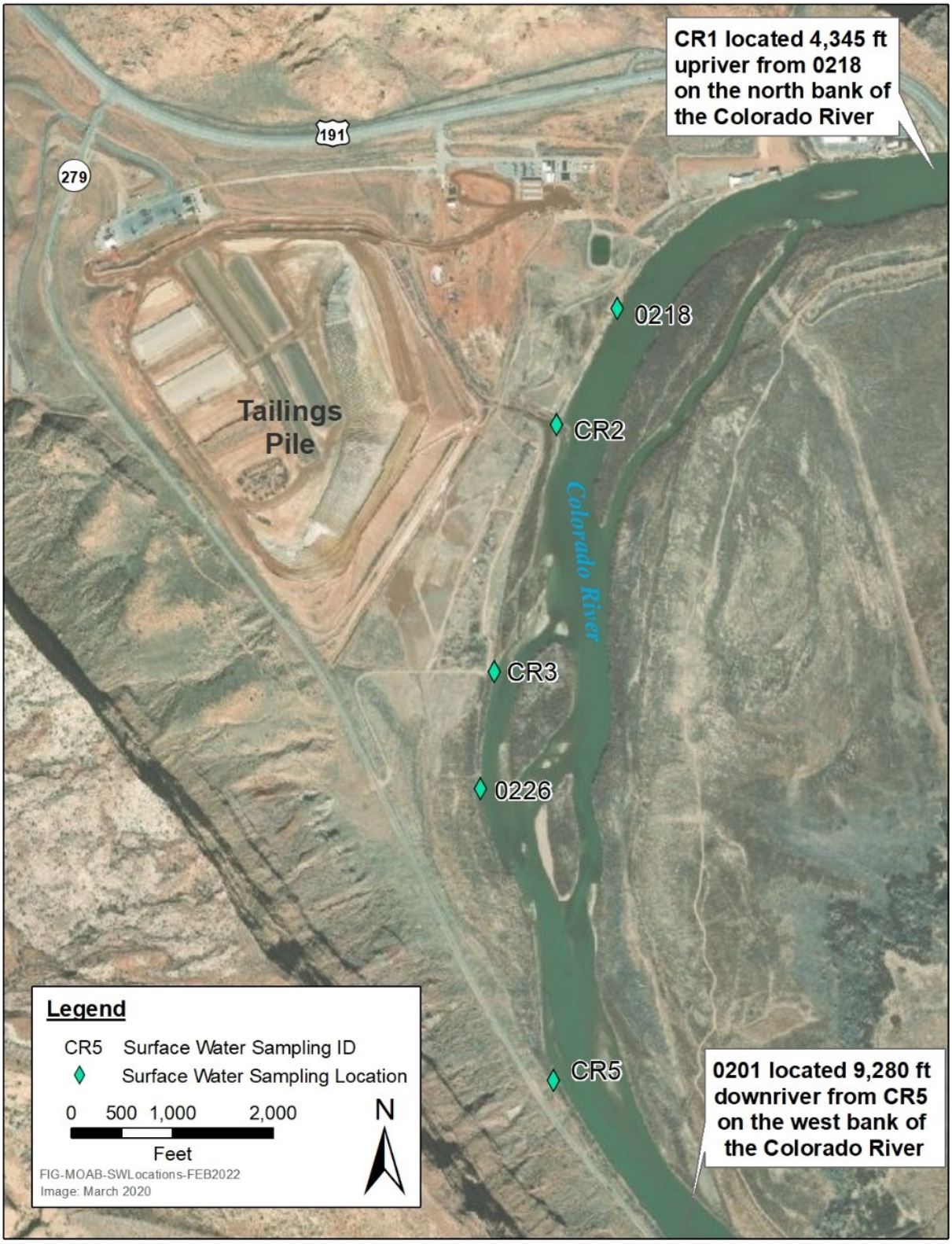


*Figure 11. 2024 Site-wide Event Surface Water Sampling Locations*

# 7.0 Quality Assurance

Environmental monitoring conducted by the Moab UMTRA Project is performed in accordance with an established and comprehensive Quality Assurance Program (QAP). The QAP describes the measures used to ensure the quality of radiological and non-radiological data and complies with the requirements of American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA) consensus standards, "Quality Assurance Requirements for Nuclear Facility Applications," Title 10 Code of Federal Regulations Part 830 (10 CFR 830), "Nuclear Safety Management," Subpart A, "Quality Assurance Requirements," DOE O 414.1E Chg 2, "Quality Assurance," and DOE Office of Environmental Management (EM) "EM Quality Assurance Program" (EM-QA-001, Revision 2). These requirements are flowed down through quality assurance (QA) implementing procedures and environmental sampling and analysis plans.

The degree of application of the QA requirements is dependent on the importance of the structures, systems, and components or activities affecting the safety of the operations and the health and safety of the worker, public, or the environment. This is accomplished through the "graded approach" process, which determines the appropriate level of effort necessary to attain and document the requirements.

## 7.1 Laboratory Analysis and Qualification

### 7.1.1 Analytical Laboratories

The Project flows down QAP requirements to subcontracted, qualified analytical laboratories to ensure that the data produced is defensible, valid, reliable, and can be used to support decision-making for clean-up, remediation, and on-going operations. The following laboratories were used for analysis of environmental samples in 2024: 1) GEL, Charleston, SC, for radiological and non-radiological analytes, 2) Radonova, Lombard, Illinois, for radiological analytes; and 3) Landauer Dosimetry Services, 2 Science Road Glenwood, IL 60425-1586 USA, for total gamma radiation dose.

All samples were analyzed according to EPA-approved methods or by standard industry methods where no EPA methods are available. In addition, environmental technicians performed field monitoring for parameters including conductivity, pH, ORP, temperature, and turbidity.

### 7.1.2 Laboratory Qualification

Radonova was qualified under the American Association of Radon Scientists and Technologists National Radon Proficiency Program (AARST NRPP); Radon Detector Performance Testing; ISO 17025; and ISO 9001. Landauer Dosimetry Services was qualified under the Remedial Action Contractor UMTRA DOELAP Audit Program and National Voluntary Laboratory Accreditation Program (NVLAP). GEL was qualified under the National Environmental Laboratory Accreditation Program (NELAP); ISO 17025:2005 Department of Energy Consolidated Audit Program (DOECAP) State of Utah Environmental Laboratory Certification Program Certification Perry Johnson Laboratory Accreditation Certificate of Accreditation (DoD-ELAP).

### 7.1.3 Verification and Validation

Environmental data are verified and validated according to QA implementing procedures and environmental sampling and analysis plans. Verification includes evaluating the completeness, correctness, and compliance of data against plans/procedures, methods, and contractual

requirements. Data validation is used to determine if data meets the specific technical and quality control criteria established, and to establish the usability and extent of bias of any data not meeting those criteria through the evaluation of an analytical data package. A graded approach is applied to determine validation requirements and data is validated at a level corresponding to the analytical service level specified. Certain data may require a higher level of confidence or defensibility. This data requires complete validation to meet the data use requirements.

### 7.2 Assessments and Issues Management

The effectiveness of the Environmental Program is routinely evaluated through QA implementation of a formal and comprehensive assessment program that includes audits, independent assessments, external certification, and self-assessments. Deficiencies identified are promptly identified, managed thorough a robust Issues Management Program, and corrected as soon as practicable. Completion of corrective actions and their effectiveness is verified and documented.

### 7.3 Records Management

All documentation associated with this ASER is considered a Project record and will be managed in accordance with the *Moab UMTRA Project Records Management Program Plan* (DOE-EM/GJ1545), which follows DOE orders, policies, and regulations for retention and maintenance of records.

## 8.0 References


10 CFR 1022 (Code of Federal Regulations), "Compliance with Floodplain and Wetland Environmental Review Requirements."

36 CFR 800 (Code of Federal Regulations), "National Historic Preservation Act."

40 CFR 61 (Code of Federal Regulations), "National Emission Standards for Hazardous Air Pollutants."

40 CFR 112 (Code of Federal Regulations), "Oil Pollution Prevention."

40 CFR 192 (Code of Federal Regulations), "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings."

7 USC 136 (United States Code), Federal Insecticide, Fungicide, and Rodenticide Act.

16 USC 703-712 (United States Code), Migratory Bird Treaty Act.

16 USC 1531-1544 (United States Code), Endangered Species Act.

42 USC 85 (United States Code), Clean Air Act.

42 USC 300f (United States Code), Safe Drinking Water Act.

42 USC 2011-2021 (United States Code), Atomic Energy Act.

42 USC 7901 (United States Code), Uranium Mill Tailings Radiation Control Act.

42 USC 11001 (United States Code), Emergency Planning and Community Right-to-Know Act.

42 USC 17001 (United States Code), Energy Independence and Security Act.

DOE (U.S. Department of Energy), *"PFAS Strategic Roadmap: DOE Commitments to Action 2022-2025."*

DOE (U.S. Department of Energy), *National Environmental Protection Act Implementing Procedures, June 30, 2025.*

DOE (U.S. Department of Energy), *Moab UMTRA Project Records Management Program Plan* (DOE-EM/GJ1545).

DOE (U.S. Department of Energy), *Moab UMTRA Project Revegetation and Weed Control Plan* (DOE-EM/GJRAC1655).

DOE (U.S. Department of Energy), *Moab UMTRA Project Wildland Fire Management Plan* (DOE-EM/GJ2150).

DOE (U.S. Department of Energy), *Moab UMTRA Project Climate Change Vulnerabilities and Resiliency Plan* (DOE-EM/GJ2193).

DOE (U.S. Department of Energy) Order 231.1B Admin Chg 1, "Environment, Safety and Health Reporting."

DOE (U.S. Department of Energy) Order 414.1E Chg 2, "Quality Assurance."

DOE (U.S. Department of Energy) Order 435.1 Chg 2, "Radioactive Waste Management."

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DOE (U.S. Department of Energy), *Record of Decision for the Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties, Utah* (6450-01-P).

DOE (U.S. Department of Energy), *Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties, Utah, Final Environmental Impact Statement* (DOE/EIS-0355).

Executive Order 11988, "Floodplain Management."

Executive Order 11990, "Protection of Wetlands."

Executive Order 13751 "Safeguarding the Nation from the Impacts of Invasive Species."

ISO (International Organization for Standardization) Standard 14001:2015, "Environmental Management Systems."

National Council on Radiation Protection and Measurements Report No. 160. *Ionizing Radiation Exposure of the Population of the United States* (2009).

National Council on Radiation Protection and Measurements Report No. 184. *Medical Radiation Exposure of Patients in the United States* (2019).

Public Law 106-398, Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001.

Public Law 110-140, Energy Independence and Security Act of 2007.

UAC R307-205-8 (Utah Administrative Code), "Emission Standards; Fugitive Emissions and Fugitive Dust; Tailings Piles and Ponds."

U.S. Census Bureau, *https://data.census.gov*.