DOE–EM/GJ1921

Office of Environmental Management – Grand Junction

UMTRA Project

Moab UMTRA Project Annual Site Environmental Report for Calendar Year 2009

September 2010

U.S. Department of Energy

Office of Environmental Management

Prepared by the Remedial Action Contractor under contract number DE-AT30-07CC00014
for the U.S. Department of Energy Office of Environmental Management, Grand Junction, Colorado.

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Revision 0

Review and Approval

Edward B. Baker — 9-29-10
RAC Environmental Compliance Manager — Date

Lawrence M. Brede — 9/29/10
RAC Project Manager — Date

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Moab Federal Project Director — Date

Revision History

Revision No.	Date	Reason/Basis for Revision
0	September 2010	Initial issue.

Table of Contents

Figures

Tables

Acronyms and Abbreviations

ACM	asbestos-containing material
ALARA	as low as reasonably achievable
ARRA	American Recovery and Reinvestment Act
BMPA	Best Management Practice Area
BO	Biological Opinion
CA	Contamination Area
CFR	Code of Federal Regulations
DCG	derived concentration guide
DOE	U.S. Department of Energy
DOE O	DOE Order
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
I-70	Intertate 70
IA	interim action
lb	pounds
MEI	maximally exposed individual
mrem/yr	millirems per year
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RRM	residual radioactive material
SR-279	State Route 279
TSCA	Toxic Substances Control Act
UAC	Utah Administrative Code
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
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service

Executive Summary

This Annual Site Environmental Report presents information pertaining to environmental activities conducted for the U.S. Department of Energy (DOE) under the Moab Uranium Mill Tailings Remedial Action (UMTRA) Project during 2009. This report includes activities conducted at either the Moab site located near Moab, Utah, or the Crescent Junction, Utah, site, located approximately 30 miles north of the Moab site.

The purpose of the Annual Site Environmental Report is to summarize major site programs, environmental performance measures, and the status of an implementing Environmental Management System (EMS). The Annual Site Environmental Report is a key component of DOE efforts to keep the public informed of environmental conditions at DOE sites. Consequently, this report contains monitoring data and compliance information for 2009.

Primary site activities in 2009 included the completion of major infrastructure construction at the Moab and Crescent Junction sites and the beginning of uranium mill tailings haulage in April. Other activities included site management, security, maintenance, waste management, pollution prevention, and environmental compliance monitoring (air and surface water). In addition, non-pile soils remediation and operation of the surface water initial action and interim action (IA) ground water remediation systems occurred at the Moab site.

Highlights of Site Activities and Summary of Environmental Programs for 2009
Significant accomplishments and activities conducted for the Moab UMTRA Project during 2009 are highlighted below. In addition, summaries of environmental programs are provided. During 2009, the Moab and Crescent Junction sites received no notices of violation and did not have any environmental occurrences that required reporting to outside agencies.

Major Project Accomplishments

- Much of the work over the past year was major construction activities in preparation for beginning the mill tailings haul in April.
- The U.S. Department of the Interior approved a 20-year renewal of 936 acres of land held in temporary withdrawal for support facilities associated with the disposal cell at the Crescent Junction site in June.
- Using funding awarded under the American Recovery and Reinvestment Act (ARRA), the project began a fifth weekly shipment (Friday) in mid-June. ARRA funding was used to hire additional personnel for a second work shift and to procure equipment to support acceleration of the tailings haul by increasing weekly shipments from five to 10 starting in mid-August.
- The project placed asphalt on the Crescent Junction disposal site roadways and Moab site haul roads, lidding structure area, and rail load-out area in June and July.
- Railroad crossing upgrades and track improvements on the Cane Creek Subdivision line were also performed along the entire tailings rail route.

Moab Site Remediation and Construction Activities

- Contractors completed construction of the Moab container lidding structure in March, the hillside benching, haul road, rail load-out area, and rail upgrades on the Cane Creek Subdivision line were completed by April.

- The project began excavating and conditioning mill tailings in February, initiated startup and test of shipping operations on April 20, and began full tailings shipments 4 days a week in May.
- A major construction effort for an underpass of State Route (SR-279) was completed in December; this has eliminated project vehicles from having to cross the public highway.
- A significant effort was made to provide erosion control on the hillside following construction. Approximately 28 acres of disturbed area was seeded and mulched, and in some areas, turf-reinforced matting was installed. In addition, tamarisk trees were removed from a 3.5-acre area west of the well field. This area was revegetated with willow and cottonwood trees and other native species.
- Approximately 9 acres of the DOE property south of the tailings pile was remediated in preparation for expansion of the ground water well field in late fall. About 144,424 cubic yards of contaminated soil was removed and taken to the Crescent Junction site for disposal. The contaminated footprint of the DOE site has been reduced by a total of 94 acres and 475,024 cubic yards to date.

Crescent Junction Site Construction Activities

- To start mill tailings shipments in the spring of 2009, new railroad spurs at the Crescent Junction site were constructed.

Waste Management and Pollution Prevention

- Approximately 2,700 pounds (lb) of paper, 2,425 lb of plastic, and 1,180 lb of aluminum cans were collected from the Moab UMTRA Project sites and the Grand Junction, Colorado, office for recycling. Automotive batteries, toner cartridges, and power strips were also recycled.

Environmental Radiological Protection Program Summary

- DOE's environmental air monitoring strategy targets concentrations of radon-222, airborne particulates, exposure levels to direct gamma radiation, and fugitive dust emissions. The environmental air monitoring network consists of on-site, off-site, and background sampling locations.
- Two new air monitoring stations (with continuous air samplers) were added immediately downwind of the disposal cell and at the offices at the Crescent Junction site.
- One Moab off-site monitoring location had radon-222 concentrations that exceeded the DOE guideline for indoor air quality immediately south of the Moab site property boundary on vacant land. However, data indicate that radon concentrations attenuate to near background levels within ¼-mile of the Moab site boundary.
- One Moab off-site monitoring location had a direct gamma radiation reading above the DOE established dose limit, but the data was identified as an anomaly, and, since the land was vacant, no public exposure limit was exceeded.
- Radioparticulate air emissions data were below the public dose limits applicable to the Moab and Crescent Junction sites at all on-site and off-site monitoring locations.
- DOE diligently controlled visible emissions of fugitive dust through implementation of dust-suppression techniques and various engineering and procedural controls.
- Quarterly environmental air monitoring reports were prepared that summarize and trend the data collected and compare it to exposure limits and guidelines. These reports are posted on the DOE Moab UMTRA Project website at www.gjem.energy.gov/moab.

Ground Water Protection Program Summary

Ground water activities were performed at the Moab site to protect water quality in the Colorado River. Almost 26 million gallons of ground water was extracted in 2009 through the IA remediation wells, with more than 90,500 lb of ammonia and 400 lb of uranium removed, thus preventing these contaminants from discharging to the Colorado River. A total of 152 million gallons of ground water has been extracted, with 627,000 lb of ammonia and 2,750 lb of uranium removed since the IA system was initiated in 2003. The contaminated ground water was pumped to an evaporation pond and applied to the tailings pile with sprinklers to enhance evaporation or distributed via water truck for dust control on the tailings pile. Other activities included the following:

- Ground water and surface water sampling was conducted to evaluate IA remedial action performance and surface water quality.
- Twenty-eight remediation wells were operated.
- Seven new extraction wells were drilled, with completion in 2010, to extract the contaminated ground water closer to the tailings pile.
- Four new injection wells were drilled in the existing well field to assist in protecting the adjacent aquatic habitat.
- Three new monitoring wells were installed to better characterize the contamination plumes.

Document Distribution

This document may be viewed in its entirety on the DOE Moab UMTRA Project website at www/gjem.energy.gov/moab. Hard copies may be obtained by contacting Mr. Donald Metzler, Moab Federal Project Director, at (970) 257-2115, or at the address below.

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Comments or questions regarding this document also may be directed to the Moab UMTRA Project toll-free telephone number at (800) 637-4575. Members of the public who wish to comment on this document or have questions are encouraged to contact DOE at the above phone number or by email at moabcomments@gjem.doe.gov.

1.0 Introduction

1.1 Purpose

The purpose of the Annual Site Environmental Report is to provide information regarding DOE environmental activities conducted for the Moab UMTRA Project during 2009 and to provide a summary of environmental monitoring data results.

This report was prepared in accordance with the requirements of DOE Order (O) 231.1A, "Environment, Safety, and Health Reporting," DOE O 5400.5, "Radiation Protection of the Public and the Environment," and supplemental guidance from DOE Headquarters.

1.2 Scope

This report includes activities conducted at either site included in the Moab UMTRA Project: the Moab site located near Moab, Utah, or the Crescent Junction, Utah, site, located approximately 30 miles north of the Moab site.

This report is structured as follows:

- Section 2.0 describes the compliance status with applicable federal and state environmental regulations and contains a table of the permits held by the project.
- Section 3.0 provides the status of the EMS.
- Section 4.0 describes the environmental radiological protection program and dose assessment.
- Section 5.0 describes the environmental nonradiological programs.
- Section 6.0 describes the ground water protection program.
- Section 7.0 discusses the quality assurance (QA) measures implemented for the project.
- Section 8.0 provides a list of references used in the preparation of this document.

1.3 Site Descriptions

The Moab site is a former uranium ore-processing facility located about 3 miles northwest of the city of Moab in Grand County, Utah (Figure 1), and lies on the west bank of the Colorado River at the confluence with the Moab Wash. The 439-acre site is bordered on the north and southwest by sandstone cliffs. The Colorado River forms the eastern boundary of the site.

U.S. Highway 191 (US-191) parallels the northern site boundary, and SR-279 transects the western and southwestern portions of the property. The Union Pacific Railroad traverses a small section of the site west and uphill of SR-279, then enters a tunnel and emerges several miles to the southwest. Arches National Park has a common property boundary with the Moab site on the north side of US-191, and the park entrance is located less than 1 mile northwest of the site. Figure 2 shows Moab site features, including the site boundary, structures, tailings pile, roads, and rail line.

The Crescent Junction site is located northeast of the junction of Interstate 70 (I-70) and US-191, approximately 30 miles north of the Moab site, and is the location for disposal of the Moab site uranium mill tailings.

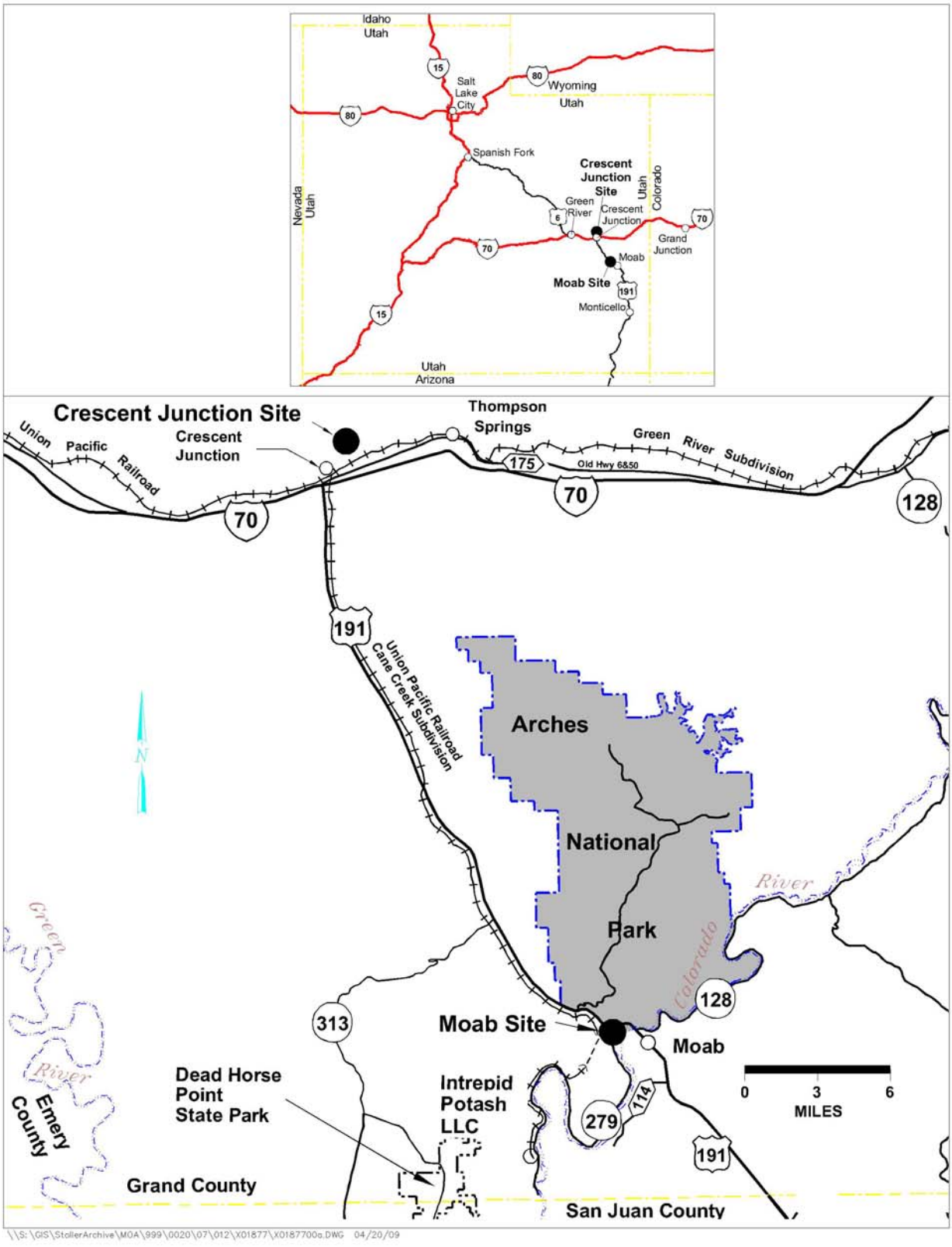

Figure 1. Location of the Moab and Crescent Junction Sites

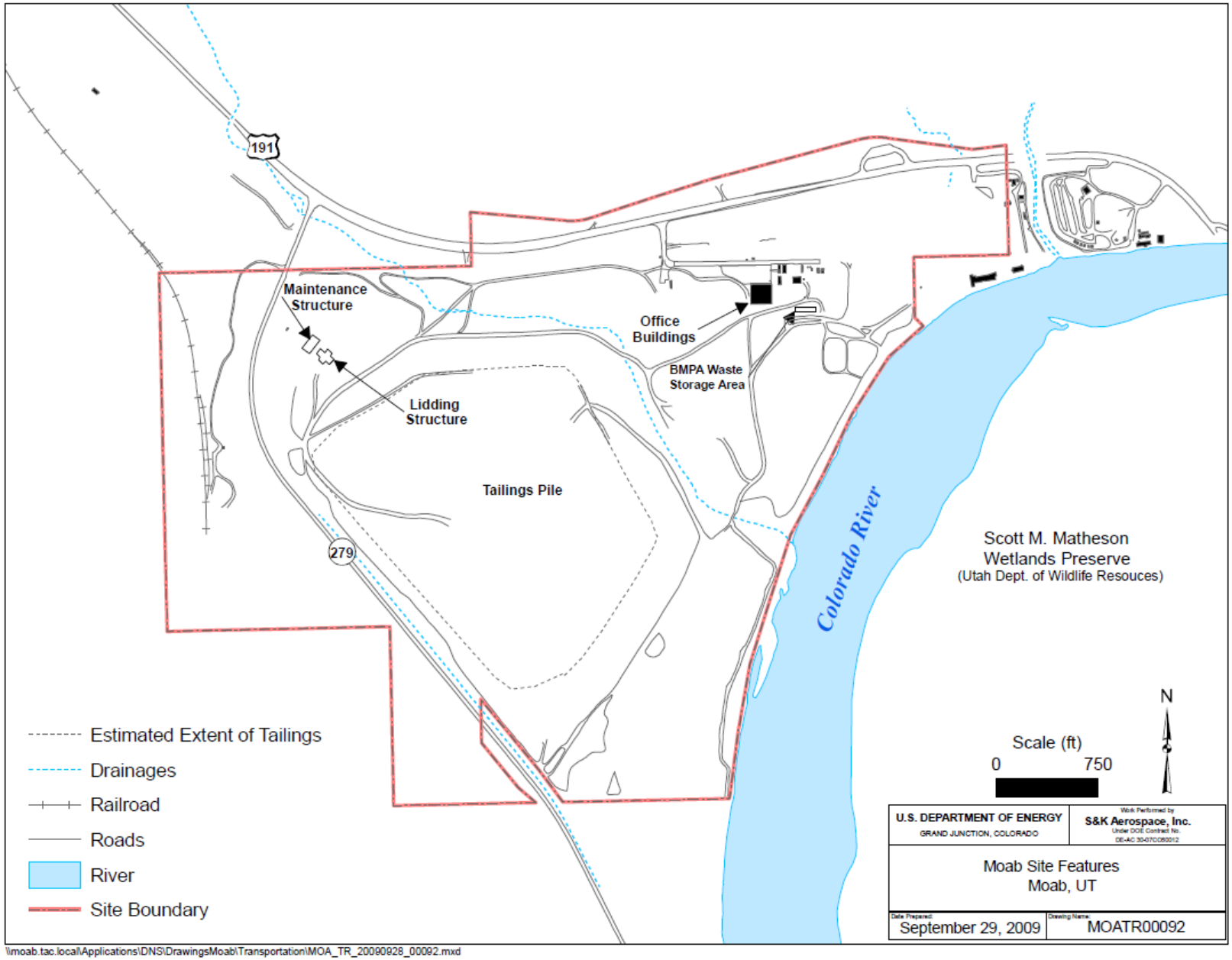

Figure 2. Moab Site Features Map

1.4 Site History

The Moab millsite operated under various owners from 1956 through 1984. Uranium mill tailings are residual radioactive material (RRM) that results from the processing of uranium ore. The tailings resulting from the milling operation were slurried to a 130-acre unlined area located at the western portion of the property. The resultant deposition created a pile of material with an estimated total mass of 16 million tons and a volume of 12 million cubic yards. The tailings pile height (4,076 feet above mean sea level) averages 94 feet above the Colorado River and is located in the 100-year floodplain. Although the milling process recovered about 95 percent of the uranium, these tailings contain several naturally occurring radioactive elements, including uranium, thorium, radium, polonium, and radon. The tailings at the Moab site contain contaminants in concentrations that could be hazardous to the environment and public health and could exceed the U.S. Environmental Protection Agency (EPA) standards in Title 40 Code of Federal Regulations Part 192 (40 CFR 192), "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings."

In October 2000, the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398) transferred ownership and responsibility for reclamation of the Moab site to DOE. The DOE Office of Environmental Management, located in Grand Junction, manages cleanup of the Moab site under the Moab UMTRA Project.

To minimize potential adverse effects to human health and the environment in the short term, former site operators, custodians, and DOE instituted environmental and administrative controls and interim measures at the Moab site. Controls have included placement of an interim cover on the tailings pile, storm water management, dust suppression, pile dewatering, and site access restrictions. Interim measures have included monitoring ground water and surface water and managing legacy chemicals. In addition, DOE designed and implemented an IA ground water remediation system to intercept contaminants, mostly ammonia and uranium, before they discharge to the Colorado River. The IA system has been expanded since its initial implementation in the summer of 2003.

In July 2005, DOE published *Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties, Utah, Final Environmental Impact Statement* (EIS) (DOE/EIS-0355) that presents the preferred alternatives of active ground water remediation and off-site disposal of the tailings pile and other contaminated materials at the proposed Crescent Junction disposal site using predominantly rail transportation. The preferred alternatives included clean up and reclamation of the former millsite property and certain off-site properties known as vicinity properties. DOE issued the Record of Decision (ROD) in September 2005 that detailed the selection of the preferred alternatives and the basis for that decision. In February 2008, the ROD was amended to allow more truck transport.

DOE also prepared the *Moab UMTRA Project Final Remedial Action Plan and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at the Crescent Junction, Utah, Disposal Site* (DOE-EM/GJ1547) that presents the basis for constructing the disposal cell at Crescent Junction. The Final Remedial Action Plan was submitted to the U.S. Nuclear Regulatory Commission (NRC), and DOE received conditional concurrence in July 2008.

Jurisdiction of 2,300 acres of land at the Crescent Junction site was transferred to DOE through a temporary land withdrawal action from the U.S. Department of the Interior. Five hundred acres was permanently transferred to DOE in March 2008, and an application to renew the temporary withdrawal of 938 acres was approved in June 2009.

2.0 Compliance Summary

2.1 Compliance Status

The Moab and Crescent Junction sites operated during 2009 without any notices of violation. In accordance with the U.S. Fish and Wildlife (USFWS)-required *Moab UMTRA Project Biota Monitoring Plan* (DOE-EM/GJ1079), the USFWS was notified that one dead (non-endangered species) fish was found in the Colorado River backwater channel adjacent to the Moab site in September.

2.1.1 Environmental Restoration and Waste Management

Moab UMTRA Project environmental restoration and waste management are discussed below.

Superfund Amendments and Reauthorization Act/Executive Order 12856

Title III of the Superfund Amendments and Reauthorization Act (Title 42 United States Code Section 9601 [42 USC 9601]), which is the Emergency Planning and Community Right-to-Know Act of 1986 (42 USC 11000), and Executive Order 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements," established requirements for industry and the government to provide the public with information about the hazardous and toxic chemicals in their communities and to do emergency planning and notifications to protect the public in the event of a release of extremely hazardous substances.

DOE reviews the chemical inventories and activities at the Moab and Crescent Junction sites annually to determine if any relevant reporting is required. During 2009, four hazardous chemicals were stored in amounts exceeding the threshold planning quantity as established in Section 312 of the Superfund Amendments and Reauthorization Act: calcium chloride and glycerin at the Moab site, propane at the Crescent Junction site, and diesel at both sites. Tier Two Emergency and Hazardous Chemical Inventory reports were submitted as required to the Utah Emergency Response Commission, the Moab Emergency Planning Committee, and the Moab Fire Department.

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) (42 USC 6901), established in 1976 and subsequently amended several times, is the nation's primary law governing the proper management of nonhazardous and hazardous solid waste from the point of generation to final disposal. All waste generated within the Moab site's Contamination Area (CA) is considered RRM, the cleanup and management of which is regulated by the Uranium Mill Tailings Radiation Control Act (UMTRCA) (42 USC 7901), not RCRA. However, waste generated outside the CA is considered non-RRM and, therefore, can be regulated by RCRA. No RCRA wastes were generated in 2009.

National Environmental Policy Act

Remedial actions performed pursuant to UMTRCA are considered to be major federal actions that are subject to the requirements of the National Environmental Policy Act (NEPA) (42 USC 4321). Council on Environmental Quality regulations to implement NEPA are codified in 40 CFR 1500, "Purpose, Policy, and Mandate." These regulations require each federal agency to develop its own implementing procedures (40 CFR 1507.3, "Council on Environmental Quality, Agency Procedures"). DOE-related NEPA regulations are established in 10 CFR 1021, "National Environmental Policy Act Implementing Procedures."

In October 1996, DOE issued the *Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Projec*t (DOE/EIS-0198) to analyze the potential impacts of implementing alternatives for ground water compliance at the designated processing sites. The applicable standards are determined on a site-specific basis. The ROD published in 1997 implemented a framework to select the appropriate compliance strategies for ground water remediation at Title I sites. The framework satisfies the requirements of the Floyd D. Spence Act in the selection of a ground water compliance strategy for the Moab site. In 2005, DOE issued the final EIS and ROD for the Moab site, as described in Section 1.4.

In 2009, the surface water initial action and IA ground water remediation system were conducted in accordance with DOE and Council on Environmental Quality NEPA regulations.

Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) (15 USC 2601) was enacted in 1976 to regulate the manufacturing and distribution of certain chemical substances. TSCA provides EPA with authority to require testing of any chemical substances entering the environment and to regulate their production, sale, and management as a waste, where necessary. TSCA specifically addresses the use and management of asbestos and polychlorinated biphenyls (PCBs). Historical records indicate various types of asbestos-containing material (ACM) including pipes, insulation, siding, roofing, and floor tiles from the former millsite structures were disposed in the Moab tailings pile. PCB-contaminated materials, such as discarded electrical transformers, are not known to be disposed in the tailings pile. It is suspected that ACM is present in the remaining on-site millsite building and utilities, and PCB wastes may be present in fluorescent light ballasts in this building. Any ACM or PCBs that remain within the site's CA are considered RRM and are, therefore, subject to UMTRCA regulation, not TSCA regulation. During 2009, no ACM or PCBs required management at the Moab site.

Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (7 USC 136) governs the use, storage, registration, and disposal of pesticides. This act categorizes pesticides as either "restricted use" or "general use." EPA may classify a pesticide as restricted use if: (1) it is determined that substantial adverse effects to the applicator or environment may occur without additional regulatory restrictions; or (2) unreasonable harm to humans or the environment may occur, even if the pesticide is used as directed by the label instructions. Restricted-use pesticides must be used or applied only by a certified private or commercial applicator or under the direct supervision of a certified applicator. A certified applicator was utilized to apply general use herbicides at the Moab site in 2009 to control noxious weeds.

2.1.2 Radiation Protection

Moab UMTRA Project radiation protection is discussed below.

UMTRCA

In 1978, Congress passed UMTRCA in response to public concern regarding potential health hazards of long-term exposure to radiation from uranium mill tailings. Title I of UMTRCA requires DOE to establish a remedial action program and authorizes DOE to stabilize, dispose of, and control uranium mill tailings and other contaminated material at 24 uranium ore-processing sites and associated vicinity properties. Vicinity properties are locations where uranium mill tailings were used as construction material or fill before the hazards associated with this material were known. UMTRCA also directed the EPA to promulgate cleanup standards (now codified at 40 CFR 192) and assigned the NRC to oversee the cleanup and issue licenses to the completed disposal cells. Remediation of the Moab site and disposal at the Crescent Junction site will comply with these standards.

RRM, specifically defined at 40 CFR 192.01(a), is waste that DOE determines to be radioactive and related to the milling process. RRM generally refers to uranium mill tailings, but may also consist of contaminated soil, debris, equipment, and other wastes. Other contaminated materials requiring cleanup at the Moab site include debris from dismantling of the mill buildings and associated structures, remnants of ponds used during ore-processing activities, disposal trenches, other locations used during mill operations, and buried septic tanks that are assumed to be contaminated. Contaminated ground water beneath the Moab site is also considered RRM. For the purposes of this document, "contaminant" or "contamination" refers to RRM unless otherwise specified.

UMTRCA and, by association, the Floyd D. Spence Act and its implementing regulations, are the primary regulatory drivers for the Moab and Crescent Junction sites because RRM is the predominant waste. During 2009, RRM, in the form of contaminated soil and associated materials, and contaminated ground water were remediated and managed in accordance with regulatory requirements.

RRM may also be combined with hazardous or toxic components related to the milling process. DOE manages RRM that is combined with hazardous or toxic components in a manner that is protective of human health and the environment as a best management practice. For example, certain legacy chemicals and industrial products that were stored at the Moab site were considered RRM and were managed in a safe manner that protected site workers and the environment.

Floyd D. Spence Act

The Moab site was originally subject to Title II of UMTRCA because it was an active uranium-processing site when the legislation was passed and it was regulated under an NRC license. The Floyd D. Spence Act amended UMTRCA to include the Moab site as a designated processing site for remediation under Title I. This legislation specifies that the NRC license for the radioactive materials at the Moab site be terminated and the title and responsibility for cleanup be transferred to the Secretary of Energy. The Act further designates that the Moab site undergo remediation in accordance with Title I of UMTRCA.

2.1.3 Air Quality and Protection

The applicability of the Clean Air Act (42 USC 7401) to Moab UMTRA Project air quality and protection is discussed below. The environmental air monitoring program for the Moab UMTRA Project and results of data collected in 2009 are discussed further in Section 4.0.

National Emission Standards for Hazardous Air Pollutants

Regulatory requirements associated with the Clean Air Act establish emission standards for hazardous air pollutants associated with various industrial processes codified at 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants" (NESHAP). The Moab UMTRA Project is not required to report under the NESHAP program as there are no NESHAP-regulated air emissions associated with the Moab and Crescent Junction sites.

Fugitive Dust

Extensive surface area at the Moab and Crescent Junction sites consists of exposed soil. With the exception of a narrow strip of land adjacent to the bank of the Colorado River where tamarisk and willows are abundant, vegetation at the two sites is relatively sparse and offers little protection or stabilization to the site's soils. Consequently, controlling windblown material is a concern.

In Utah, federal Clean Air Act requirements are implemented by an equivalent set of state regulations. To comply with Utah Administrative Code (UAC) Section R307-309-6, "Fugitive Dust Control," in 2002 DOE prepared the *Moab UMTRA Project Moab Project Site Fugitive Dust Control Plan* (GJO-2002-301-TAR). In 2006, a similar plan was prepared for the disposal site: the *Moab UMTRA Project Crescent Junction Site Fugitive Dust Control Plan* (DOE-EM/GJ1235). These plans outline specific areas of the sites that are particularly vulnerable to wind erosion and describe the engineering and procedural controls DOE has implemented at the sites to control fugitive dust emissions. During 2009, DOE implemented the controls outlined in the plans and controlled fugitive dust emissions at the sites to the extent practicable.

Radon

During 2009, DOE continued its environmental air monitoring program at the Moab site and completed the fourth year of baseline monitoring at Crescent Junction (prior to disposal activities that began in April) to measure radon emissions at various locations on the millsite property boundary, around the Moab community, and at and around the Crescent Junction site. Background monitoring locations have also been established to provide a baseline against which site exposure data may be compared. DOE O 5400.5 provides guidelines for all DOE facilities, operations, and activities and offers a conservative goal for guidance with respect to controlling radon emissions at the Moab UMTRA Project sites, while remediation of the tailings pile is ongoing. This DOE order established an indoor guideline for radon-222 concentrations, and this guideline is used at DOE's property boundary and at off-site locations. The guideline or goal is 3.0 picocuries per liter (pCi/L) above background concentrations.

Radioparticulates/Direct Gamma Radiation

DOE also conducts environmental air monitoring for airborne radioparticulates (thorium-230, radium-226, polonium-210, and total uranium) and direct gamma radiation. The monitoring data for 2009 indicate that direct gamma radiation levels are elevated at several on-site locations along the DOE property boundary; however, exposure rates near the maximally exposed

individual (MEI) location and off-site monitoring locations around the Moab community were below the acceptable exposure limits specified by DOE order and by state of Utah radiation protection requirements codified at UAC R313-15-301, "Standards for Protection Against Radiation, Dose Limits for Individual Members of the Public."

2.1.4 Water Quality and Protection

Moab UMTRA Project efforts regarding water quality and protection are discussed below.

Clean Water Act/National Pollutant Discharge Elimination System

Under the Clean Water Act (33 USC 1251), the National Pollutant Discharge Elimination System was designed to regulate and control pollutants from industrial wastewater and storm water discharges, both of which can have negative effects on the quality of surface waters of the United States. The federal discharge requirements are implemented by an equivalent state system known as the Utah Pollutant Discharge Elimination System (UPDES). As required by the Clean Water Act, the project obtained UPDES Storm Water General Permits for Construction Activities for sites at Moab and Crescent Junction, Utah. No discharges were noted under the UPDES during 2009.

Storm water discharges from the sites are regulated by UPDES requirements. The state of Utah issued the Moab UMTRA Project two storm water permits (see Table 1) in 2006 and 2007. As required by the permits, DOE prepared and implemented the *Moab UMTRA Project Moab Site Storm Water Pollution Prevention Plan* (DOE-EM/GJRAC1475) and the *Moab UMTRA Project Crescent Junction Disposal Site Storm Water Pollution Prevention Plan* (DOE-EM/GJ1238) that outline the engineering controls and best management practices that DOE has implemented to control and minimize storm water discharges from the sites. Copies of the plans and the storm water discharge permit are maintained at each respective site. To ensure continued compliance with the plans, DOE conducts at least one storm water inspection per month and documents the inspection results on a site-specific checklist.

Several localized heavy storm events occurred at the Moab site during 2009. Eroded areas were filled with clean material, damaged areas were re-graded using heavy equipment, and native vegetation was reseeded. Erosion logs and blanket material were also used in uncontaminated areas to control storm water that was entering the site from US-191. All storm water controls functioned as designed, and no contaminated materials were discharged off site.

There is no sewer effluent discharge points associated with Moab or Crescent Junction site operations. DOE installed on-site sewer collection and leach-field systems at Moab and Crescent Junction and constructed a domestic waterline to the Crescent Junction site. Bottled water is provided for Moab on-site drinking water needs, and city water is trucked to the site for other domestic requirements.

Safe Drinking Water Act

The provisions of the Safe Drinking Water Act (42 USC 300f) are not directly relevant to the Moab or Crescent Junction sites because neither ground water 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; therefore, a Temporary Change Application was submitted and received from the State of Utah Department of Natural Resources, Division of Water Rights.

2.1.5 Other Environmental Statutes

The applicability of various environmental statutes to the Moab UMTRA Project is discussed below.

Endangered Species Act

The Endangered Species Act (16 USC 1531) requires federal agencies to consult with the USFWS prior to any ground-disturbing activities that may impact protected species (threatened or endangered) or their habitat. There are four endangered fish species (Colorado pikeminnow, razorback sucker, humpback chub, and bonytail chub) present in the Colorado River, with the pikeminnow and razorback sucker found near the Moab site. There is one endangered avian species (southwestern willow flycatcher) that may inhabit tamarisk areas on or near the site.

The final EIS included a Biological Assessment and a Biological Opinion (BO) that evaluated potential impacts of the proposed actions to protected species that may be present. DOE continues to meet the required habitat protective measures stated in the BO. DOE requested a water-depletion allowance of 235 acre feet per year for use of the Colorado River water to meet project needs.

As required by the BO, DOE developed the *Biota Monitoring Plan* in 2006 to evaluate Moab site-related impacts on fish. One adverse impact was noted in 2009 with the discovery of one dead fish. The non-endangered fish was reported to the USFWS.

National Historic Preservation Act

Memorandums of Agreement are in place among DOE, the State Historic Preservation Office, the Utah Department of Transportation, and the Bureau of Land Management for protection of cultural and historic resources at the project sites. In 2009, an annual cultural resource inventory was performed at the Crescent Junction site for Indian art sites per the applicable memoranda of agreement.

Migratory Bird Treaty Act

To ensure compliance with the Migratory Bird Treaty Act (16 USC 703), the presence of migratory birds in the Moab area was evaluated in the Biological Assessment. The BO concurred that the potential migratory bird species that may inhabit the Moab site area included the bald eagle (threatened), the southwestern willow flycatcher (endangered), and the yellow-billed cuckoo (candidate species). Surveys were conducted to locate the southwestern willow flycatcher prior to vegetation removal. However, none were found to be present at the Moab site in 2009. No endangered, threatened, or candidate species have been noted on the Moab site.

At the Crescent Junction site, the burrowing owl, a Utah "sensitive" species, was identified as potentially present; however, none was observed in 2009. Construction work conducted during 2008 did not affect a nesting site previously identified in the withdrawal area. There are a large number of prairie dog burrows present, which are associated with burrowing owl habitat. If a nesting burrowing owl is determined to be present, DOE is committed to a ¼-mile buffer area around the nest and to avoid activities in this area until August. Hawks are known to hunt in the Crescent Junction site area; however, no nests are known to be present. Additionally, a botanical survey was completed at the Crescent Junction site, and no protected plant species were present.

2.1.6 DOE Orders 450.1A and 430.2B and Executive Orders 13423 and 13514

DOE O 450.1A, "Environmental Protection Program," enforces environmental compliance and reinforces the need to respond to and meet the national sustainability goals through implementation of an integrated EMS that considers environmental aspects affected by all agency activities. The status of the Moab UMTRA Project EMS implementation is further discussed in Section 3.0.

Specific national goals related to improving energy, water, and fuel efficiency and using environmentally preferable products and services are stated in Executive Order 13423, "Strengthening Federal Environmental, Energy, and Transportation Management," and DOE Order 430.2B, "Departmental Energy, Renewable Energy and Transportation Management." In October 2009, the former Secretary of Energy indicated that DOE would exceed the goals established in Executive Order 13423 by applying Leadership in Energy and Environmental Design criteria established by the United States Green Buildings Council. The Moab UMTRA Project is currently awaiting direction from DOE Headquarters prior to establishing greenhouse gas reduction targets and sustainability goals to reach those targets in compliance with Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance." These goals, once established, will be reported in the appropriate Annual Site Environmental Report.

In fiscal year 2008, the Crescent Junction site consumed more than 3 million gallons of domestic water. In 2009, the project utilized an alternative source of raw water for nondomestic (construction) uses, thus reducing domestic water usage. To manage the water usage, meters will be installed on the DOE domestic waterline and the Green River alternative source waterline.

Floodplain Management

DOE's implementing regulations in 10 CFR 1022, "Compliance with Floodplain and Wetlands Environmental Review Requirements," identify the requirements of Executive Order 11988, "Floodplain Management," for actions that may affect floodplains. Portions of the Moab site fall within the 100-year and 500-year floodplains as described in the *Moab UMTRA Project Floodplain and Wetlands Assessment for Additional Interim Actions at the Moab Project Site* (DOE-EM/GJ805).

Activities conducted in the floodplain during 2009 included soils remediation and revegetation. Revegetation activities included planting and seeding of desirable, native species, irrigation to promote vegetation, and weed control. Minor erosion control actions were taken in 2009 to prevent sedimentation to the river, and all wetlands were avoided.

Protection of Wetlands

DOE regulation 10 CFR 1022 implements the requirements of Executive Order 11990, "Protection of Wetlands," for actions that may affect wetlands. Jurisdictional wetlands were delineated at the Moab site in 2004 and verified by the U.S. Army Corps of Engineers (USACE) in 2005. Moab UMTRA Project activities performed in 2007 through 2009 with the potential to affect jurisdictional wetlands include construction that disturbed upland soils, storm water controls, road improvements, construction of Crescent Junction water pipelines, revegetation,

and erosion control activities. All of these activities were authorized under the USACE 404 permitting program or by the state of Utah's Streambank Alteration permit program through a cooperative agreement with USACE. Required monitoring continued in 2009.

2.2 Other Major Environmental Issues and Actions

DOE uses external and internal audits, surveillances, and management assessments to evaluate environmental compliance and to implement corrective actions. The Moab UMTRA Project QA organization performed surveillances and management assessments in 2009 to verify system descriptions and compliance with internal procedures. Mitigation and compliance requirements in the BO and ROD are tracked for compliance.

2.3 Continuous Release Reporting

Not applicable to the Moab UMTRA Project.

2.4 Unplanned Releases

No unplanned releases occurred in 2009.

2.5 Summary of Permits

Table 1 shows the permits and agreements that were active for the Moab UMTRA Project during 2009.

Table 1. Permits/Agreements Active in 2009 for the Moab UMTRA Project

Permits/Agreements	Issuing Agency	No. of Permits
Moab UPDES Storm Water Discharge Permit (permit number UTR107469)	State of Utah, Department of Environmental Quality, Division of Water Quality	1
Crescent Junction UPDES Storm Water Discharge Permit (permit number UTR108269)	State of Utah, Department of Environmental Quality, Division of Water Quality	1
EPA Hazardous Waste Generator Identification Number (UTP 000001244)	EPA	1
Stream Channel Alteration Permits for the Colorado and Green River intake structures and for structures and well fields to support the surface water initial action and IA ground water remediation system	State of Utah, Department of Natural Resources, Division of Water Rights	6
Water rights applications to change points of diversion to support ground water actions and a non-use application to extract water from the Colorado River	State of Utah, Department of Natural Resources, Division of Water Rights	3
Highway right-of-way encroachment permits to conduct surveys, perform remediation, and construct pipelines	State of Utah, Department of Transportation	8
Special Permit to transport mill tailings	U.S. Department of Transportation	2
UPDES General Permit for Storm Water Discharges Associated with Industrial Activity: UTR105820	State of Utah, Department of Environmental Quality	1

Table 1. Permits/Agreements Active in 2009 for the Moab UMTRA Project (continued)

Permits/Agreements	Issuing Agency	No. of Permits
Fugitive Dust Control Authorization Letters: Moab DAQC-626-2002 Crescent Junction DAQC-1110-2006	State of Utah, Department of Environmental Quality	2
404 Nationwide General Permit for Green River pump inlet, water pipelines, and Moab Wash	USACE	3

3.0 EMS

As with most federal agencies, DOE's EMS is based on the standard elements identified in International Organization for Standardization 14001, "Environmental Management System Standard." The EMS integrates these elements into the core functions of the contractors' Integrated Safety Management System Program, which follows the "Plan-Do-Check-Act" cycle to ensure continuous improvement. The Moab UMTRA Project's EMS is a structured process for reducing the environmental consequences of project activities to maximize beneficial use of finite resources and minimize wastes. In an effort to implement a comprehensive EMS for the Moab UMTRA Project in accordance with DOE O 450.1A, the *Moab UMTRA Project Environmental Management Program Manual* (DOE-EM/GJ1630) was prepared in September 2008 as one element of the EMS. Revisions are being made to the manual to incorporate comments received in July 2009 following a DOE review.

3.1 Environmental Initiatives

3.1.1 Pollution Prevention

Pollution prevention is part of the waste management strategy for the Moab UMTRA Project. Operations are evaluated to identify technically and economically feasible opportunities for source reduction, recycling, decontamination, or treatment. Disposal is the final solution after other options have been considered. Pollution prevention is also achieved through environmentally preferred purchasing.

Reuse and Recycling

In 2009, approximately 2,700 lb of paper, 2,425 lb of plastic, and 1,180 lb of aluminum cans were collected from the Moab UMTRA Project sites and the Grand Junction office for recycling. Automotive and rechargeable batteries, toner cartridges, and power strips were also recycled. All these recycled materials were nonradioactive.

Environmentally Preferable Purchasing

The preferred procurement process favors the acquisition of environmentally preferable products and services. This may entail purchasing materials with recycled content or materials or services that have a less adverse or even beneficial effect on the environment. One of the site contractors routinely adds language to contracts that specifies a preference for the use of recycled or otherwise recovered materials and removes language that prohibits the use of recycled materials. In addition, the project participates in the Blue Sky Renewable Energy Program by buying

10 percent renewable energy. As a result, the Remedial Action Contractor and the Moab UMTRA Project have received Blue Sky Champion Partner and EPA Green Power Partner designations.

Energy Efficiency
The project's newly constructed facilities were designed to be energy efficient and comply with DOE O 430.2B and the Secretary of Energy's new energy initiatives for real property. The Moab and Crescent Junction sites receive power from overhead lines through the Rocky Mountain Power distribution system. Rocky Mountain Power performed an energy assessment in July, and no major recommendations were made.

3.2 Waste Management

During 2009, DOE conducted operations consistent with the *Moab UMTRA Project Waste Management Plan* (DOE-EM/GJ1633). Formal training in the requirements of this plan was provided to project staff and subcontractors.

4.0 Environmental Radiological Protection Program and Dose Assessment

4.1 Radiological Discharges and Doses

4.1.1 Employee Monitoring Program
An employee monitoring program is conducted to ensure safe working conditions are maintained and to limit exposures to "as low as reasonably achievable" (ALARA). On-site radiation readings are higher than off-site locations; therefore, the CA workers represent the highest potentially exposed individuals. External radiation monitoring of employees who enter the CA is performed using a thermoluminescent dosimeter that is analyzed quarterly. Personal electronic dosimeters are also used to give real-time monitoring of the workers in the CA.

The project's ALARA goal for individual exposures is 700 millirems per year (mrem/yr), which is very conservative when compared to the DOE exposure limit of 2,000 mrem/yr and the NRC limit of 5,000 mrem/yr. The 2009 monitoring results were well below the ALARA goal, with the highest individual radiological worker dose being approximately 167 mrem/yr, versus 20 mrem/yr in 2008, prior to excavation of the mill tailings. These results indicate that with proper personal protective equipment and by limiting exposure, employees can safely work within the CA.

4.2 Clearance of Property Containing RRM and Protection of Biota

To support remediation of the Moab site, DOE assessed Moab site soils not associated with the pile for radiological contamination. Interim soils remediation is part of DOE's cleanup strategy and one of the ongoing measures to address contamination resulting from historical uranium ore processing at the site to reduce potential health and environmental risks.

In 2009, approximately 144,424 cubic yards of contaminated soil was remediated at the Moab site as part of the well field expansion activities, resulting in a reduction of the contaminated footprint by about 9 acres. The excavated contaminated soil was transported to the tailings pile

for shipment to the Crescent Junction site for disposal. The footprint has been reduced by a total of 94 acres since the start of interim soil remediation. As areas are remediated, DOE replants native species.

Calculated dose rate is 0.01 less than the guideline for terrestrial plants or biota; therefore, the Moab UMTRA Project has no biota monitoring program for radiological impacts. Biota monitoring for nonradiological effects is discussed in Section 6.0.

4.3 Unplanned Radiological Releases

There were no unplanned radiological releases in 2009.

4.4 Environmental Radiological Monitoring

Radiological protection is provided through the environmental air monitoring program, which is described in the *Moab UMTRA Project Environmental Air Monitoring Sampling and Analysis Plan* (DOE-EM/GJRAC1434). This plan documents DOE's strategy for monitoring various airborne contaminants, including monitoring goals and objectives, and includes evaluation of public radiological exposure. This section provides descriptions of the environmental air monitoring program elements. Environmental air monitoring data are compiled and published in DOE's quarterly environmental air monitoring reports. These reports compare monitoring data to exposure limits and guidelines and are posted on the DOE Moab UMTRA Project website at www.gjem.energy.gov/moab.

In addition to the environmental air monitoring program, DOE has a comprehensive Integrated Safety Management System Program and Radiological Control Program to minimize workplace hazards and to ensure protection of employees and the public. These programs are described in applicable project documents.

During 2002, DOE initiated environmental air monitoring at the Moab site to assess the potential for radiation dose to members of the public that could result from site operations and to demonstrate compliance with applicable radon concentration guidelines established by DOE O 5400.5. In late 2005, air monitoring was also initiated at the Crescent Junction site to collect baseline data before disposal operations began in April 2009. DOE established the air monitoring network for the Moab site to measure atmospheric radon, airborne radioparticulate matter, and direct gamma radiation at various on-site, off-site, and background locations. The monitoring network was established after considering prevailing wind directions and the proximity of the site to the general population center of the city of Moab. Off-site monitoring stations were located such that emissions or releases of airborne contaminants would be detected before they reached the public. This strategy enables DOE to quantify any public exposures that may be associated with Moab UMTRA Project activities. A similar monitoring network was established for the Crescent Junction site. Table 2 summarizes the types of data collected at the various monitoring locations for Moab and Crescent Junction. Monitoring locations for Moab are shown in Figures 3 and 4 and for Crescent Junction in Figure 5.

Table 2. Summary of Environmental Air Monitoring Locations at the Moab and Crescent Junction Sites

Monitoring Station	Location	Parameter
Moab On-site Locations		
0101	Office area	Rn, G
0102	Perimeter	Rn, G, RP
0103	Perimeter	Rn, G
0104	Perimeter	Rn, G
0105	Perimeter	Rn, G, RP
0106	Perimeter	Rn, G
0107	Perimeter	Rn, G
0108	Perimeter	Rn, G
0109	Perimeter	Rn, G
0110	Perimeter	Rn, G
0111	Perimeter	Rn, G
0112	Perimeter	Rn, G
0113	Perimeter	Rn, G
Moab Off-site Locations		
0117	Bar-M Chuckwagon (background location, ~5½ miles north of millsite)	Rn, G, RP
0118	Arches National Park Entrance	Rn, G, RP
0119	Utah Division of Wildlife Resources (Matheson Wetlands Preserve)	Rn, G, RP
0120	Portal RV Park	Rn, G, RP
0121	Moab Wastewater Treatment Plant	Rn, G, RP
0122	Grand County Recycle Center	Rn, G, RP
0123	Kane Creek Road (background location, ~2¾ miles south of millsite)	Rn, G, RP
0124	Utah Division of Wildlife Resources (Matheson Wetlands Preserve)	Rn, G
0125	Utah Division of Wildlife Resources (Matheson Wetlands Preserve)	Rn, G
0126	Private property (~¼-mile south of millsite)	Rn, G
0127	Private property (~¾-mile south of millsite)	Rn, G
0128	Private property (1/10-mile south of millsite)	Rn, G
0129	Bureau of Land Management property (~200 yards northwest of millsite)	Rn, G, RP
MEI	Residence (~50 feet east of Moab millsite)	Rn, G
Crescent Junction Locations		
0301-0305	Crescent Junction on-site locations	Rn, G
0308	Crescent Junction on-site location	Rn, G, RP
0307	Crescent Junction off-site location	Rn, G, RP
MEI	Residence (~½-mile south of disposal cell) (0306)	Rn, G, RP

G = gamma, Rn = atmospheric radon, RP = radioparticulate.

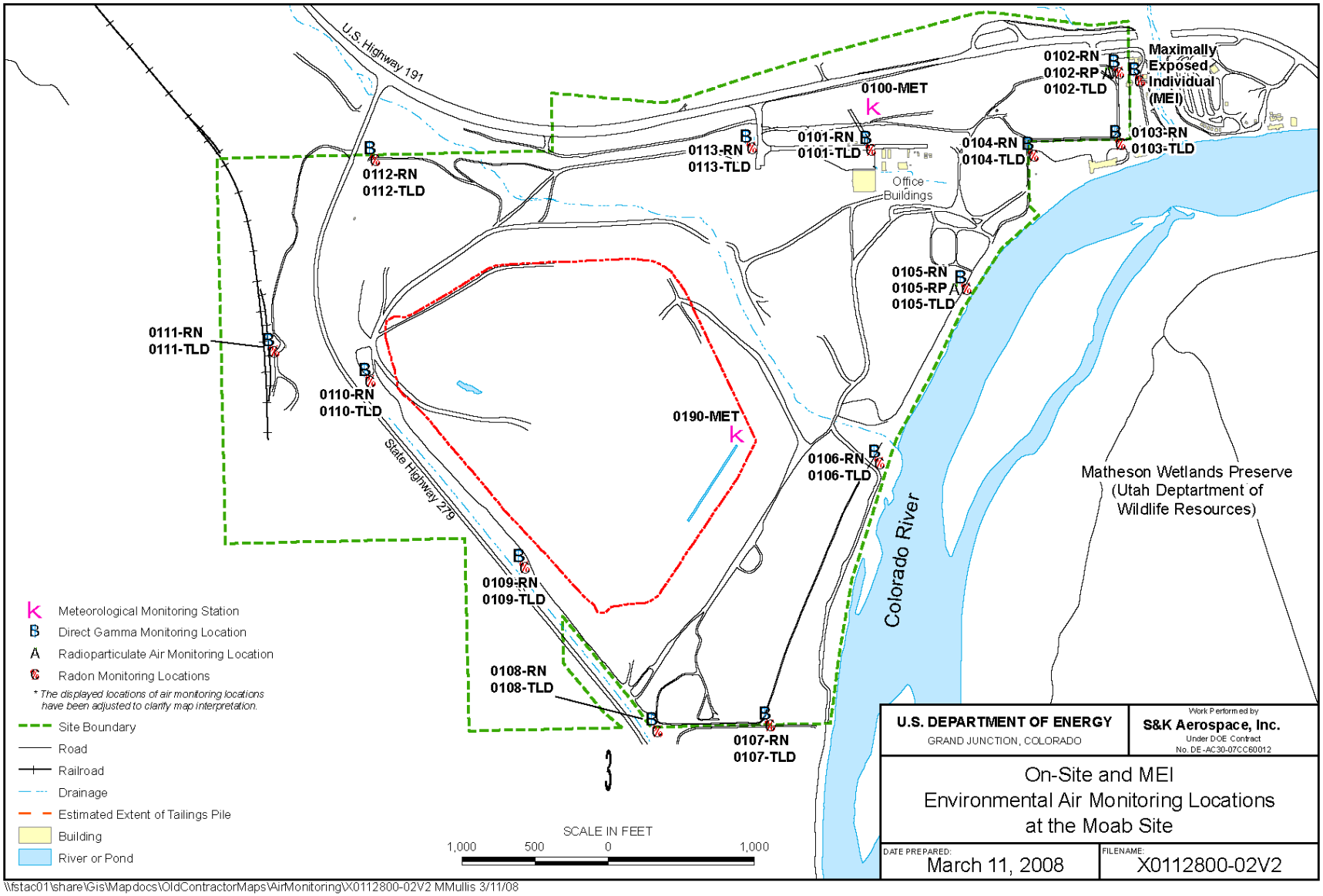

Figure 3. Moab On-site and MEI Environmental Air Monitoring Locations

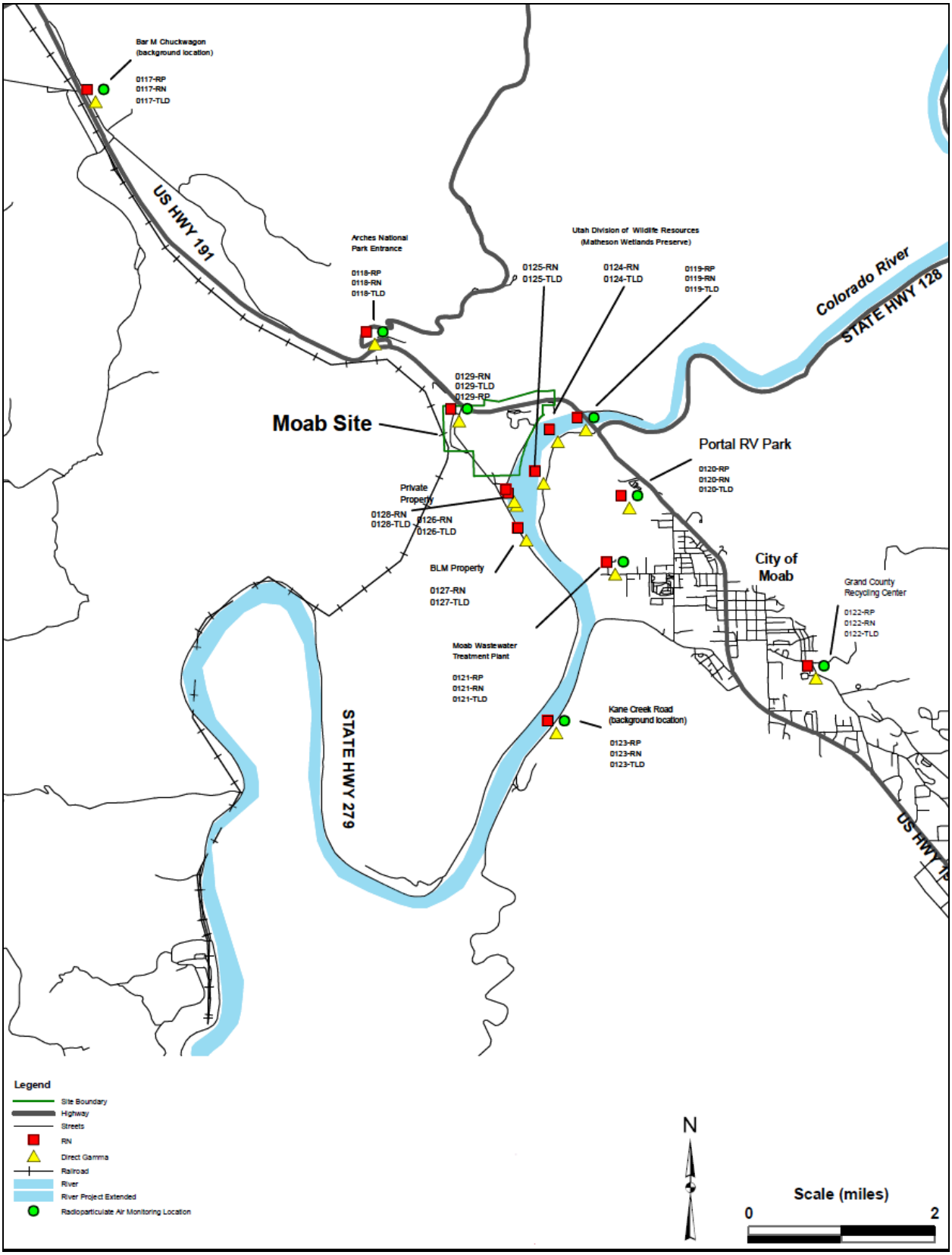

Figure 4. Moab Off-site Environmental Air Monitoring Locations

Figure 5. Crescent Junction Site Environmental Air Sampling Locations

Background monitoring locations have been established that are sufficiently removed from the Moab and Crescent Junction sites such that the air quality is not influenced by airborne contaminants associated with operations. Background monitoring locations provide baseline ambient air quality conditions against which site monitoring data may be compared.

MEI locations (for Moab site see Figure 3 and for Crescent Junction see Figure 5) have special significance with respect to environmental monitoring because they represent the members of the public potentially receiving the largest dose from all sources of radionuclide emissions combined and are considered to be the worst-case exposure scenario for a continuously occupied residential property. The MEI locations are the closest inhabited private property to each site.

A summary of the maximum individual public dose (or MEI) is shown in Table 3. The public and MEIs receive only background dose per project monitoring results.

Table 3. Moab Site Public Radiation Dose Reporting for 2009

Pathway	Dose to MEI *in* mrem (mSv)	% of DOE 100 mrem/yr Limit	Estimated Population Dose *in* person-rem	Population Within 80 km (~50 miles)	Estimated Bkgd Radiation Population Dose *in* person-rem
Air	12 (0.12)	12	less than 0.005	~10,000	less than 0.005
Water	N/A	N/A	N/A	N/A	N/A
Other Pathways	N/A	N/A	N/A	N/A	N/A
All Pathways	12 (0.12)	12	less than 0.005	N/A	less than 0.005

% = percent; bkgd = background; km = kilometers; mSv = milliseivert; N/A = not applicable; rem = roentgen man equivalent; Sv = seivert

4.4.1 Atmospheric Radon

Radon gas (radon-222) is a daughter product associated with the radioactive decay of uranium mill tailings. The EPA promulgated various radon control standards in 40 CFR 61. DOE and the state of Utah reviewed the applicability of Subparts Q and T of these standards and determined that they are not applicable to the Moab site while it is being remediated nor to the Crescent Junction disposal site because these subparts apply to flux rates for radon released from disposal sites that have an engineered radon barrier and cover. Similarly, design standards and regulations intended to control the release of radon have also been promulgated by the NRC and the state of Utah and are aimed at sites that are currently licensed by the NRC.

In the absence of a federal or state environmental radon standard that is directly applicable to the Moab site in its current condition, the indoor guideline established in DOE O 5400.5 for atmospheric radon emissions is being used for Moab on-site and off-site locations. The guideline for radon-222 is 3.0 pCi/L above the background concentration. Based on 5 years of data, the background concentration in the Moab area has been established as 0.7 pCi/L; therefore, the guideline for radon-222 emissions is 3.7 pCi/L. Based on 3 years of site-specific data for the Crescent Junction area, background concentrations of radon-222 have been established at 0.9 pCi/L; therefore, the guideline is 3.9 pCi/L.

During 2009, atmospheric radon was measured at 35 locations (19 on-site, 14 off-site, and two MEI) using alpha-sensitive detectors (i.e., radon cups). Radon cups were exposed for a period of approximately 3 months (a quarterly exposure). Upon collection, the radon cups were sent to an off-site laboratory for analysis. Analytical results were typically received from the laboratory within 30 days. Radon monitoring data results for all on-site, off-site, and MEI locations are shown in Table 4.

During 2009, the atmospheric radon concentration exceeded the guideline at four Moab on-site locations and one off-site location that was on vacant land (Table 4). However, data indicate that off-site radon concentrations attenuate to near background levels within ¼-mile beyond the Moab site boundary. Because the tailings pile does not have an engineered radon barrier nor is the existing interim cover designed to control radon flux, it is not surprising that radon concentrations are elevated at various locations at or near the Moab site perimeter. There were no radon exceedances at the Crescent Junction site. The 2009 radon monitoring data collected at the MEI locations were consistently below the 3.7 pCi/L and 3.9 pCi/L guidelines for Moab and Crescent Junction, respectively.

Based on these data, radon emissions from the mill tailings stored at the Moab site are not affecting the general population in or near the city of Moab. However, unacceptable exposures to the public may result to individuals if they were to camp or reside for extended periods of time within ¼-mile of the DOE southern property boundary between SR-279 and the Colorado River. To prevent unauthorized access near the southern property boundary and to minimize the potential for excessive public exposures to radon gas, DOE will continue, to the extent possible, to enforce the existing institutional controls (e.g., warning signs, fences, other physical barriers).

4.4.2 Direct Gamma Radiation

The uranium mill tailings stockpiled at the Moab site are a source of direct gamma radiation. As uranium decays, several of the decay products emit gamma radiation. Gamma radiation has sufficient energy to penetrate body tissues; therefore, protection against elevated exposure levels is of utmost importance to DOE. DOE public dose limits applicable to the Moab site are outlined in DOE O 5400.5, Chapter II, "Requirements for Radiation Protection of the Public and Environment" [1][a]. This order establishes standards and requirements for DOE operations (and DOE contractors) with respect to protection of members of the public and environment against undue risk from radiation.

Routine DOE activities shall not cause an effective public dose equivalent (for all exposure modes) greater than 100 mrem/yr above naturally occurring gamma levels (i.e., background). Contributions from radon are excluded from the dose limit and are addressed independently. DOE has determined that the background direct gamma radiation dose is approximately 81 mrem/yr in the Moab area and 92.5 mrem/yr in the Crescent Junction area. These values were derived by averaging monitoring data collected at background monitoring locations. Therefore, the DOE dose limit for direct gamma radiation at the site boundary (and at any off-site location) is approximately 181 mrem/yr at Moab and 192.5 mrem/yr at Crescent Junction.

During 2009, direct gamma radiation was measured at 35 locations (20 on-site, 13 off-site, and two MEI) using thermoluminescent dosimeters that are exposed for a period of approximately 3 months (a quarterly exposure). Upon collection, the dosimeters are sent to an off-site

laboratory for analysis. Analytical results are typically received from the laboratory within 30 days. Direct gamma radiation data results for all on-site, off-site, and MEI locations are shown in Table 4.

Table 4. Summary of Atmospheric Radon and Gamma Monitoring Data for the Moab and Crescent Junction Sites for 2009

Station Number	1st Quarter 2009		2nd Quarter 2009		3rd Quarter 2009		4th Quarter 2009		2009 Annual Results	
	Radon (pCi/L)	Gamma (mrem*/91 d*)	Radon (pCi/L)	Gamma (mrem*/91 d*)	Radon (pCi/L)	Gamma (mrem*/91 d*)	Radon (pCi/L)	Gamma (mrem*/91 d*)	Average Radon (pCi/L)	Gamma (mrem*/yr)
On-Site Locations										
0101	2.2	31.9	1.3	47.0	2.1	31.9	2.8	27.3	2.1	138.3
0102	1.6	20.9	0.9	35.0	1.3	19.3	1.5	17.7	1.3	93.1
0103	1.8	21.2	1.2	38.3	1.2	19.2	1.9	16.8	1.5	95.6
0104	2.7	25.5	1.4	45.0	1.7	23.0	2.1	20.5	1.9	114.1
0105	3.4	41.9	2.1	60.4	2.2	41.5	3.7	40.8	2.8	184.7
0106	7.1	44.1	4.2	62.8	5.2	41.7	6.3	48.1	5.7	196.8
0107	6.7	33.0	3.9	60.0	4.6	34.2	5.2	33.0	5.1	160.4
0108	3.6	42.7	3.4	60.5	4.7	44.7	4.3	41.7	4.0	189.7
0109	1.2	52.7	2.3	79.1	2.7	67.5	2.9	78.6	2.2	278.0
0110	2.5	62.3	4.0	91.9	2.5	88.4	2.4	77.2	2.8	320.0
0111	1.2	59.9	1.4	69.4	1.0	33.1	1.0	26.8	1.1	189.3
0112	1.9	34.3	NDA	53.5	2.0	42.5	2.6	37.6	1.6	168.1
0113	2.2	25.9	1.4	41.0	2.7	26.7	3.1	23.9	2.3	117.5
0301	1.1	23.2	0.9	37.9	1.0	21.7	0.8	14.8	0.9	97.6
0302	NDA	21.0	0.9	38.2	NDA	20.2	0.6	14.2	0.3	93.6
0303	NDA	23.9	1.3	41.1	0.7	23.7	1.0	17.5	0.7	106.2
0304	0.9	26.0	1.4	35.6	0.9	24.5	1.1	14.8	1.0	100.9
0305	0.8	26.4	0.9	38.6	1.0	26.5	0.8	NDA	0.8	91.5
0308	0.7	16.0	0.6	32.3	0.5	15.0	0.7	11.1	0.6	74.4
Off-Site Locations										
0117	0.8	20.2	0.6	39.9	0.8	19.1	0.8	NDA	0.7	79.3
0118	0.8	18.8	0.5	32.0	0.6	18.1	0.7	17.1	0.6	86.2
0119	0.9	18.2	NDA	41.3	0.7	17.6	0.8	18.7	0.6	96.0
0120	1.0	17.0	0.6	33.6	0.6	15.9	0.7	16.6	0.7	83.2
0121	0.6	18.8	0.7	36.4	0.8	17.5	0.6	16.0	0.6	88.8
0122	0.5	17.9	1.0	35.6	0.3	16.3	0.5	13.9	0.5	83.9
0123	0.4	18.4	0.5	35.2	0.3	17.5	0.4	12.9	0.4	84.3
0124	1.7	20.6	0.6	40.5	1.0	20.1	1.1	20.8	1.1	102.3
0125	2.1	24.5	2.0	47.0	1.7	23.6	1.9	26.5	1.9	121.7
0126	2.8	22.5	1.1	35.0	1.7	20.9	2.4	19.9	2.0	98.5
0127	1.2	21.1	1.0	40.5	0.7	20.1	0.8	20.4	0.9	102.3
0128	4.0	22.4	2.2	39.1	2.5	22.2	2.9	21.0	2.9	104.8
0129	1.8	20.9	1.5	40.1	2.0	21.8	1.9	21.7	1.8	104.6
MEI (Moab)	1.1	18.0	0.8	32.5	0.9	17.3	1.4	14.2	1.1	82.1
0303	NDA	23.9	1.3	41.1	0.7	23.7	1.0	17.5	0.7	106.2
0304	0.9	26.0	1.4	35.6	0.9	24.5	1.1	14.8	1.0	100.9
MEI (CJ)	0.8	24.9	0.6	39.3	0.7	23.4	0.5	16.6	0.6	104.2
0307	0.4	25.4	0.8	41.9	0.6	25.0	0.7	18.0	0.6	110.3

CJ = Crescent Junction; NDA = no data available.
*mrem value is prorated to a 91-day exposure period.

During 2009, direct gamma radiation measurements exceeded the DOE annual guideline at five on-site locations and zero off-site locations (see Table 4); however, this is not unexpected due to the large volume of uranium mill tailings stockpiled at the Moab site and their associated gamma activity. In addition, the annual average gamma radiation dose at the Moab MEI location was 82.1 mrem/yr, substantially below the limit of 181.0 mrem/yr. At the Crescent Junction MEI location, the annual average was 104.2 mrem/yr, below the limit of 192.5 mrem/yr.

Based on the levels of direct gamma radiation, these emissions are not affecting the general population in or near Moab, Crescent Junction, or Thompson Springs.

4.4.3 Airborne Radioparticulates

Collection of radioparticulate data are of particular interest to DOE because this data provide information relative to the dose that the public may be receiving from the inhalation of radioactive particulate matter. In 2009, air samplers operated continuously at three on-site locations and 10 off-site locations at Moab and Crescent Junction. These samplers consist of a low-volume air sampling pump that draws air (at a prescribed rate of 60 liters per minute) through a glass fiber filter. As air passes through the filter, particulate matter suspended in the air is captured on the surface of the filter. Air filters were collected weekly and submitted as a composite sample on a quarterly basis. The filters were then analyzed for specific radionuclides that are common constituents of uranium mill tailings, including radium-226, thorium-230, polonium-210, and total uranium.

The annual average derived concentration guide (DCG) values were compared to the DCGs published by DOE for inhaled air for various radioisotopes. A DCG represents the concentration from a specified radionuclide that would cause a member of the public residing at the point of collection to receive a dose of 100 mrem/yr. Exposures above this limit are considered unacceptable. The DCG values for the radionuclide included in the DOE monitoring program are shown in Table 5.

Table 5. Summary of DCGs for Inhaled Air Radionuclides Monitored at the Moab and Crescent Junction Sites for 2009

Radionuclide	DCG (µCi/mL)
Radium-226	1.0E-12
Thorium-230	4.0E-14
Polonium-210	1.0E-12
Total Uranium	2.0E-12

µCi/mL = microcuries per milliliter

The annual averages for airborne radioparticulate concentrations did not exceed the DCG values for any of the on-site or off-site locations for either Moab or Crescent Junction during 2009 (see Table 6). These data demonstrate that emissions of airborne radioparticulate matter were consistently two to four orders of magnitude below their respective DCG values, and, therefore, do not exceed levels or concentrations that would result in an unacceptable public exposure.

Table 6. Summary of Radioparticulate Air Monitoring Data for the Moab and Crescent Junction Sites for 2009

Moab Station Number	Isotope	1st Quarter 2009 (µCi/mL)	2nd Quarter 2009 (µCi/mL)	3rd Quarter 2009 (µCi/mL)	4th Quarter 2009 (µCi/mL)	Annual Average (µCi/mL)
On-site Locations						
0102-RP	Uranium	1.4E-16	1.9E-16	2.6E-16	1.70E-16	1.9E-16
	Thorium-230	1.1E-16	1.8E-16	2.2E-16	2.0E-16	1.8E-16
	Radium-226	9.6E-17	9.7E-17	1.3E-16	1.6E-16	1.2E-16
	Polonium-210	1.0E-14	4.6E-15	6.7E-15	9.1E-15	7.7E-15
0105-RP	Uranium	2.6E-16	4.1E-16	6.6E-16	3.8E-16	4.3E-16
	Thorium-230	2.0E-16	3.5E-16	6.4E-16	6.6E-16	4.6E-16
	Radium-226	1.6E-16	7.6E-17	3.0E-16	5.8E-16	2.8E-16
	Polonium-210	1.2E-14	5.6E-15	6.7E-15	1.4E-14	9.5E-15
Off-site Locations						
0117-RP	Uranium	1.1E-16	1.5E-16	1.6E-16	1.3E-16	1.4E-16
	Thorium-230	8.3E-17	1.7E-16	7.8E-17	8.3E-17	1.0E-16
	Radium-226	5.9E-17	3.3E-18	5.2E-17	8.8E-17	5.1E-17
	Polonium-210	8.3E-15	3.9E-15	5.6E-15	7.6E-15	6.3E-15
0118-RP	Uranium	1.6E-16	2.0E-16	2.5E-16	1.5E-16	1.9E-16
	Thorium-230	1.3E-16	2.9E-16	4.4E-16	2.0E-16	2.7E-16
	Radium-226	4.8E-17	-2.4E-17	4.5E-16	1.6E-16	1.6E-16
	Polonium-210	9.9E-15	3.8E-15	5.8E-15	9.1E-15	7.1E-15
0119-RP	Uranium	1.4E-16	3.1E-16	2.7E-16	1.8E-16	2.2E-16
	Thorium-230	1.3E-16	2.4E-16	2.0E-16	1.4E-16	1.8E-16
	Radium-226	5.1E-17	1.9E-16	9.4E-17	9.1E-17	1.1E-16
	Polonium-210	9.6E-15	4.2E-15	5.6E-15	8.2E-15	6.9E-15
0120-RP	Uranium	1.3E-16	1.8E-16	1.9E-16	1.6E-16	1.7E-16
	Thorium-230	1.1E-16	1.7E-16	1.1E-16	1.5E-16	1.3E-16
	Radium-226	7.8E-17	1.1E-16	8.6E-17	2.1E-17	7.4E-17
	Polonium-210	8.8E-15	3.6E-15	6.1E-15	8.4E-15	6.7E-15
0121-RP	Uranium	1.6E-16	1.6E-16	1.8E-16	1.3E-16	1.6E-16
	Thorium-230	4.3E-17	1.1E-16	1.3E-16	1.1E-16	9.7E-17
	Radium-226	5.8E-17	4.2E-17	9.3E-17	1.3E-16	8.1E-17
	Polonium-210	9.2E-15	4.3E-15	5.4E-15	7.6E-15	6.6E-15
0122-RP	Uranium	1.4E-16	1.7E-16	1.6E-16	1.6E-16	1.6E-16
	Thorium-230	1.1E-16	9.5E-17	1.1E-16	1.4E-16	1.1E-16
	Radium-226	3.2E-17	8.3E-17	1.0E-16	1.3E-16	8.7E-17
	Polonium-210	8.9E-15	3.4E-15	5.1E-15	7.9E-15	6.3E-15
0123-RP	Uranium	1.2E-16	1.7E-16	1.6E-16	1.4E-16	1.5E-16
	Thorium-230	1.3E-16	1.3E-16	1.3E-16	1.2E-16	1.3E-16
	Radium-226	9.0E-18	5.5E-17	1.3E-16	1.0E-16	7.4E-17
	Polonium-210	9.3E-15	3.9E-15	5.6E-15	8.5E-15	6.8E-15

Table 6. Summary of Radioparticulate Air Monitoring Data for the Moab and Crescent Junction Sites for 2009 (continued)

Moab Station Number	Isotope	1st Quarter 2009 (µCi/mL)	2nd Quarter 2009 (µCi/mL)	3rd Quarter 2009 (µCi/mL)	4th Quarter 2009 (µCi/mL)	Annual Average (µCi/mL)
Off-site Locations *(continued)*						
0129-RP	Uranium	3.2E-16	2.8E-16	6.7E-16	4.4E-16	4.3E-16
	Thorium-230	2.5E-16	3.8E-16	2.0E-15	8.0E-16	8.6E-16
	Radium-226	1.2E-16	2.3E-16	1.1E-15	4.0E-16	4.7E-16
	Polonium-210	1.1E-14	4.2E-15	7.5E-15	1.1E-14	8.2E-15
Crescent Junction Station Number	**Isotope**	**1st Quarter 2009 (µCi/mL)**	**2nd Quarter 2009 (µCi/mL)**	**3rd Quarter 2009 (µCi/mL)**	**4th Quarter 2009 (µCi/mL)**	**Annual Average (µCi/mL)**
On-site Location						
0308-RP	Uranium	1.4E-16	2.1E-16	3.9E-16	1.9E-16	1.8E-16
	Thorium-2302	8.9E-17	1.9E-16	5.9E-16	1.5E-16	1.2E-16
	Radium-2263	8.9E-17	1.7E-16	2.6E-16	1.2E-16	8.0E-17
	Polonium-2104	6.5E-15	4.6E-15	6.2E-15	7.4E-15	7.4E-15
Off-site Locations						
MEI (0306-RP)	Uranium	1.1E-16	1.3E-16	1.4E-16	1.2E-16	1.2E-16
	Thorium-230	1.3E-16	9.9E-17	8.5E-17	9.1E-17	1.0E-16
	Radium-226	3.6E-17	4.8E-17	5.6E-17	9.3E-17	5.8E-17
	Polonium-210	7.8E-15	3.9E-15	6.5E-15	7.4E-15	6.4E-15
0307-RP	Uranium	1.3E-16	1.2E-16	2.6E-16	1.7E-16	1.7E-16
	Thorium-230	3.7E-17	1.2E-16	1.5E-16	1.3E-16	1.1E-16
	Radium-226	2.0E-17	2.3E-17	9.7E-17	6.8E-17	5.2E-17
	Polonium-210	7.5E-15	3.4E-15	5.5E-15	7.1E-15	5.9E-15

4.4.4 Fugitive Dust

Most of the surface area at the Moab site consists of exposed, unprotected soils and sand. Vegetation at the Moab site is relatively sparse and offers little protection or stabilization to the site's sandy soils. Consequently, controlling windblown sand, soil, and dust is a recognized concern.

State of Utah regulations require that fugitive dust emissions from construction activities shall not exceed 20 percent opacity. When necessary, opacity determinations are documented according to EPA Method 9 protocols and provided to project personnel as appropriate.

During 2009, DOE diligently monitored fugitive dust emissions and implemented the controls outlined in the fugitive dust control plans to the greatest extent practicable. On an annual basis, DOE applies approximately 200,000 gallons of a calcium or magnesium chloride solution, a dust suppressant, to the RRM at Moab and Crescent Junction and unpaved haul and access roads in an effort to stabilize areas that are susceptible to wind erosion. In addition, DOE restricts travel in off-road areas of the sites and limits vehicular speed to minimize the generation of fugitive dust.

As areas are remediated or disturbed, DOE seeds and mulches the areas to establish vegetative cover to control windblown dust. Approximately 38.5 acres was revegetated in 2009, including 28 acres on the hillside at the Moab site, 3.5 acres west of the well field where tamarisk trees were removed, and 7 acres on the Crescent Junction disposal cell wedge.

4.5 Best Management Practice Area

The Best Management Practice Area (BMPA) is a dedicated area within the CA at the Moab site that is designed to safely store and isolate waste materials, such as existing structures, equipment, or soil that require further characterization or for which a disposal strategy has not yet been selected. The area is located about 300 feet southeast of the office buildings (see Figure 2). It measures approximately 14 feet by 8 feet, is surrounded by a 2-foot-high earthen berm, and is lined with 30-millimeter plastic sheeting. Once adequate characterization data are obtained and a disposal strategy is selected, wastes are removed from the BMPA.

4.6 Source Reduction

Source reduction generally means any change in products, services, or actions that reduce, eliminate, or prevent the amount or toxicity of waste being generated. The Moab UMTRA Project sites primarily achieve source reduction by using work practices that minimize the amount of radioactive waste that is generated. The ALARA principle is emphasized to keep materials from becoming radioactively contaminated. An example of source reduction at the project sites during 2009 was the use of a nonhazardous, environmentally friendly product to wash greasy engine parts and equipment instead of the hazardous chemical solvents that are typically used for such purposes.

Using administrative controls such as establishing radioactive materials areas, limiting the use of materials in the CA (especially hazardous materials such as chemicals), and segregating radioactive waste from nonradioactive waste reduces the volume of radioactive waste generated. Certain materials that must be taken into the CA can be protected from becoming radioactively contaminated. Decontamination is performed if warranted, feasible, and cost-effective.

5.0 Environmental Nonradiological Program Information

5.1 Meteorological Monitoring

DOE has installed two meteorological monitoring stations at the Moab site and two at or near the Crescent Junction site (see Figures 3 and 5, respectively). Meteorological monitoring is an important element in the design of environmental monitoring networks. Not only do these data enable DOE to monitor site-specific climatic conditions and events, but they also provide a valuable resource for assessing impacts resulting from any unplanned release of airborne contamination.

Meteorological parameters monitored at the Moab and Crescent Junction sites include air temperature, relative humidity, solar radiation, wind speed, wind direction, and precipitation. Table 7 summarizes 2009 meteorological data for temperature, wind speed, and precipitation for the Moab site; these data are similar to the Crescent Junction site.

Table 7. Meteorological Data Summary for the Moab Site for 2009

Month	Temperature (degrees F)		Wind Speed (mph)		Precipitation* (inches)
	Max Temp.	Min Temp.	Avg.	Peak Gust	
January	59.4	11.2	3.1	39.9	0.15
February	68.9	25.0	3.3	34.9	0.08
March	79.6	26.8	4.8	48.6	0.12
April	86.2	32.8	5.2	50.5	0.36
May	98.1	50.7	3.9	44.3	0.94
June	101.2	54.5	4.3	41.3	0.63
July	107.4	66.5	4.1	39.7	0.09
August	104.3	59.6	3.7	41.1	0.31
September	97.3	44.1	4.0	43.6	0.17
October	85.0	30.7	3.9	40.1	0.79
November	76.7	23.8	2.5	31.7	0.16
December	52.6	-0.8	2.2	35.7	0.77
***Total Adjusted with Manual Gauge**					**4.57**

F = Fahrenheit; max = maximum; min = minimum; mph = miles per hour; temp = temperature.

6.0 Ground Water Protection Program

The ground water beneath the Moab site has been contaminated from former uranium milling operations. Ground water at and in the vicinity of the site is not usable due to the naturally high salinity. Ammonia and uranium are the primary contaminants of concern. To protect the Colorado River water, ground water is extracted through an IA system installed at the Moab site, and when endangered species habitat areas form, freshwater is introduced to the backwater channel to reduce ammonia concentrations. Locations of select monitoring and extraction/injection wells at the Moab site are shown in Figure 6. The locations where routine ground water and surface water monitoring was conducted during 2009 are shown in Figure 7. Monitoring results show that the contaminant plumes of ammonia and uranium did not expand in 2009.

6.1 Ground Water

More than 20 extraction wells were used to minimize contaminant discharge to the Colorado River in 2009. Monthly sampling was conducted of wells in the IA ground water system that operated during the year. Routine ground water and surface water sampling was also conducted in May and June.

The ground water samples were analyzed for the site-related analytes: ammonia, chloride, manganese, sulfate, uranium, and total dissolved solids. A few selected locations were also analyzed for selenium and copper. In addition, alkalinity, dissolved oxygen, oxidation reduction potential, pH, specific conductance, temperature, and turbidity were measured in the field at all locations. Data results from sampling events are available on the Moab UMTRA Project website at www.gjem.energy.gov/moab.

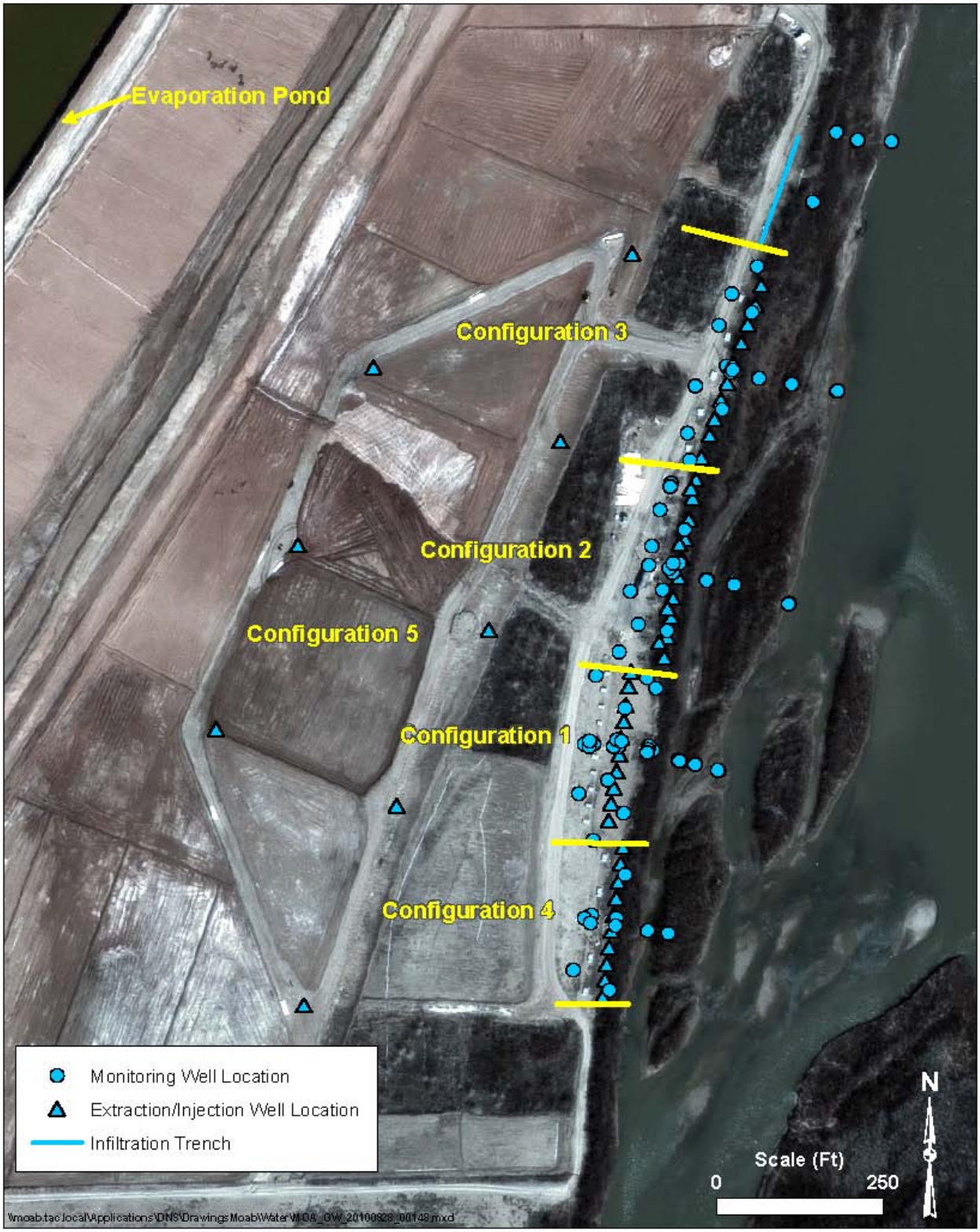

Figure 6. Locations of Select Monitoring and Extraction/injection Wells at the Moab Site

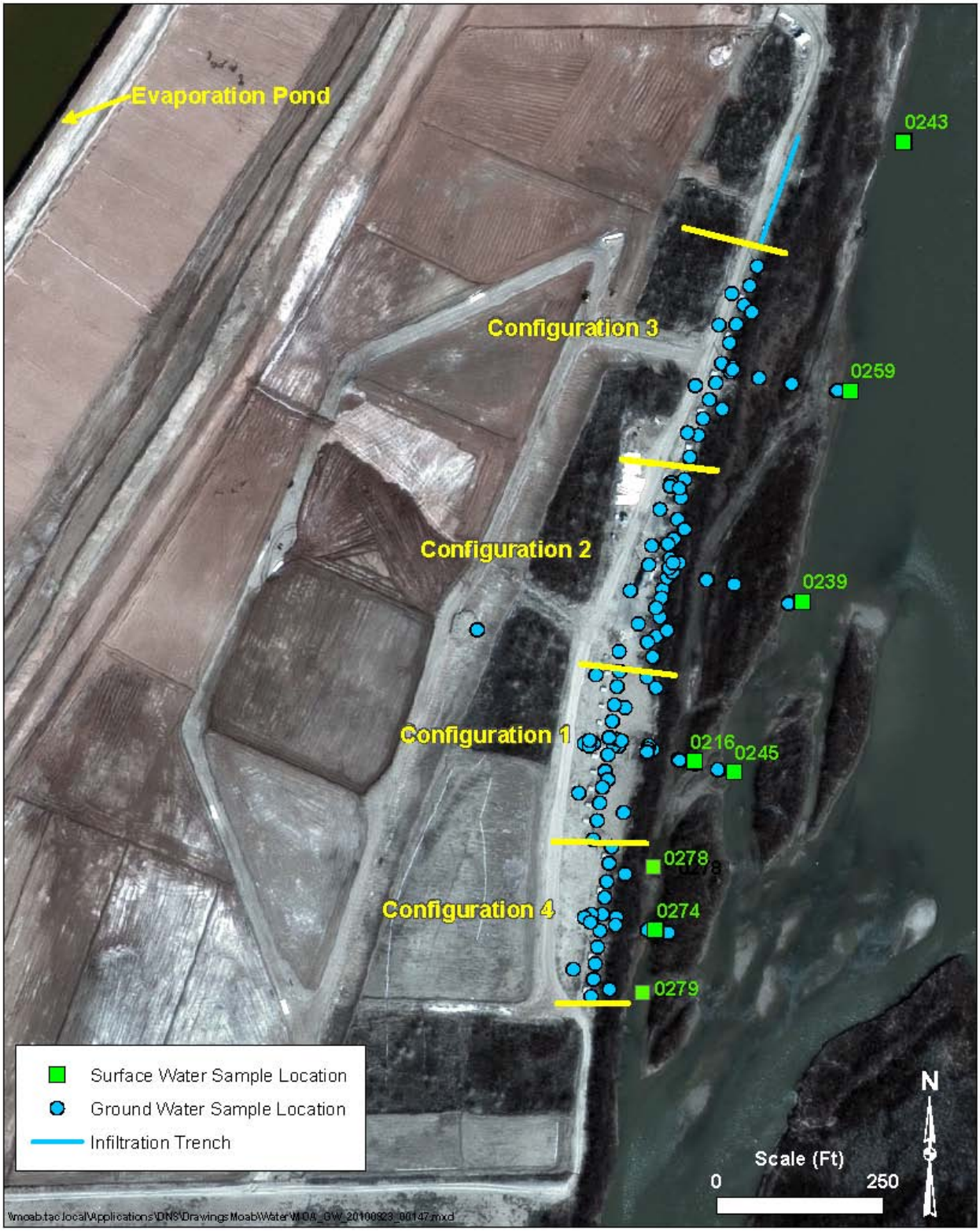

Figure 7. Select 2009 Surface Water Sampling Locations

More than 25 million gallons of ground water was extracted in 2009 from the IA system, with 90,653 lb of ammonia and 442 lb of uranium removed. A total of about 152 million gallons has been extracted since initial implementation of the system through the end of 2009, including 627,000 lb of ammonia and 2,752 lb of uranium.

Construction of three new monitoring wells began in 2009 to gain information for contaminant plume maps. One well is located north of the tailings pile, one is located on the southwestern side of the tailings pile adjacent to SR-279, and the third well is located on the southern edge of the Moab site.

Construction began on 11 new remediation wells during 2009. Seven of the wells are located just southeast of the toe of the tailings pile. These extraction wells are known as Configuration 5. The purpose of these wells is to extract the contaminated ground water closer to the tailings pile. In addition, four new injection wells were installed in the existing Configuration 2 (see Figure 6) to assist in protecting the aquatic habitat in the river if necessary.

6.2 Surface Water

The principle surface water feature in the vicinity of the Moab site is the Colorado River, which forms the eastern boundary of the site. Surface water sampling in 2009 focused on understanding the effects of ground water discharge and ground water remediation activities on the quality of surface water in areas of potential fish habitat. Favorable habitat is characterized by fairly shallow, low-velocity backwater channels that are closed off from the main channel on the upriver side. The site-related constituent of greatest concern at the site is ammonia because of its toxicity to aquatic life. Discharge of ammonia to the backwater channel of the Colorado River is of primary concern during low river flow.

Table 8 presents data for surface water locations and dates when ammonia exceeded the acute and/or chronic ambient water quality criteria as delineated in the EPA "Update of Ambient Water Quality Criteria for Ammonia" (EPA-822-R-99-014). The sampling was biased toward areas where the ammonia concentration was expected to be the highest. The highest concentrations of contaminants were observed near the riverbank of the DOE property in shallow, low-velocity portions of the river during baseflow conditions (late summer through winter) when the fish were not utilizing shallow water. The ammonia concentration downriver of the site was at background levels.

Biota Monitoring

In addition to water quality monitoring, biota monitoring of the river bank was conducted during the summer months of 2009 to observe the effect, if any, of site-related contamination on fish in habitat areas. Biota monitoring is conducted from July to September when the young-of-year pikeminnow may potentially inhabit the backwater channel. Beginning on September 11, diverted river water was introduced into the backwater channel adjacent to Configuration 4 (Figure 6), where a habitat area had formed. On September 14, one dead fish was observed in the backwater channel adjacent to Configuration 4; USFWS was notified. Diversion of river water ceased on September 21, when the river flow increased and the ammonia had returned to background concentrations.

Table 8. Surface Water Locations with Ammonia Concentrations Exceeding Ambient Water Quality Criteria During 2009

Location	Date	Ammonia Total as N (mg/L)	State/Federal AWQC – Acute Total as N (mg/L)	State/Federal AWQC – Chronic Total as N (mg/L)
0216	8/18/09	2.2	5.72	0.973
0216	11/3/09	7.7	10.1	2.8
0239	3/18/09	2.4	6.95	2.10
0243	8/17/09	1.4	5.72	0.973
0245	3/17/09	1.1	2.65	0.646
0259	3/18/09	4.0	8.40	1.17
0274	3/16/09	69.0	12.1	1.22
0274	8/19/09	1.6	4.71	1.22
0274	9/11/09	2.5	5.72	1.43
0274	11/2/09	2.4	8.40	2.43
0278	9/11/09	56.0	5.72	1.63
0279	09/11/09	1.5	3.88	1.07

AWQC = ambient water quality criteria; mg/L = milligrams per liter

7.0 Quality Assurance

The Moab UMTRA Project has a QA Program that provides a structured approach for the application of QA principles to work performed on the project by DOE contractors and which is based on DOE O 414.1C, "Quality Assurance," requirements. The QA Program is implemented with contractor-specific QA plans, which ensure environmental data collected are valid and traceable.

7.1 Laboratory Analysis

The DOE contractors ensure the receipt of analytical data that meet environmental monitoring program requirements by subcontracting analytical services to qualified laboratories. The subcontract laboratories are qualified under the Environmental Management Consolidated Audit Program, Utah Certification, and participate in proficiency testing programs. The contractors evaluate the quality of the data received from the laboratories through a formal data validation process.

7.2 Records Management

Project records are created both on paper and electronically in a retrievable format. Electronically created records will be converted to paper prior to being transferred to a federal record center for long-term storage. Records are protected against deterioration, damage, and loss. Records generated in support of environmental monitoring are subject to the requirements of 36 CFR 1220-1234, "Federal Records; General," and are managed accordingly.

8.0 References

10 CFR 1021 (Code of Federal Regulations), "National Environmental Policy Act Implementing Procedures."

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

36 CFR 1220-1234 (Code of Federal Regulations), "Federal Records; General."

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

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

40 CFR 1500 (Code of Federal Regulations), "Purpose, Policy, and Mandate."

40 CFR 1507.3 (Code of Federal Regulations), "Council on Environmental Quality Agency Procedures."

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

15 USC 2601 (United States Code), Toxic Substances Control Act.

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

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

33 USC 1251 (United States Code), Clean Water Act.

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

42 USC 4321 (United States Code), National Environmental Policy Act.

42 USC 6901 (United States Code), Resource Conservation and Recovery Act.

42 USC 7401 (United States Code), Clean Air Act.

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

42 USC 9601 (United States Code), Superfund Amendments and Reauthorization Act.

42 USC 11000 (United States Code), Emergency Planning and Community Right-to-Know Act.

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DOE (U.S. Department of Energy). *Moab UMTRA Project Biota Monitoring Plan* (DOE-EM/GJ1079), January 2006.

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DOE (U.S. Department of Energy). *Moab UMTRA Project Moab Storm Water Pollution Prevention Plan* (DOE-EM/GJRAC1475), May 2010.

DOE (U.S. Department of Energy). *Moab UMTRA Project Waste Management Plan* (DOE-EM/GJ1633), July 2008.

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), September 2005.

DOE (U.S. Department of Energy) Order 231.1A, "Environment, Safety, and Health Reporting."

DOE (U.S. Department of Energy) Order 414.1C, "Quality Assurance."

DOE (U.S. Department of Energy) Order 430.2B, "Departmental Energy, Renewable Energy, and Transportation Management."

DOE (U.S. Department of Energy) Order 450.1, "Environmental Protection Program."

DOE (U.S. Department of Energy) Order 5400.5, "Radiation Protection of the Public and the Environment."

EPA (U.S. Environmental Protection Agency), "Update of Ambient Water Quality Criteria for Ammonia" (EPA-822-R-99-014).

Executive Order 11990, "Protection of Wetlands."

Executive Order 11988, "Floodplain Management."

Executive Order 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements."

Executive Order 13423, "Strengthening Federal Environmental, Energy, and Transportation Management."

Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance."

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

International Organization for Standardization 14001, "Environmental Management System Standard."

UAC R307-309-6 (Utah Administrative Code), "Fugitive Dust Control Plan."

UAC R313-15-301 (Utah Administrative Code), "Standards for Protection against Radiation, Dose Limits for Individual Members of the Public."