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Office of Environmental Management – Grand Junction

MOAB UTAH
UMTRA Project

Annual Site Environmental Report for Calendar Year 2005

June 2006

U.S. Department of Energy

Office of Environmental Management

Work Performed Under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Environmental Management.

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Acronyms

ACM	asbestos-containing-material
ALARA	as low as reasonably achievable
AWQC	ambient water quality criteria
BA	Biological Assessment
BLM	Bureau of Land Management
BMPA	best management practice area
BO	Biological Opinion
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
CY	calendar year
DCG	derived concentration guide
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
EM	DOE's Office of Environmental Management
EMS	Environmental Management System
ESA	Endangered Species Act
EPA	U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
MEI	maximally exposed individual
mrem/yr	millirem per year (mR/yr)
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
PEIS	programmatic environmental impact statement
QA	quality assurance
QAPP	Quality Assurance Program Plan
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RRM	residual radioactive materials
SARA	Superfund Amendments and Reauthorization Act
SWP^3	Storm Water Pollution Prevention Plan
TAC	Technical Assistance Contractor
TLD	thermoluminscent dosimeter
TSCA	Toxic Substances Control Act
U.A.C.	Utah Administrative Code
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act
UPDES	Utah Pollutant Discharge Elimination System
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USF&WS	U.S. Fish and Wildlife Service

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Executive Summary

This Annual Site Environmental Report presents information pertaining to environmental activities conducted under the Moab Uranium Mill Tailings Remedial Action (UMTRA) Project during calendar year (CY) 2005. This report includes activities at both the Moab Site located in Moab, Utah, and the Crescent Junction site, located northeast of the junction of Interstate 70 (I-70) and State Highway 191 (US-191) approximately 30 miles north of the Moab Site. The Moab Site is owned by the U.S. Department of Energy (DOE). Jurisdiction of the Crescent Junction site is currently being transferred to DOE through a Bureau of Land Management (BLM) land withdrawal. DOE's Office of Environmental Management (EM) located in Grand Junction, Colorado operates both sites. S.M. Stoller Corporation, the Technical Assistance Contractor (TAC) for DOE's Grand Junction Office, prepared this Annual Site Environmental Report in accordance with the requirements of DOE Order 231.1, *Environment, Safety, and Health Reporting*, DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, and supplemental guidance from DOE Headquarters.

According to DOE orders, all DOE facilities that conduct significant environmental protection programs shall prepare an annual site report, the purpose of which is to present summary environmental data so as to characterize site environmental management performance, confirm compliance with environmental standards and requirements, and highlight significant programs and efforts. The Annual Site Environmental Report is a key component of DOE's efforts to keep the public informed of environmental conditions at DOE sites. Consequently, this report contains the most accurate and complete monitoring data available and up-to-date compliance information for CY 2005.

DOE took possession of the Moab Site in October 2001, and as the new custodian of this property, one of DOE's first actions was to secure the property boundary and any on-site facilities that presented an imminent risk or hazard to the public, site workers, or the environment. Primary site activities in 2005 included site management and public involvement; site security, stabilization, and maintenance actions; site assessment, characterization, and initial site remediation; waste management and pollution prevention; continued operation of the Initial and Interim ground water remediation projects; and environmental compliance monitoring (air, surface, and ground water). All activities performed at the Moab Site during 2005 were conducted in compliance with applicable federal, state, and local regulations and requirements, and with applicable DOE orders.

During CY 2005, the Moab Site received no notices of violation and did not have any occurrences that required reporting to outside agencies. Air monitoring and meteorological data collection were initiated at Crescent Junction during CY 2005.

Site Activities and Highlights for Calendar Year 2005

Significant highlights, accomplishments, and activities conducted by DOE on the Moab UMTRA Project during 2005 are as follows:

Site Management and Public Involvement

- In accordance with the National Environmental Policy Act (NEPA) process for evaluating major federal actions, DOE prepared and issued a final Environmental Impact Statement (EIS) to evaluate alternatives for remediation and disposal of contaminants associated with the former millsite, vicinity properties, and ground water. DOE worked with 12 cooperating agencies in the preparation of the final EIS.
- DOE prepared and issued a Record of Decision (ROD), announcing its decision to remove the uranium mill tailings and other contaminated material from the Moab milling site and nearby off-site properties (vicinity properties) and relocate them at the Crescent Junction site, using predominantly rail transportation. The ROD also states that DOE will implement active ground water remediation at the Moab milling site.
- A 404 Permit application was submitted to the U.S. Army Corps of Engineers (USACE) for pump station improvements, river dike remediation, and Moab Wash remediation and relocation.
- An application was submitted to the U.S. Department of Transportation for an exemption for transportation of tailings from the Moab Site.
- The Moab Site became integrated into the Environmental Management System (EMS) that is partially managed by the DOE-EM office in Grand Junction, Colorado.
- Stakeholder/public involvement activities were held.

Site Security, Stabilization, and Maintenance

- Physical security of the site perimeter was maintained (e.g., upgraded and repaired existing perimeter fencing, posted current applicable warning signs, implemented institutional controls as appropriate).
- Upon DOE's receipt of the property in October 2001, the entire site was in an overall state of disrepair. DOE has continued its general "housekeeping" efforts to improve the site's safety and environmental conditions, and to clean up and repair facilities and structures that had been neglected.
- Site conditions and facilities were stabilized (implemented fugitive dust controls and storm water run-off controls, established radiological barriers, locked form mill buildings, and improved on-site roads, ponds, etc.).
- A site access control facility consisting of a decontamination trailer, office trailers, and several sea-land storage units for storing equipment were maintained.
- General ongoing maintenance of roads, utilities, fences, water diversion structures, pipelines, and pumps were maintained.

Site Remediation and Construction Activities

- Removal of contaminated soil from the east end of the site was stated. The contaminated surface soil contamination was mainly from wind-blown source. Approximately 58,000 cubic yards were removed from areas in the extreme northeast side, and approximately 75,000 cubic yards from the southeast side of the Moab Site, for a total of 133,000 cubic yards.

- The contaminated footprint at the Moab Site was reduced by 29 acres through remediation of contaminated soil.
- Designs for remediation of contaminated soils associated with the area under and around the Moab Site raw water ponds were prepared, as well as designs for construction of two new ponds for storage of water on site.

Waste Management and Pollution Prevention

- Approximately 150 gallons of non-radioactive waste oil was consumed in a waste oil burner at the Moab Site.
- Disposition of all legacy chemicals remaining at the Moab Site was completed.
- The Best Management Practice Area (BMPA) was maintained. The BMPA is a lined and bermed impoundment designed to safely store and isolate potential waste materials permanent disposition can be completed.
- DOE participates in a program offered by the Utah Power electric utility to purchase electricity generated by a renewable source (wind power) for the site's electrical needs.
- Approximately 250 pounds of paper and 50 pounds of aluminum were recylced.

Environmental Compliance

- Site dust controls in accordance with the *Moab Site Fugitive Dust Control Plan* (DOE 2002b) (submitted to State of Utah in 2002) were maintained.
- Site storm water controls were maintained and weekly inspections were conducted in accordance with the *Moab Site Storm Water Pollution Prevention Plan* (DOE 2002c).
- *Temporary Change Applications* were prepared and submitted to the Utah Division of Water Rights for the temporary change in use of existing water rights to support both the Initial and Interim ground water remediation projects.
- Formal consultation was made with the U.S. Fish and Wildlife Service (USF&WS) to ensure protection of threatened and endangered species and critical habitat at and near the Moab Site. The formal consultation process resulted in the preparation of a Biological Assessment (BA) and subsequent Biological Opinion (BO).
- The *Floodplain and Wetlands Assessment for Interim Actions at the Moab Project Site* (DOE 2005a) report for the Moab Site was updated.

Environmental Air Monitoring

- Both on-site and off-site environmental air monitoring activities was conducted in accordance with the *Moab Project Environmental Air Monitoring Sampling and Analysis Plan* (DOE 2003a) at the Moab Site. Air monitoring was also initiated at the Crescent Junction site in the fall of 2005. Parameters monitored at the both sites include radon-222, direct gamma radiation, and radioparticulate matter (polonium-210, radium-226, thorium-230, and total uranium). For the Moab Site, the air monitoring network is designed to collect data from the Moab Site, the surrounding community, and background locations. At the Crescent Junction site, the air monitoring network is designed to collect initial baseline data at and near the site before construction activities commence.

- Meteorological monitoring data continues to be collected from a monitoring station that was installed at the Moab Site in 2002, and an additional meteorological monitoring station was installed near the Crescent Junction site.
- Quarterly environmental air monitoring reports were prepared that summarize and trend the air monitoring data collected from the Moab Site and the surrounding community. Quarterly reporting of the Crescent Junction air monitoring data will begin in 2006. These reports compare monitoring data to exposure limits and guidelines, and are posted on DOE's Moab Project website (http://gj.em.doe.gov/Moab).
- Interior radon monitoring at the Maximally Exposed Individual (MEI) locations were conducted. These data are collected from the nearest, continuously occupied residences, one located closest to the Moab Site, and one located closest to the Crescent Junction site. The MEI locations represent the worst-case exposure scenario to a member of the general public.

Ground Water and Surface Water Monitoring

- Extensive ground water and surface water monitoring and field investigations were conducted throughout 2005.
- Additional remediation wells were installed, two interim action ground water remediation systems were operated during 2005, and monthly performance data was collected.
- Technical reports associated with assessment of interim action performance and characterization of ground water and surface water conditions and contaminants (e.g., calculation sets, sensitivity analyses, and data validation packages) were prepared.
- Surface water samples from potential endangered fish habitat to evaluate effects from discharge of contaminated ground water were collected.

Compliance Summary for Calendar Year 2005

Ground Water/Surface Water

The principal surface water feature in the vicinity of the Moab Site is the Colorado River, which flows adjacent to the east boundary of the site. Ground water discharge from the Moab Site has caused localized degradation of surface water quality in the Colorado River. The constituent of greatest concern in the Colorado River is ammonia; other contaminants have been detected (e.g., uranium and sulfate).

Extensive ground water and surface water monitoring was conducted during 2005 to serve several purposes. Two interim action active ground water remediation systems were operated during 2005. Monitoring data were collected to assess system performance. The primary purpose for conducting active ground water remediation is to improve surface water quality. Approximately 30 percent of surface water samples collected in 2005 exceeded ambient water quality criteria for ammonia, indicating that discharge of site ground water is locally affecting surface water quality. Sampling was biased toward areas where highest ammonia concentrations discharge to the Colorado River. The highest concentrations of all contaminants were in shallow, low velocity portions of the river; contaminant concentrations in the main channel were low.

Environmental Air Monitoring

DOE's environmental air monitoring strategy for the Moab UMTRA Project is designed to monitor public and environmental exposures to airborne contaminants that are directly attributable to the uranium mill tailings and other contaminated materials stockpiled at the Moab Site. Specifically, DOE's air monitoring strategy targets concentrations of radon-222 gas, airborne radioparticulates, exposure levels to direct gamma radiation, and fugitive dust emissions. DOE's Moab and Crescent Junction site's environmental air monitoring networks consists of on-site, off-site, and background sampling locations.

During 2005, DOE's monitoring data at the Moab Site continued to indicate that both radon concentrations and direct gamma radiation levels exceeded applicable DOE guidelines at several locations along the DOE property boundary. However, these same data also indicate that both radon concentrations and direct gamma radiation levels (attributable to the mill tailings) attenuate to near background levels within one-half mile of the Moab Site boundary. Monitoring data from the MEI location (both interior and exterior measurements), which represents the worst-case public exposure scenario, indicate that both radon and direct gamma radiation levels are below DOE exposure guidelines. Similarly, radon and gamma levels at all off-site monitoring locations within the Moab community were below public exposure guidelines specified by DOE order.

Radioparticulate monitoring data at the Moab Site show that concentrations of airborne contaminants are several orders of magnitude below DOE's public exposure limits. These data demonstrate that there were no public exposures to airborne radioparticulates that exceeded regulatory limits.

Evaluation of the monitoring data at the Crescent Junction site will begin in 2006 and results will be reported in future Annual Site Environmental Reports.

DOE's goal for on-site fugitive dust emissions is to maintain all emissions below the State standard for opacity (i.e., fugitive dust emissions cannot exceed 20-percent opacity). DOE aggressively controls visible emissions of fugitive dust through implementation of dust-suppression techniques and various engineering and procedural controls.

Public Radiological Dose/Exposure Summary

Radiological exposures to the public resulting from uranium mill tailings stored at the Moab Site consist of two components: direct gamma radiation and airborne emissions of radioparticulates. Radiation associated with radon exposures (and its decay products) is addressed independently.

The direct gamma radiation exposure limit for DOE activities and operations at the Moab Site is calculated to be 181 millirem per year (mrem/yr). Although direct gamma radiation exposures were elevated at several locations along the DOE property boundary, all off-site locations were observed to be near background levels.

DOE must also monitor airborne radioactive materials released to the atmosphere. The DOE airborne emissions limit is 10 mrem/yr. DOE conducted continuous air particulate sampling at various on- and off-site monitoring locations during 2005. DOE's radioparticulate monitoring

targeted specific radionuclides that are common constituents of uranium mill tailings. Radioparticulate monitoring data collected at all sampling locations at the Moab Site during 2005 were below the 10 mrem/yr emissions limit.

In summary, environmental data collected for direct gamma radiation and radioparticulate air emissions during 2005 were below the public dose limits applicable to the Moab Site at all off-site monitoring locations.

Waste Management/Pollution Prevention

During 2005, DOE continued to manage radioactively contaminated legacy wastes to better protect the public, site workers, and the environment. These materials included laboratory chemicals, industrial products, and used oil. Certain legacy materials were identified for reuse, while others were disposed of onsite. Legacy used oil was safely stored within the site's BMPA. Both non-radioactive legacy used oil and non-radioactive used oil generated during 2005 were burned during colder months in onsite oil burning space heaters.

Materials such as paper products, aluminum cans, and automotive batteries were collected and recycled within the Moab community, and a nonhazardous solvent was used to clean grease from equipment. A legacy radioactive calibration source was transferred to the Idaho National Laboratory in Idaho Falls, Idaho, for reuse.

Electricity generated by a pollution free source (wind power) was purchased from the site's electric utility to support renewable energy. In addition, biodiesel fuel was tested in one of the on-site vehicles.

Distribution of this Document

This document may be viewed in its entirety at the DOE Moab UMTRA Project website at http://gj.em.doe.gov/moab. Hard copies may be obtained by contacting Mr. Don Metzler, DOE Moab Federal Project Director at (970) 248-7612 or at the U.S. Department of Energy, 2597 B 3/4 Road, Grand Junction, CO 81503. Comments or questions regarding this document also may be directed to the Moab Project toll free at 1-800-637-4575. Members of the public who wish to comment on this document or have questions are encouraged to contact DOE at the above phone numbers or by email at moabcomments@gjo.doe.gov.

1.0 Introduction

1.1 Background

The Moab UMTRA Project includes two sites: (1) the Moab Site is owned by the DOE, and (2) the Crescent Junction Site is being transferred from the BLM to the DOE. The Crescent Junction Site is located northeast of the junction of Interstate 70 (I-70) and U.S. Highway 191 (US-191) approximately 30 miles north of the Moab Site.

The Moab Site lies approximately 30 miles south of I-70 on US-191 in Grand County, Utah (Figure 1–1). The 439-acre Moab Site is located about 3 miles northwest of the city of Moab (Figure 1–2) and lies on the west bank of the Colorado River at the confluence with Moab Wash. The site is bordered on the north and southwest by steep sandstone cliffs. The Colorado River forms the eastern boundary of the site. US-191 parallels the northern site boundary, and State Road 279 (SR-279) transects the west and southwest portion of the property. The Union Pacific Railroad traverses a small section of the site just west 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. Canyonlands National Park is located about 12 miles to the southwest.

The Moab Site is a former uranium-ore processing facility that operated under various owners from 1956 through 1984. Uranium tailings from the milling operation were slurried to a 130-acre pile located at the west portion of the property. Uranium mill tailings are radioactive residue wastes that result from the processing of uranium ore. Although the milling process recovered about 95 percent of the uranium, these residues, or 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 which 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."

The mill tailings pile is located in an unlined impoundment at the Moab Site and occupies approximately 130 acres of the western portion of the site. The tailings pile height averages 94 feet above the Colorado River terrace (4,076 feet above mean sea level) and is located in the 100-year floodplain of the Colorado River about 750 feet from the river. The pile consists of an outer compact embankment of coarse tailings, an inner impoundment of both course and fine tailings, and an interim cover of uncontaminated soil. DOE estimates the total contaminated material at the Moab Site has a total mass of approximately 16 million tons and a volume of approximately 12 million cubic yards. Debris from dismantling the mill buildings and associated structures was placed in an area at the southern toe of the pile and was covered with contaminated soils and fill. Evidence indicates that historical building materials may contain asbestos. Surveys indicate that soils outside the pile also contain radioactive contaminants at concentrations above EPA standards. Besides tailings, contaminated soils, and debris, other contaminated materials requiring cleanup include ponds used during ore-processing activities, disposal trenches, other locations used for waste management during mill operation, and buried septic tanks that are assumed to be contaminated. Figure 1–3 provides a map of the basic Moab Site features (e.g., site boundary, buildings, tailings pile, roads, etc.).

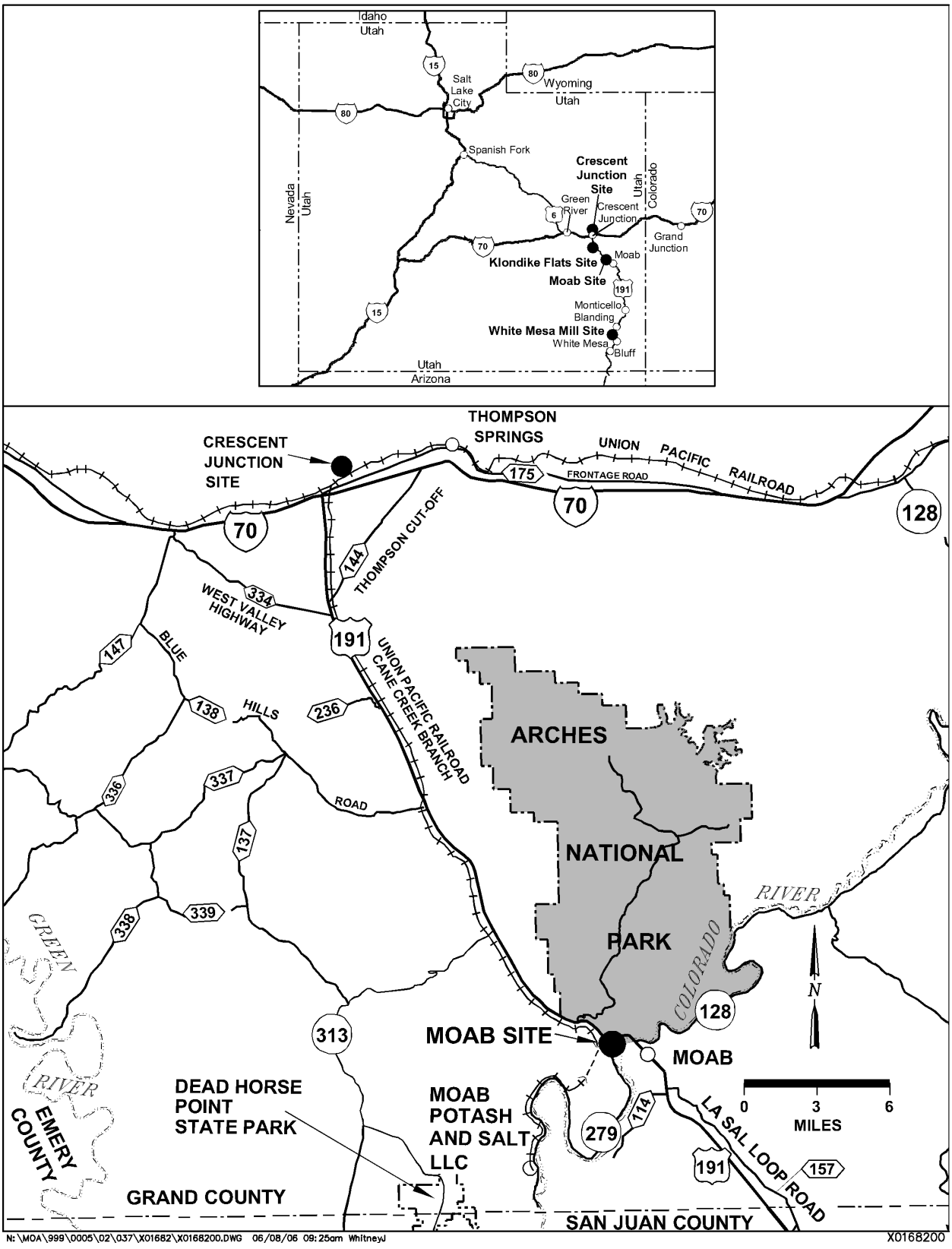

Figure 1–1. Location of the Moab and Crescent Junction Sites in Grand County, Utah

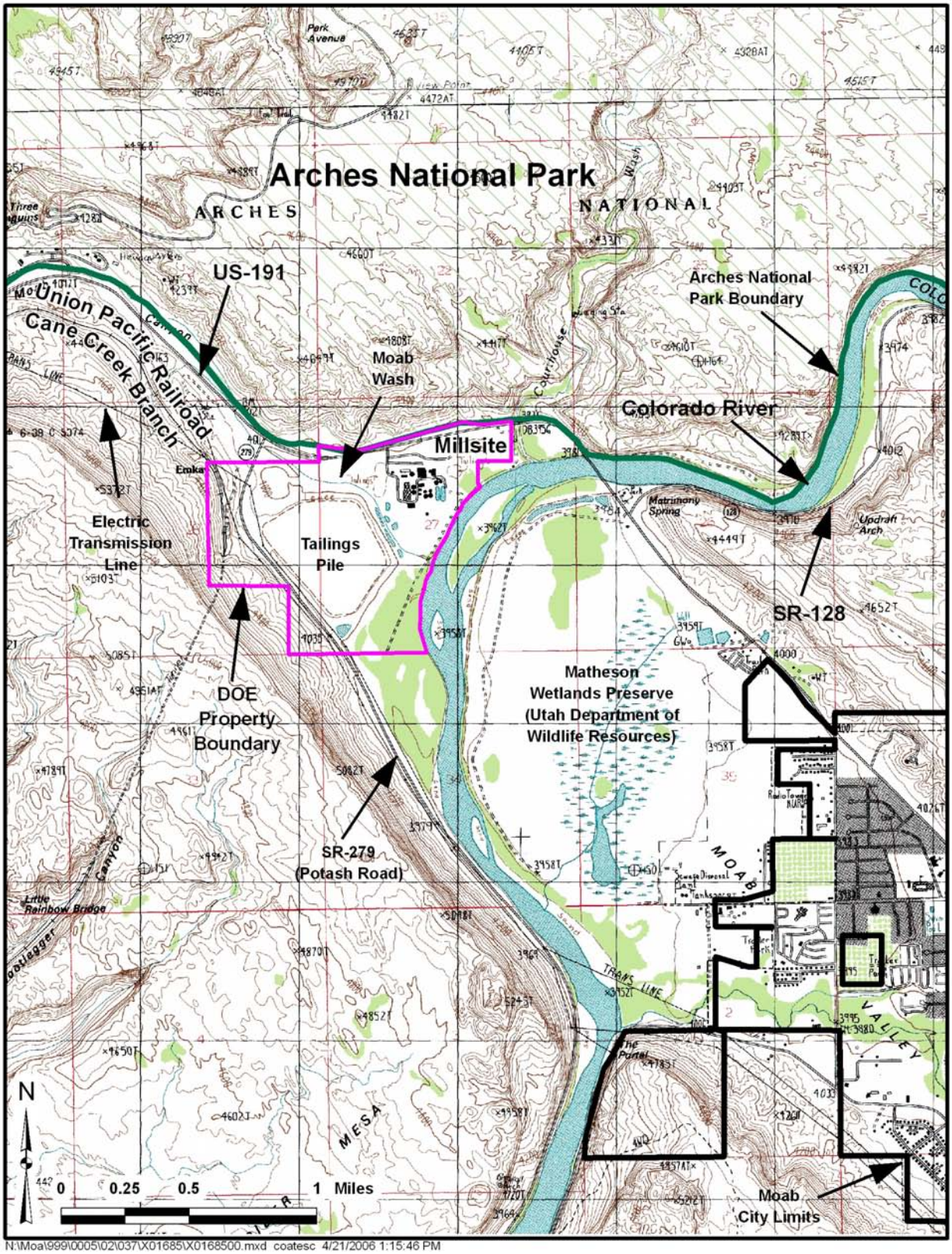

Figure 1–2. Location of the Moab Site in Relation to the City of Moab, Utah

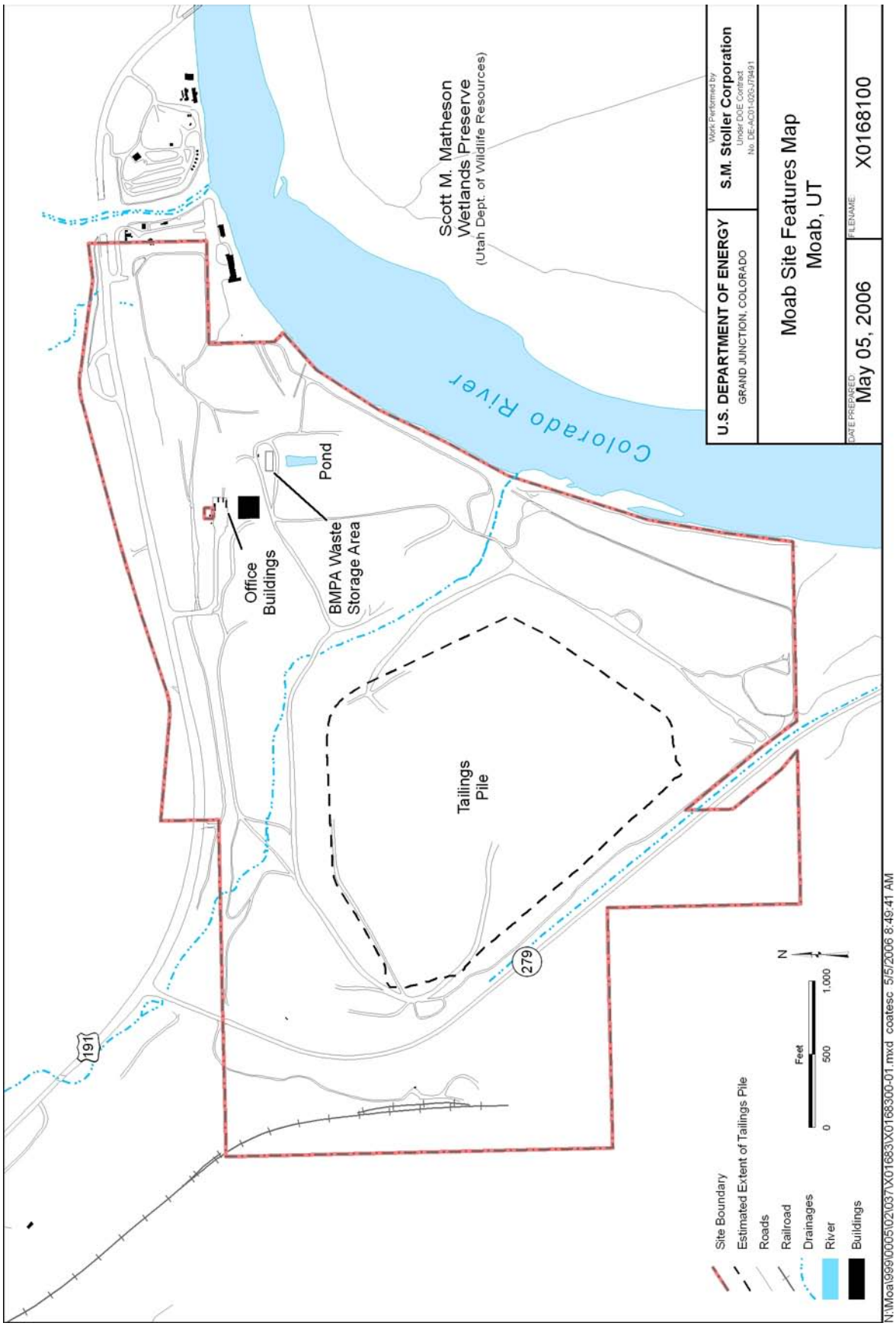

Figure 1–3. Moab Site Features Map

Contaminants are currently seeping from the tailings pile at low rates and may be adversely affecting ground water and surface water. Contaminants from the mill tailings are leaching downward into alluvial ground water, which discharges into the Colorado River. Consequently, the surface water quality in some low-velocity areas of the Colorado River adjacent to the site has been negatively affected as a result of site-related contamination. The primary constituents of concern in ground water and surface water are ammonia and, to a lesser extent, uranium. The primary concern for airborne contaminants from the tailings pile is radon-222 gas (a daughter product associated with the radioactive decay of uranium mill tailings) and fugitive dust emissions.

Besides tailings, contaminated soils, and contaminated ground water, other contaminated materials requiring cleanup include ponds used during ore-processing activities, disposal trenches, and other locations used for waste management during mill operation. There is also evidence that historical building materials may contain asbestos.

1.2 Site History

The Moab Site is a former uranium-ore processing facility that was owned and operated by the Uranium Reduction Company and later by the Atlas Minerals Corporation under a license issued by the U.S. Nuclear Regulatory Commission (NRC). The processing facility, which was used for processing uranium ore to extract uranium for nuclear power plants, no longer operates and has been dismantled except for one building that is currently used by DOE as a repair/maintenance shop and warehouse.

By 1984, all milling operations at the Moab Site had ceased. Decommissioning of the mill began in 1988, and an interim cover was placed on the tailings pile between 1989 and 1995. In 1996, Atlas submitted a revised Reclamation Plan and an application to NRC to amend its existing NRC License (No. SUA-917) and to allow for reclamation of the site. Under the license amendment, Atlas was required to reclaim the tailings impoundment in accordance with the October 1996 submittal to NRC titled *Final Reclamation Plan, Atlas Corporation Uranium Mill and Tailings Disposal Area* (Atlas 1996).

In 1999, NRC completed the *Final Environmental Impact Statement Related to Reclamation of the Uranium Mill Tailings at the Atlas Site, Moab, Utah* (NRC 1999), which focused on stabilizing the tailings pile in place. The final EIS received numerous comments both in favor of and opposed to the proposed action. However, the EIS did not address ground water compliance or remediation of vicinity properties. As part of the EIS process, the USF&WS completed a BO that was included in the final version of the EIS. The USF&WS concluded in the final BO that continued leaching of existing concentrations of ammonia and other constituents into the Colorado River would jeopardize the existence of two endangered fish—the razorback sucker and Colorado pikeminnow found near the project.

In October 2000, the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 (Public Law No. 106-398) gave DOE responsibility for remediation of the Moab Site. This legislation also mandated that the Moab Site be remediated in accordance with Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I "subject to the availability of appropriations for this purpose" and required DOE to prepare a remediation plan to evaluate the costs, benefits, and risks associated with various remediation alternatives. The Act further stipulated that the draft plan be presented to the National Academy of Sciences (NAS) for review. NAS was

charged with providing "technical advice, assistance, and recommendations" for remediation of the Moab Site. Under the Act, the Secretary of Energy was required to consider NAS comments before making a final recommendation on the selected remedy. If the Secretary prepared a remediation plan that was not consistent with NAS recommendations, the Secretary must submit a report to Congress explaining the reasons for deviation from those recommendations.

DOE's draft Plan for Remediation was completed in October 2001 and forwarded to NAS. After reviewing the draft plan, NAS provided a list of recommendations for DOE to consider during its assessment of remediation alternatives for the Moab Site. Subsequently, DOE prepared a draft EIS as required by the NEPA, 42 *United States Code* (U.S.C.) §§ 4321 *et seq*., to assess the potential environmental impacts of remediating the Moab Site. NAS recommendations were considered in preparation of the draft EIS. The draft EIS was issued for public comment in November 2004.

To minimize potential adverse effects to human health and the environment in the short term, former site operators, custodians, and DOE have instituted environmental controls and interim actions at the Moab Site. Controls have included storm water management, dust suppression, pile dewatering activities, and placement of an interim cover on the tailings to prevent movement of contaminated windblown materials from the pile. Interim actions have included restricting site access, monitoring ground water and surface water, and managing legacy chemicals to minimize the potential for releases to the environment. In addition, DOE designed a ground water extraction system (implemented in the summer of 2003) to intercept ground water contaminants discharging to the Colorado River thereby reducing ammonia and uranium concentrations in ground water discharging to the river.

As part of the EIS process, DOE hosted several informational meetings that were open to the general public and interested parties providing a status of site activities and the development of the EIS. DOE also sponsored several meetings with the various cooperating agencies.

Federal and state regulatory agencies expressed concern about the effects of disposing of contaminated materials at the site and the effects of contaminated ground water entering the Colorado River. Stakeholders, including local and state governments, environmental interest groups, and downstream users of Colorado River water, also expressed concern regarding the status of the site. DOE is committed to establishing and maintaining clear lines of communication with all stakeholders.

1.3 Current Status of the Moab Site

In July 2005, DOE completed the final EIS for the Moab Site. On the basis of the analysis documented in the EIS, the comments received during the public comment period on the draft EIS, and other factors, DOE determined that its preferred alternatives were the off-site disposal of the mill tailings pile, combined with active ground water remediation at the Moab Site. The preferred off-site disposal location was identified as the Crescent Junction site, and the preferred method of transportation was identified as rail.

In September 2005, DOE prepared and issued a ROD, announcing its decision to implement the preferred alternatives identified in the EIS. DOE is currently conducting activities at the Moab and Crescent Junction sites in preparation of implementing the selected alternative, including the environmental monitoring described in this report.

The purpose of this report is to provide DOE, state officials, and interested members of the public with current information regarding DOE activities of the Moab UMTRA Project. This report will summarize environmental activities conducted during CY 2005, environmental monitoring data collected during 2005, and noteworthy milestones and accomplishments. This report is structured as follows:

- Section 2.0 defines the laws and regulations that govern operations at the site and includes information about the site's compliance status.
- Section 3.0 describes the environmental programs operating at the site.
- Section 4.0 summarizes the data collected by the various environmental monitoring programs.
- Section 5.0 provides an overview of the ground water monitoring program and data.
- Section 6.0 discusses the quality assurance (QA) measures implemented at the site.
- Section 7.0 provides a list of references used in the preparation of this document.

End of current text

2.0 Compliance Summary

This section describes the compliance status of the Moab Site with applicable federal environmental regulations, describes current issues and actions, and contains a summary of the permits held by the Moab Site.

2.1 Compliance Status

The Moab and Crescent Junction sites operated during CY 2005 without receiving any notices of violation and did not have any occurrences that required reporting to outside agencies.

2.1.1 Floyd D. Spence Act

The primary regulatory driver for the remediation of the Moab Site is the Floyd D. Spence National Defense Authorization Act for fiscal year 2001 (Public Law 106-398), which amended UMTRCA. This Act specifies that the license for the radioactive materials at the Moab Site issued by the NRC 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.

A plan for remediation was also a requirement of the Floyd D. Spence Act. The remediation plan is required to evaluate "the costs, benefits, and risks associated with various remediation alternatives, including removal or treatment of radioactive or other hazardous materials at the site, ground water restoration, and long-term management of residual contaminants." DOE completed the draft Plan for Remediation in October 2001. After having reviewed the Plan, the NAS provided recommendations for DOE to consider during its assessment of remediation alternatives for the Moab Site. DOE addressed the NAS recommendations and public comments in the EIS for remediation which was issued July, 2005 and the ROD in September, 2005 (see Section 2.1.3).

2.1.2 Uranium Mill Tailings Radiation Control Act

In 1978, Congress passed UMTRCA, 42 U.S.C. §§ 7901 *et seq*., 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 the Department to stabilize, dispose of, and control uranium mill tailings and other contaminated material at 24 uranium-ore processing sites and approximately 5,200 associated vicinity properties (properties where uranium mill tailings were used as construction material or landfill before the hazards associated with this material were known). UMTRCA also directed EPA to promulgate cleanup standards (now codified at 40 CFR 192) and assigned NRC to oversee the cleanup, and issue licenses to the completed disposal cells. Remediation of the Moab Site will comply with these standards.

Uranium mill tailings fit within the larger description for residual radioactive materials (RRM). For purposes of this document, "contaminant" or "contamination" refers to RRM, unless specified otherwise. RRM is defined by UMTRCA and its implementing regulations in 40 CFR 192 as (1) waste that DOE 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 (2) other wastes that DOE determines to be radioactive at a processing site which relate to such processing, including any residual stock of unprocessed ores or low-grade materials. RRM includes soils, tailings, facility components, buildings or building materials, equipment, legacy chemicals, and other wastes. Contaminated ground water is ground water in the uppermost aquifer that is contaminated with RRM.

UMTRCA (and by association, the Floyd D. Spence Act [see Section 2.1.1]) and its implementing regulations are the primary regulatory drivers at the Moab Site because RRM is the predominant waste generated.

During 2005, RRM was managed at the Moab Site in accordance with regulatory requirements. RRM in the form of uranium mill tailings and contaminated soils and associated materials were remediated as described in Section 2.1.17. Section 2.1.15 describes actions undertaken to remediate contaminated ground water that exists beneath the site. Sections 3.4.1 and 3.5.2 describe how RRM consisting of legacy chemicals and industrial products was managed during 2005.

2.1.3 National Environmental Policy Act

Remedial actions performed pursuant to UMTRCA are considered to be major federal actions that are subject to the requirements of NEPA (42 U.S.C. 4321, *et seq*.). Regulations of the Council on Environmental Quality (CEQ) to implement NEPA are codified in 40 CFR 1500; these regulations require each federal agency to develop its own implementing procedures (40 CFR 1507.3). DOE-related NEPA regulations are established in 10 CFR 1021, *National Environmental Policy Act Implementing Procedures*. DOE prepared site-specific NEPA documentation (either an Environmental Assessment or an EIS) to address surface remediation (i.e., cleanup of tailings, residual processing materials, soil, and buildings) at each UMTRCA Title I site.

In October 1996, DOE issued the *Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project* (PEIS) (DOE 1996). The purpose of the PEIS was to analyze the potential impacts of implementing four programmatic alternatives for ground water compliance at the designated processing sites. The preferred alternative for the UMTRA Ground Water Project was published in a ROD in 1997. The ROD provides three basic options for achieving compliance with ground water standards: no remediation, natural flushing, or active remediation. The standards that may be met include background, maximum concentration limits (as stipulated in 40 CFR 192, Subpart A), alternate concentration limits, or supplemental standards. The applicable standards are determined on a site-specific basis. The ROD also implemented a framework to select the appropriate compliance strategies for ground water remediation at Title I sites. The framework considers risks to human health and environment, costs, and stakeholder input and therefore 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 continued operation of an interim action, which focused on the reduction of site-related ground water contamination (e.g., ammonia) that is currently discharging to the Colorado River. Interim actions in 2005 were conducted in accordance with DOE and CEQ NEPA regulations.

In 2005, DOE issued the final EIS for the Moab Site. The EIS identified DOE's preferred alternatives for the Moab Site based on comments received during the public comment period on the draft EIS, the analysis documented in the EIS, and other factors. The EIS identified DOE's preferred alternatives as off-site disposal of the uranium mill tailings pile, combined with active ground water remediation at the Moab Site. The preferred off-site disposal location was identified as the Crescent Junction site, and the preferred method of transportation was rail. A ROD for the Moab Site was issued in September 2005 and announced DOE's decision to implement the preferred alternatives identified in the EIS.

Off-site disposal of mill tailings was selected as the preferred alternative primarily because of the uncertainties related to long-term performance of a capped pile at the Moab Site. Issues, such as the potential for river migration and severe flooding, contributed to this uncertainty. The Crescent Junction site was identified as the preferred off-site disposal location over other potential sites because it has the longest isolation period (time it would take for contaminants to reach the ground water); the lowest land-use conflict potential; access to existing rail lines; the shortest haul distance from the rail line into the disposal cell (reducing the size of the radiological control area); and flat terrain, making operations easier and safer. DOE identified rail as the preferred mode of transportation, because compared to truck transportation, rail has a lower accident rate, lower potential impacts to wildlife, and lower fuel consumption.

2.1.4 Clean Air Act/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. The primary air emissions associated with the Moab Site in its current condition are fugitive dust emissions and radon, a daughter product associated with the radioactive decay of uranium mill tailings.

Fugitive Dust

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

In the state of Utah, federal Clean Air Act requirements are implemented by an equivalent set of state regulations. To comply with the State of Utah, Division of Air Quality regulations for the control of fugitive dust (Section R307-309-4, *Fugitive Dust Control Plan*, of the Utah Administrative Code [U.A.C.]), DOE prepared the *Moab Project Site Fugitive Dust Control Plan* (DOE 2002b). This plan outlines specific areas of the Moab Site that are particularly vulnerable to wind erosion, and describes the engineering and procedural controls DOE has implemented at the site to control fugitive dust emissions.

As required by state regulations, DOE provided a copy of the *Moab Project Site Fugitive Dust Control Plan* (DOE 2002b) to the State of Utah Division of Air Quality on April 2, 2002. In a return letter dated May 7, 2002, the State of Utah, Division of Air Quality concurred that the DOE plan fulfilled the regulatory requirements for preparing a dust control plan and implementing controls at the Moab Site as required by Section R307-309-4 of the U.A.C. During 2005, DOE diligently implemented the controls outlined in the plan and controlled fugitive dust

emissions at the Moab Site to the greatest extent practicable. On an annual basis, DOE applies approximately 200,000 gallons of calcium chloride, a dust suppressant, to the mill tailings pile and site roads in an effort to stabilize those areas of the millsite that are susceptible to wind erosion. In addition to the application of dust suppressants, DOE restricts travel in off-road areas of the millsite, and limits vehicular speed to minimize the generation of fugitive dust. As areas are remediated, DOE seeds and mulches the areas to establish vegetative cover to control windblown dust.

Radon

During 2005, DOE continued its environmental air monitoring program at the Moab Site to monitor radon emissions and radiological exposures at various locations along the millsite property boundary and throughout the Moab community. Background monitoring locations have also been established to provide a baseline against which site exposure data may be compared. In addition to radon, DOE also collects radioparticulate and direct gamma radiation data as part of its environmental air monitoring program.

EPA has promulgated various radon control standards through its National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations in 40 CFR 61. DOE and the State of Utah have reviewed the applicability of the various subparts (Subparts Q, and T) of NESHAP regulations and have determined that these subparts are not applicable to the Moab Site in its current unremediated condition. 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 NRC and the State of Utah, and are aimed at sites that are currently licensed by NRC. In its current, unremediated condition, the Moab Site does not meet the definition of a facility that is subject to these regulations. These regulations will likely apply to the Crescent Junction site in the future.

DOE Order 5400.5, *Radiation Protection of the Public and Environment*, provides guidelines for all DOE facilities, operations, and activities and offers the best guidance with respect to controlling radon emissions at the Moab Site, given its current status. This DOE order established a guideline for radon-222 concentrations at DOE's property boundary of 3.0 picocuries per liter (pCi/L) above background concentrations. Environmental air monitoring data collected by DOE at the Moab Site during CY 2005 indicated that radon concentrations were elevated above this guideline at several on-site locations along the millsite property boundary. Off-site monitoring data indicated that, although radon levels were elevated at the DOE property boundary, these concentrations attenuated rapidly within a relatively short distance from the millsite boundary. Radon concentrations were observed to be reduced essentially to background levels within a distance of one-half mile of the millsite boundary. During 2005, DOE also conducted radon monitoring at the residential property located closest to the millsite property. This location is known as the MEI and is of particular interest to DOE because it represents a worst-case exposure scenario, where the individuals residing at this location would be exposed to the highest concentrations of radon gas. DOE's monitoring data indicate that radon concentrations at this location during 2005 were consistently below the radon guideline in DOE Order 5400.5.

Radioparticulates/Direct Gamma Radiation

In addition to controlling fugitive dust and monitoring radon levels at the Moab Site, DOE also conducts environmental air monitoring for airborne radioparticulates (thorium-230, radium-226, polonium-210, and total uranium) and direct gamma radiation. Data collected during 2005 indicate that concentrations of airborne radioparticulates were several orders of magnitude below the inhaled air derived concentration guides (DCGs) outlined in DOE Order 5400.5. DOE concludes from these data that there were no public exposures to airborne radioparticulates that exceeded regulatory limits in 2005.

As with the radon data for CY 2005, the direct gamma radiation monitoring data also indicate that direct gamma radiation levels are elevated at several on-site locations along the DOE property boundary; however, exposure rates near the MEI and at all off-site monitoring locations throughout the Moab community were below the acceptable exposure limits specified by DOE order and by State of Utah radiation protection requirements (Section R313-15-301, *Standards for Protection Against Radiation, Dose Limits for Individual Members of the Public*, U.A.C.). Section 3.0 of this document provides more detail regarding DOE's environmental air monitoring activities at the Moab Site during 2005.

2.1.5 Clean Water Act/National Pollutant Discharge Elimination System

Under the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) program 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. In the state of Utah, the federal NPDES discharge requirements are implemented by an equivalent state system known as the Utah Pollutant Discharge Elimination System (UPDES).

The Moab Site has no wastewater point source discharges that are subject to UPDES regulations; however, storm water discharges from the site are regulated by UPDES requirements. In compliance with UPDES storm water discharge regulations in Section R317-8-3.8 of the U.A.C., DOE submitted a Notice of Intent to the State of Utah, Department of Environmental Quality, Division of Water Quality on May 21, 2002. In response to this Notice of Intent, the State of Utah issued a *General Permit for Storm Water Discharges Associated with Industrial Activity* (permit number UTR100971) on September 25, 2002. As required by the storm water discharge permit, DOE also prepared and implemented the *Moab Project Site Storm Water Pollution Prevention Plan* (SWP^3) (DOE 2002c). This SWP^3 outlines the engineering controls and best management practices that DOE has implemented at the Moab Site to control and minimize storm water discharges from the site. Copies of the SWP^3 and the storm water discharge permit are maintained at the site. To ensure that the storm water controls and best management practices are performing as designed, DOE conducts bi-weekly storm water inspections and documents the inspection results on a site-specific checklist. The storm water discharge permit issued to the Moab Site provides coverage under the UPDES storm water discharge regulations until May 27, 2007.

Localized heavy storm events were received at the Moab Site on several occasions during 2005. Erosional features were repaired by filling the eroded areas with clean fill material, regrading damaged areas with heavy equipment, and reseeding with native vegetation. Straw bales and a culvert were also used in clean areas to control storm water entering the site from US-191 and

collecting in a depression onsite created during remediation. All storm water controls functioned as designed, and no contaminated materials were discharged off site.

There is no sewer effluent associated with site operations; porta-potties are provided for on-site personnel and are serviced on a weekly schedule. Bottled water is provided for on-site drinking water needs.

2.1.6 Clean Water Act/Executive Order 11990, *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 USACE in 2005.

Activities accomplished in 2005 with the potential to affect jurisdictional wetlands include upland soils remediation, storm water controls, road improvements, temporary access roads, vegetation removal (chiefly tamarisk), revegetation activities, installation of monitoring and injection wells (Configuration 3), and dredging operations to maintain the water intake structure supplying the on-site holding pond used for site activities such as dust control and equipment washing. All of these activities were permitted under the State of Utah's Streambank Alteration permits through a cooperative agreement with the USACE.

2.1.7 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA), 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.

As noted in Sections 2.1.1 and 2.1.2, the primary regulatory driver at the Moab Site is the Floyd D. Spence National Defense Authorization Act for FY 2001, and through it, UMTRCA. This is because the primary waste generated at the Moab Site is RRM in the form of uranium mill tailings and associated materials, the cleanup and management of which is regulated by UMTRCA, not RCRA. All waste generated within the boundary of the site contaminated area is considered RRM. Waste generated outside the contaminated area is considered non-RRM and, therefore, can be regulated by RCRA.

2.1.8 Executive Order 13148, Greening the Government Through Leadership in Environmental Management, and Executive Order 13101, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition

Executive Order 13101, *Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition*, requires Federal agencies to generate less waste, perform recycling activities and use recycled products, and procure environmentally preferable goods and services. Executive Order 13148, *Greening the Government Through Leadership in Environmental Management*, requires Federal agencies to integrate environmental accountability into day-to-day operations and long-term planning through such means as reducing the use or release of toxic chemicals and ozone depleting substances, using environmentally beneficial landscaping, and establishing environmental management systems.

DOE has implemented the requirements of Executive Order 13148 through issuance of DOE Order 450.1, *Environmental Protection Program*. The objective of this Order is to implement sound stewardship practices that are protective of the air, water, land, and other natural and cultural resources. The DOE order requires that DOE develop and implement an Environmental Management System (EMS). In 2005, the Moab Site became integrated into the EMS that is partially managed by the DOE-EM office in Grand Junction, Colorado. The EMS is designed to integrate environmental protection, environmental compliance, pollution prevention, and continual improvement into work planning and execution. The document establishes a framework for identifying measurable environmental goals, objectives, and targets, which are reviewed and updated annually.

In addition, during 2005, DOE adhered to the requirements of these executive orders by: burning used oil generated from equipment maintenance in onsite oil-burning space heaters; recycling office paper, aluminum cans, and automotive batteries; purchasing electricity generated by a pollution free source (wind power); purchasing biodiesel fuel for one of the site vehicles; and purchasing a nonhazardous solvent to clean grease from equipment.

2.1.9 Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) was enacted in 1976 to regulate the manufacturing and distribution of certain chemical substances. TSCA provides EPA with authority to require testing of chemical substances, both new and old, entering the environment and to regulate their production, sale, and management as a waste, where necessary. TSCA specifically addresses the use and management of polychlorinated biphenyls (PCBs) and asbestos.

Historical records indicate various types of asbestos-containing-materials (ACM) have been disposed of in the on-site tailings pile. These ACM wastes, such as transite pipes, insulation, siding, roofing, and floor tiles, were generated from the demolition of millsite structures when Atlas terminated milling operations. It is unknown whether PCB-contaminated materials, such as discarded electrical transformers, were also disposed of in the tailings pile. It is suspected that ACM is present in remaining onsite historical buildings and utilities, and PCB wastes may be present in fluorescent light ballasts in the warehouse/shop building. All of these materials were associated with past milling operations conducted at the Moab Site. Any ACM and PCB-contaminated materials that remain within the site's contaminated area are considered RRM and, therefore, are subject to UMTRCA regulation, not TSCA regulation.

During 2005, no PCBs or ACM required management at the Moab Site.

2.1.10 Superfund Amendments and Reauthorization Act, Title III; Executive Order 12856 Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements

Title III of the Superfund Amendments and Reauthorization Act (SARA), which is the *Emergency Planning and Community Right-to-Know Act of 1986*, 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 Moab Site chemical inventory and activities annually to determine if any SARA Title III reporting is required.

During 2005, one hazardous chemical, calcium chloride, was stored at the Moab Site in an amount exceeding its threshold planning quantity, as established in Section 312 of SARA. Therefore, as required by Section 312, a *Tier Two Emergency and Hazardous Chemical Inventory* report was submitted for the calcium chloride to the state emergency response commission, the local emergency planning committee, and the local fire department. No other SARA Title III reporting requirements applied to the Moab Site during 2005.

2.1.11 Endangered Species Act and Migratory Bird Treaty Act

Endangered Species Act

The Endangered Species Act (ESA) requires federal agencies to consult with the USF&WS 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 razorbck sucker found near the Moab Site; and one endangered avian species (southwestern willow flycatcher) that may inhabit tamarisk areas on or near the site.

As part of the EIS process, formal and informal consultation has taken place with the USF&WS. The final EIS, released in July 2005, included a BA and BO that evaluated proposed actions related to either removing or stabilizing the uranium mill tailings on site and the potential impacts to protected species potentially present. Various mitigative or protective measures were included as part of the BO. These include monitoring backwater habitats for potential impacts to fish, using 0.25-inch screens on all pumps, developing a biota monitoring plan, among others. DOE continues to meet the required mitigation stated in the BO.

In addition to specific habitat protective measures, the BO required DOE to make a one-time payment of $3,917.45 (based on a current depletion charge of $16.67 per acre-foot) to the National Fish and Wildlife Foundation to offset the impact related to use of Colorado River water. DOE requested a water depletion allowance of 235 acre-feet per year for use of the Colorado River water to meet project needs.

Subsequent to the final EIS, characterization of the Moab Site soils defined contamination extending to the Colorado River bank in two areas; however, the subsurface extent and levels of contamination were unknown. One of the contaminated bank areas contains an intake structure used for pumping Colorado River water into a pond onsite (this water is used for site activities such as dust control), and the other bank area is located north of Moab Wash. In order to remove contamination without affecting river habitat or adding sediment to the river, DOE proposed to construct two cofferdams that would enable workers to conduct cleanup actions along the affected bank areas. Additionally, to more efficiently provide for project needs and to reduce the river sediment buildup in the intake structure pumps, DOE proposed extending the intake about four feet into the river and paving it with concrete to provide a hard surface for more efficient removal of sediment that precipitated from river water.

The DOE initiated informal consultation with the USF&WS over the above-described activities. The USF&WS expressed concern that activities associated with installing or removing cofferdams could jeopardize endangered fish or their habitat. They requested that DOE enter into formal consultation under Section 7 of the ESA. DOE completed a BA in December 2005 and

the USF&WS responded with a BO in January 2006. The BO required several mitigative measures, including: scheduling cofferdam construction prior to low water, and having a fisheries biologist available prior to removing the water from the area between the river bank and the cofferdam. DOE is currently considering the application of supplemental standards for removing contamination along the bank area near Moab Wash instead of installing cofferdams.

Other Surveys Conducted

As a part of characterization and cleanup of windblown materials both on the Moab Site and on adjacent properties with windblown materials, surveys were conducted for the southwestern willow flycatcher prior to vegetation removal. None were found to be present. Additionally, a botanical survey was completed at the Crescent Junction site and no protected plant species were found to be present.

Migratory Birds Treaty Act

The presence of migratory birds in the Moab area was evaluated in the BA. The BO concurred that the potential consultation migratory bird species that may inhabit the Moab Site area included the bald eagle (threatened), the southwestern willow flycatcher (endangered), and the yellow-billed cukoo (candidate species). They have been known to frequent nearby areas. None were found to be present at the Moab Site.

At the Crescent Junction site, the burrowing owl, a Utah "sensitive" species, was identified as potentially present. During a survey conducted by the Utah Division of Natural Resources in July 2005, one confirmed burrowing owl nest was located within the withdrawal area. DOE does not have work planned for the summer 2006 season that would affect nesting owls if they return. There are a large number of prairie dog burrows present, which are associated with the burrowing owl habitat needs. At the time of this writing, the nesting burrowing owl identified in 2005 has not been observed. If a nesting burrowing owl is determined to be present, DOE is committed to a 0.25-mile buffer area around the nest and to avoid activities in these areas until August 2006. Hawks are known to hunt in the Crescent Junction site area; however no nests are known to be present.

2.1.12 Executive Order 11988, *Floodplain Management*

DOE's implementing regulations in 10 CFR 1022 identifies 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 (DOE 2005a).

Interim actions implemented in the floodplain during 2005 included soils remediation, removal of tamarisk in the well field area and in areas of soils remediation, installation of additional ground water wells (Configuration 3), and revegetation. Revegetation activities included the construction of irrigated enclosures, planting and seeding of desirable, native species, and weed control. Prior to commencement of work, a Floodplain and Wetlands Assessment was prepared for the additional interim actions at the Moab Site, and a Statement of Findings was printed in the Federal Register.

Minor erosion control actions were taken in 2005 to prevent sedimentation to the river.

2.1.13 Safe Drinking Water Act

The provisions of the Safe Drinking Water Act (40 CFR 141) are not directly relevant to the Moab Site because neither ground water nor surface water at or near the site is used as a public drinking water supply. DOE did not engage in any activities that affected drinking water supply sources; therefore, the requirements of this statute are not applicable to the activities occurring at the Moab Site during CY 2005.

2.1.14 National Historic Preservation Act

In 2005, DOE prepared a draft Memorandum of Agreement between DOE, the State Historic Preservation Office, and the Utah Department of Transportation concerning the mitigation of cultural resources on the Moab Site. The remaining millsite features (warehouse building, water pump station, ore loadout structure, and scale house), a 1930s-vintage log cabin, a section of historic U.S. Highway 160, a stock driveway sign, and a prehistoric rock shelter are all located on DOE property and are eligible for inclusion in the National Register of Historic Places. Because these sites potentially could be affected by remediation activities, the draft Memorandum of Agreement describes how each site will be protected or mitigated. The draft is expected to be finalized in 2006.

In June 2005, DOE subcontracted professional archaeologists to complete an inventory of cultural resources at its Crescent Junction. The results of that inventory were published in *A Cultural Resource Inventory of the U.S. Department of Energy's Proposed Crescent Junction Disposal Site, Grand County, Utah* (Alpine Archaeology Consultants, Inc. 2005). DOE will use the inventory results to help design the layout of the disposal site facility.

2.1.15 Utah Water Rights Law

Section R655, *Water Rights*, of the U.A.C. provides regulations relative to the diversion and use of water resources within the state of Utah. All water rights associated with the former Atlas millsite were transferred to DOE in 2002. Currently, DOE uses water from the Colorado River for on-site dust suppression. Water is pumped from the millsite intake structure to an on-site holding pond, where another pump is used to fill water trucks. In conjunction with the application of dust suppressants, river water is used to control dust on site roads and in areas where construction activities may be occurring.

In addition to dust suppression activities, DOE will conduct various ground water remedial actions in the future that will require the use of existing nonconsumptive and consumptive water rights. During 2005, DOE continued operation of the interim action ground water remediation project. This effort consisted of installing an additional gallery of extraction/infiltration wells between the tailings pile and the Colorado River. The well gallery intercepts and collects contaminated ground water before it reaches the river and pumps the contaminated water to a lined evaporation pond that was constructed on top of the mill tailings pile. Because this ground water remediation strategy consumes water through evaporation, a *Temporary Change Application* was submitted and received from the State of Utah, Department of Natural Resources, Division of Water Rights. During 2005, the interim action ground water remediation system pumped and treated (through evaporation) approximately 22.7 million gallons of contaminated ground water. Through the end of 2005, a total of approximately 36.6 million gallons of contaminated ground water have been extracted and evaporated.

Also during 2005, DOE implemented the initial action ground water remediation project for less than one week. The initial action is designed to be a non-consumptive water use activity wherein clean river water is used to dilute "hot spots" of ammonia where they are most likely to be seeping into the Colorado River. This action is expected to provide immediate relief to critical fish habitat in the backwater areas of the Colorado River immediately adjacent to the Moab Site. On May 18, 2005, DOE submitted a *Temporary Change Application* to appropriate water to the State of Utah, Department of Natural Resources, Division of Water Rights. Approval for two *Temporary Change Applications* was received from the State of Utah, Department of Natural Resources, Division of Water Rights in May and August of 2005. *Temporary Change Applications* are approved only in one-year increments, and must be renewed annually for the interim action and initial action remediation systems.

2.1.16 Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) governs the use, storage, registration, and disposal of pesticides. FIFRA categorizes pesticides as either "restricted use" or "general use." EPA may classify a pesticide as restricted use (1) if it is determined that substantial adverse effects to the applicator or environment may occur without additional regulatory restrictions or (2) if unreasonable harm to humans or the environment may occur, even if the pesticide is used as directed by the label instructions. FIFRA regulations require that restricted-use pesticides 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 nonrestricted-use herbicides at the Moab Site in 2005 to control noxious weeds.

2.1.17 Surface Remediation of Moab Site

To support remediation of the Moab Site, DOE has assessed Moab Site soils for radiological contamination. This assessment provided a general sense of where the highest concentrations of radiological contaminants in soil exist. 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.

During 2005, the Moab UMTRA Project started removal of contaminated soil from the east end of the Moab Site. The contaminated soil was surface contamination probably mainly from wind-blown source. Approximately 58,000 cubic yards were removed from areas in the extreme northeast side of the site, and approximately 75,000 cubic yards from southeast side of the site, for a total of 133,000 cubic yards. Excavated contaminated soil was transported to the tailings pile for future removal to the permanent disposal site. The weight of the excavated soils on the pile serves both to consolidate the tailings and extract water. As soils are remediated, DOE is replanting native plant communities in those areas. The contaminated footprint at the Moab Site has been reduced by 29 acres through the remediation of contaminated soil.

2.2 Current Issues and Actions

DOE uses external and internal environmental audits and management compliance assessments to evaluate environmental compliance and to implement corrective actions. The QA organization performed surveillances and management assessments to verify system descriptions and compliance with internal procedures.

Mitigation and compliance requirements in the EIS and ROD will need to be tracked for compliance. Proposed initiation of Moab Site remediation and monitoring at the Crescent Junction site will require modification of existing operation and maintenance permits, i.e. Conditional Use Permit, Stormwater Discharge, and Fugitive Dust Permits. Following issuance of the USF&WS BO and USACE 404 Permit in 2006, monitoring and compliance with conditions of approval will be required.

2.2.1 Summary of Moab Site Permits

Table 2−1 shows the permits and agreements that were active at the Moab Site during 2005.

Table 2–1. Permits/Agreements Active in 2005 at the Moab Site

Permits/Agreements	Issuing Agency	No. of Permits
UPDES Storm Water Discharge Permit (permit number UTR100971)	State of Utah, Department of Environmental Quality, Division of Water Quality	1
Ground Water Monitor Well Authorizations	State of Utah, Department of Natural Resources, Division of Water Rights	50[a]
Access agreements providing ingress/egress to wells and air monitoring equipment for data collection purposes	Bureau of Land Management, Private Landowners	16
EPA Hazardous Waste Generator Identification Number (UTP 000001244)[b]	EPA	1
Stream Channel Alteration Permits for the Colorado River intake structure and for structures and well fields to support the initial and interim ground water actions	State of Utah, Department of Natural Resources, Division of Water Rights	3
Scientific Research and Collecting Permit Number ARCH-2005-SCI-001 to collect background air samples at the Arches National Park	National Park Service	1
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
Ingress and egress to railroad property to conduct subsurface soil sediment sampling and gamma scans	Union Pacific Railroad	1
Highway right-of-way encroachment permits to conduct surveys	State of Utah, Department of Transportation	2
Withdrawals of 11,985 and 2,300 acres, respectively, of Federal land to consider building a uranium mill tailings disposal cell	Bureau of Land Management	2
Right-of-way to conduct characterization studies at the Crescent Junction site	Bureau of Land Management	1

[a]This is the number of monitor wells that were authorized and installed by DOE in 2005. Since taking over the site, DOE has installed 107 authorized wells. This number does not reflect the total number of monitor wells that DOE uses to support its ground water monitoring program at the Moab Site.
[b]Acquired previously for offsite disposal of non-RRM hazardous legacy chemicals.

3.0 Environmental Program Information

Environmental programs for the Moab UMTRA Project include environmental air/radiological monitoring, surface water and ground water monitoring, waste management, and pollution prevention. This section provides descriptions of all program elements of the Moab UMTRA Project except the ground water program, which is presented in Section 5.0, "Ground Water Monitoring and Protection Program." Air and surface water monitoring results and data are presented in Section 4.0, "Environmental Monitoring Summary." This section also presents brief discussions of data associated with soil and sediment characterization, waste management, and pollution prevention.

In addition to the environmental programs, the DOE has a comprehensive Integrated Safety Management System and Radiological Control Program to minimize workplace hazards and to ensure protection of employees and the public. These programs are described in the *Moab Project Site Health and Safety Plan* (DOE 2005d), the *Site Radiological Control Manual* (STO 3), and the *Integrated Safety Management System Description* (STO 10).

3.1 Environmental Air Monitoring

During 2002, DOE initiated environmental air monitoring activities 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 Order 5400.5, *Radiation Protection of the Public and Environment*. In late 2005, air monitoring was also initiated at the Crescent Junction site to collect initial baseline data before construction activities commence. Evaluation of the Crescent Junction monitoring data will begin in 2006, and is therefore not included in this report.

To accomplish the objectives for the Moab Site, DOE established an air monitoring network that measures 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 locations were specifically located downwind of the former millsite such that any emissions or releases of airborne contaminants would be detected before they reached the city of Moab. This strategy provides a "first line of defense" in monitoring off-site airborne contamination and enables DOE to quantify any public exposures that may be associated with the Moab Site.

Two background monitoring locations were established–one at the Bar-M Chuckwagon, located approximately 5.5 miles north of the Moab Site on US-191, and at another location approximately 2.75 miles downriver from the Moab Site along Kane Creek Road. Both background locations are similar to the Moab Site in terms of geological and physiographical features; however, they are located at a sufficient distance from the Moab Site that the air quality conditions at these sites are not influenced by airborne contaminants that may be associated with the millsite. Background monitoring locations provide ambient air quality conditions and are necessary because they provide a baseline against which site monitoring data may be compared. During 2005 the monitoring network consisted of 25 monitoring locations. Table 3–1 summarizes the types of data collected at the various monitoring locations.

Table 3–1. Summary of Environmental Air Monitoring Locations at the Moab Site

Monitoring Station	Location	Parameter: Radioparticulate (RP), Atmospheric Radon (Rn), Environmental Gamma (G).
On-site Locations		
0101	Millsite, Perimeter	Rn, G
0102	Millsite, Perimeter	Rn, G, RP
0103	Millsite, Perimeter	Rn, G
0104	Millsite, Perimeter	Rn, G
0105	Millsite, Perimeter	Rn, G, RP
0106	Millsite, Perimeter	Rn, G
0107	Millsite, Perimeter	Rn, G
0108	Millsite, Perimeter	Rn, G
0109	Millsite, Perimeter	Rn, G
0110	Millsite, Perimeter	Rn, G
0111	Millsite, Perimeter	Rn, G
0112	Millsite, Perimeter	Rn, G
0113	Millsite, Perimeter	Rn, G
Off-site Locations		
0117	Bar-M Chuckwagon (background location, ~5½ miles north of former 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 former 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 former millsite)	Rn, G
0127	Private property (~¾ mile south of former millsite)	Rn, G
Maximally Exposted Individual Location		
MEI	Tex's River Tours caretaker residence, immediately east of site	Rn, G

Summary:

Total on-site monitoring locations: 13
Total off-site monitoring locations: 11
Total MEI locations: 1

Total radon monitoring locations: 25
Total gamma monitoring locations: 25
Total radioparticulate monitoring locations: 9 (two on-site and seven off-site)

Collection of meteorological data continued at the Moab Site. An additional meteorological monitoring station was also installed near the Crescent Junction site late in 2005. Wind speed and direction, evaporative transpiration potential, solar radiation, relative humidity, temperature, and precipitation are monitored at each of these locations.

Sections 3.1.1 through 3.1.5 discuss DOE's sampling plan for each of the parameters monitored.

3.1.1 Atmospheric Radon

During 2005, atmospheric radon was measured at 25 locations (13 on-site, 11 off-site, and 1 MEI) using Landauer Radtrak® alpha-sensitive detectors (i.e., radon cups). Each radon cup was housed in a PVC canister that was placed at approximately 1-meter above the ground surface. Radon cups were exposed for a period of approximately 3 months (i.e., quarterly exposures). Upon quarterly collection, the radon cups are sent to an off-site laboratory for analysis. Analytical results where typically received back from the laboratory within 30 days. These data are compiled along with other environmental air monitoring data, and are published in DOE's quarterly Environmental Air Monitoring Report. These reports compare monitoring data to exposure limits and guidelines, and are posted on DOE's Moab UMTRA Project website (http://gj.em.doe.gov/Moab).

DOE has determined that a "background" radon concentration that is representative of the Moab region is approximately 0.6 pCi/L. This value is derived from averaging monitoring data collected at the two background monitoring locations for a 1-quarter monitoring period. On-site, off-site (including background), and MEI radon monitoring locations are shown in Figure 3–1 and Figure 3–2.

In the absence of a Federal or state environmental radon standard that is directly applicable to the Moab Site in its current condition, the DOE guideline for atmospheric radon emissions at the site boundary (and at any off-site location) is approximately 3.6 pCi/L. This site-specific goal is derived by summing the applicable radon guideline of 3.0 pCi/L (from DOE Order 5400.5) and the average background radon value measured for the Moab region (0.6 pCi/L). It should be noted that this value is a guideline, or goal, for radon emissions; it is not an enforceable environmental standard. This value may change as additional data are collected and background values are revised.

The caretaker's residence for Tex's River Tours has been identified as the MEI (Figure 3–1). This location has special significance with respect to environmental monitoring because it represents the member of the public receiving the largest dose from all sources of radionuclide emissions combined and is considered to be the worst-case exposure scenario for a continuously occupied residential property. The MEI location adjoins DOE's property boundary on the east side of the site.

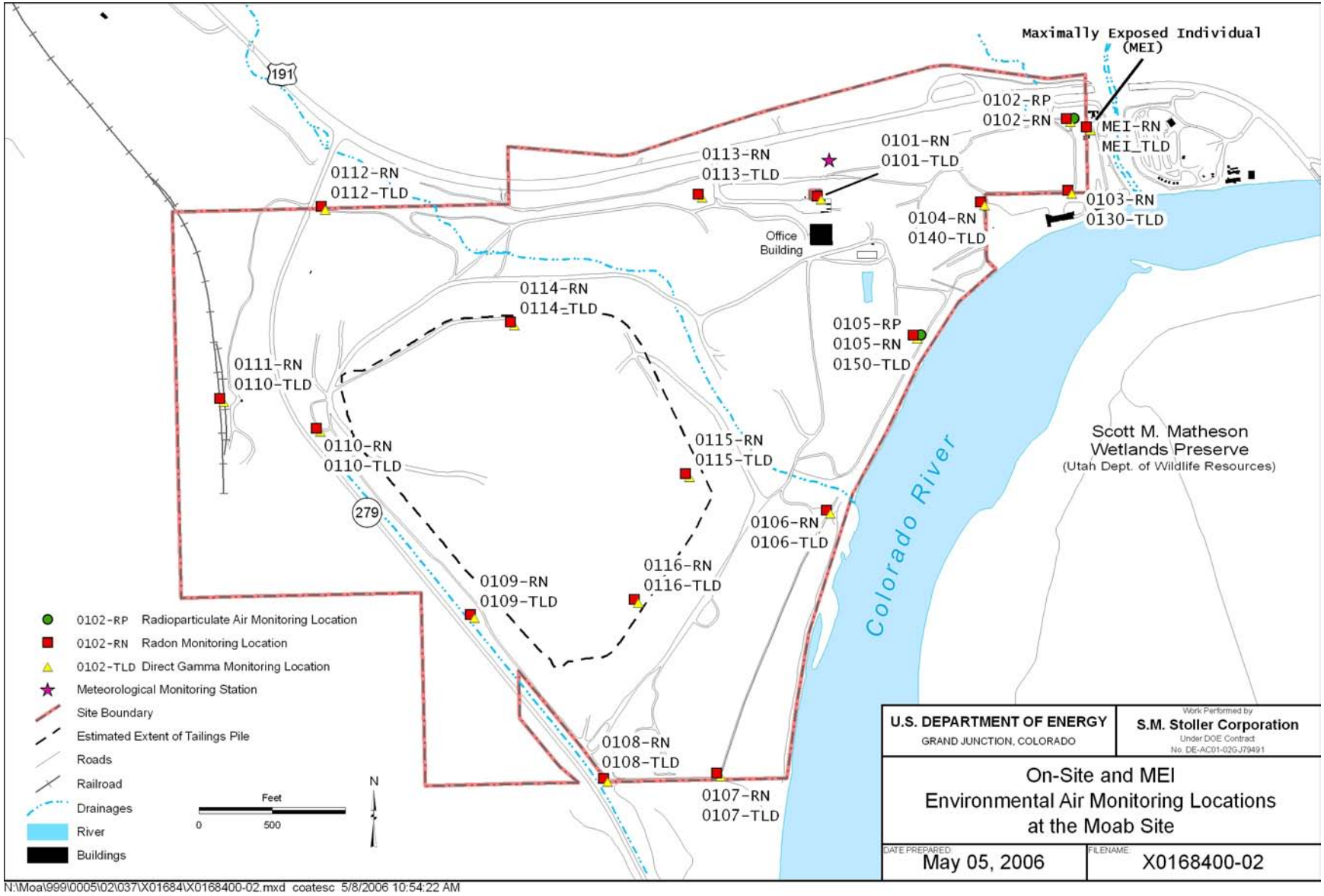

Figure 3–1. On-Site Air and Direct Gamma Monitoring Locations

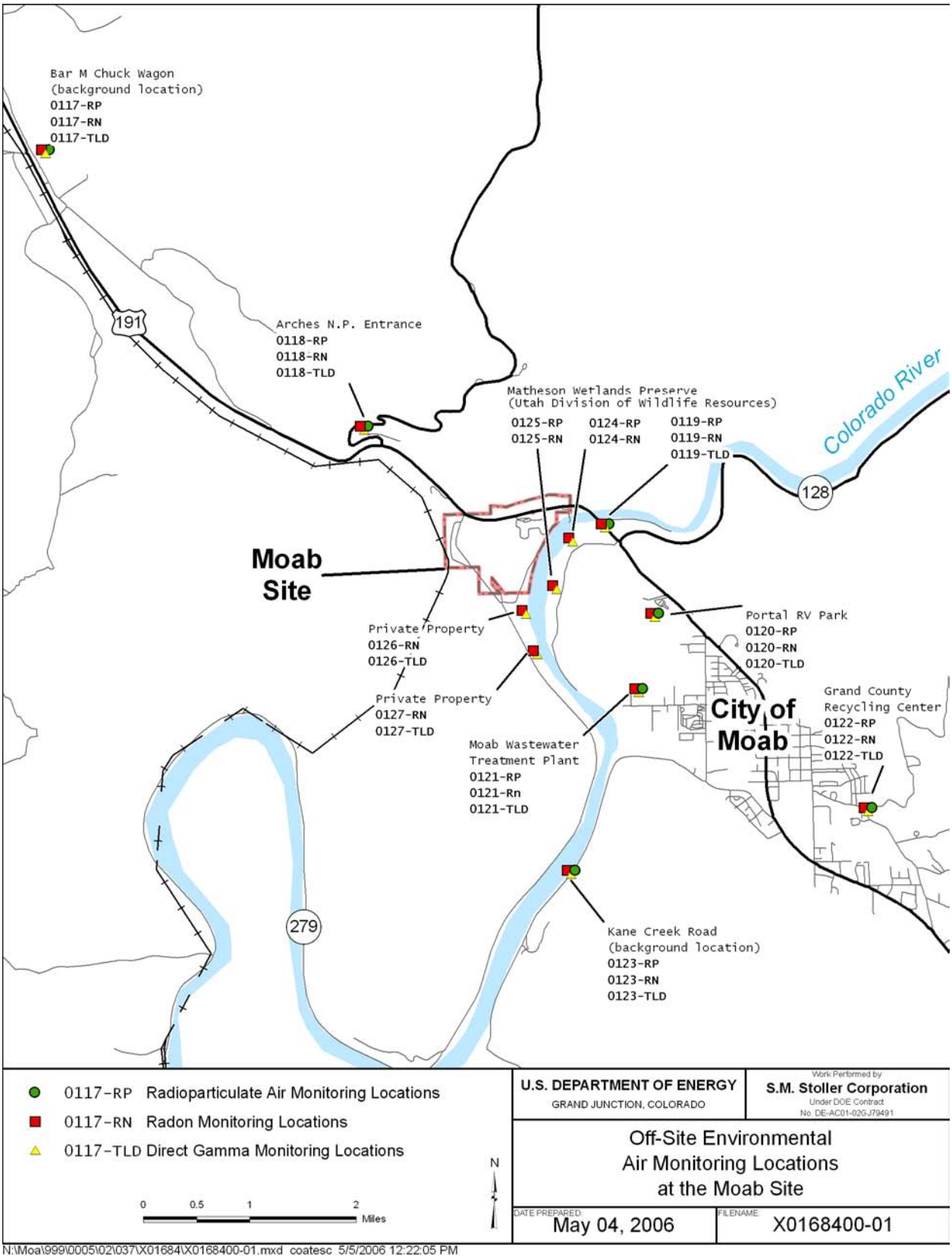

Figure 3–2. Off-Site Air and Direct Gamma Monitoring Locations

3.1.2 Direct Gamma Radiation

The uranium mill tailings stockpiled at the Moab Site are a source of 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 Order 5400.5, *Radiation Protection of the Public and the Environment*. 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. The public dose limit (for all exposure modes) as a consequence of all routine DOE activities shall not cause, in a year, an effective dose equivalent greater than 100 millirem (mrem) (DOE Order 5400.5, Chapter II[1][a]). Contributions from radon are excluded from the dose limit and are addressed independently.

Direct gamma radiation monitoring is conducted to assess the potential gamma radiation dose to persons on and near the Moab Site. During 2005, direct gamma radiation was measured at 25 locations (13 on-site, 11 off-site, and 1 MEI) using a single calcium sulfate dysprosium thermoluminscent dosimeter (TLD). TLDs are attached to fence line or metal t-post at approximately 1-meter above the ground surface. The TLDs are exposed for a period of approximately 3 months (i.e., quarterly exposures). Upon quarterly collection, the TLDs are sent to an off-site laboratory for analysis. Analytical results where typically received back from the laboratory within 30 days. These data are compiled along with other environmental air monitoring data and are published in DOE's quarterly Environmental Air Monitoring Report. These reports compare monitoring data to exposure limits and guidelines, and are posted on DOE's Moab Project website (http://gj.em.doe.gov/Moab).

DOE has determined that a background gamma radiation value that is representative of the Moab region is approximately 81 mrem/yr. This value was derived from averaging monitoring data collected at the two background monitoring locations for a 1-quarter monitoring period. The DOE site standard for direct gamma radiation at the site boundary (and at any off-site location) is approximately 181 mrem/yr. On-site, off-site (including background), and MEI radon monitoring locations are shown in Figure 3–1 and Figure 3–2.

3.1.3 Airborne Radioparticulates

In 2005, DOE's air sampling network also included nine low-volume air samplers that operate continuously at two on-site locations and seven off-site (including two background) monitoring locations (see Figure 3–1 and Figure 3–2). 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 are collected weekly and submitted as a composite sample on a quarterly (every three months) basis. The filter is then analyzed for specific radioisotopes that are common constituents of uranium mill tailings. The radioisotopes that are of interest to DOE are radium-226 (Ra-226), thorium-230 (Th-230), polonium-210 (Po-210), and total uranium (U-nat).

Radioparticulate data are compiled along with other environmental air monitoring data, and are published in DOE's quarterly Environmental Air Monitoring Report. The analytical data (the annual average values) are compared with DOE's DCG's (for inhaled air) as published in Chapter III of DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. 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.

3.1.4 Fugitive Dust

In compliance with Section R307-205, *Emissions Standards: Fugitive Emissions and Fugitive Dust* of the U.A.C., DOE monitors fugitive dust emissions that result from all construction activities at the Moab Site. 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 the construction project manager.

As required by the State of Utah regulations for the control of fugitive dust (Sections R307-309-6, *Fugitive Dust Control Plan*, of the U.A.C.), DOE prepared the *Moab Project Site Fugitive Dust Control Plan* (DOE 2002b). This plan outlines specific areas of the Moab Site that are particularly vulnerable to wind erosion and describes the engineering controls that DOE has implemented at the Moab Site to control fugitive dust emissions. This plan was provided to the State of Utah Division of Air Quality on April 2, 2002.

3.1.5 Meteorological Monitoring

DOE installed a meteorological monitoring station at the Moab Site in July 2002, and in December 2005, installed another meteorological monitoring station near the Crescent Junction site. 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 average air temperature, relative humidity, average solar radiation, evaporative transpiration potential, average wind speed, average wind direction, standard deviation of wind speed, and total rainfall.

3.2 Surface and Ground Water Monitoring

The 2005 water monitoring program for the Moab Site was extensive. Routine water monitoring was conducted 3 times during the year along with monthly sampling of the three interim action systems that were operated during the year (see Table 3–2 for chronology of sampling). A baseline area outside the influence of the interim actions was also sampled to evaluate natural variability of the ground water and surface water systems based on changes in Colorado River stage. Several calculation sets were completed that analyzed the data collected (DOE 2006a, b).

3.2.1 Surface Water

The principle surface water feature in the vicinity of the Moab Site is the Colorado River, which flows adjacent to the east boundary of the site. Another significant surface water feature, across the river from the site, is the Scott M. Matheson Wetlands Preserve (Matheson Wetlands Preserve). This is the only sizeable wetlands area on the Colorado River in the state of Utah.

Table 3–2. Moab Sampling Chronology

Date	Colorado River Flow (daily mean cfs)	Activity	Samples Collected
		Routine Events	
Apr 19−22, 2005	Flows ranged from **11,400** cfs (on April 22, 2005) to **14,100** cfs (on April 19, 2005).	Sampling corresponded to Colorado River flows on the increasing side of the hydrograph	**Millsite wells**: 0437, 0438, 0439, ATP-2-S, ATP-2-D, and TP-02 **Off-site Wells**: 0401, 0402, 0403, 0404, 0405, 0406, 0407, 0408, 0492, TP-17, TP-18, and TP-19 **Surface Water Locations**: CR1, CR3-004, CR5, 0201-004, 0204-004, 0217-004, 0218-004, 0219-004, 0220-004, 0221-004, 0222-004, 0223-004, 0224-004, 0225-004, 0226-004, 0227-004, 0228-004, 0232-004, 0233-004, 0234-004, and 0235-004. (river flows limited surface water sampling to near shore locations)
July 11−14, 2005	Flows ranged from **6,490** cfs (on July 14, 2005) to **8,160** cfs (on July 11, 2005).	Sampling corresponded to Colorado River flows on the decreasing side of the hydrograph	**Millsite wells**: 0437, 0438, 0439, ATP-2-S, ATP-2-D, and TP-02 **Off-site Wells**: 0401, 0402, 0403, 0405, 0406, 0407, 0408, 0492, TP-17, TP-18, and TP-19 **Surface Water Locations**: CR1, CR3-005, CR5, 0201, 0204-005, 0217, 0218-005, 0219-005, 0220-005, 0221-005, 0222-005, 0223-005, 0224-005, 0225-005, 0226-005, 0227-005, 0228-005, 0232-005, 0233-005, 0234-005, and 0235-005.
Nov 1−4, 2005	Flows ranged from **4,060** cfs (on July 14, 2005) to **4,530** cfs (on July 11, 2005).	Sampling corresponded to Colorado River base flow conditions.	**Millsite wells**: 0437, 0438, 0439, ATP-2-S, ATP-2-D, and TP-02 **Off-site Wells**: 0402, 0404, 0405, 0406, 0492, TP-17, TP-18, and TP-19 **Surface Water Locations**: CR1, CR3-006, CR5, 0207, 0220-006, 0222-006, 0226-006, 0227-006, 0228-006, 0236, 0260, 0261, 0262, 0263, 0264, and 0265.
		Configuration 1	
Jan 25−27, 2005	3,000 to 3,120	Completed baseline sampling for 2005 pumping season	The 10 Configuration 1 extraction wells (sampled from one depth, measured field parameters from other depths), 13 observation wells (403, 407, 480 thru 485, 557 (2 depths), 588 (2 depths), 559, 560 (2 depths), and 561 ([2 depths], 4 piezometers (562 thru 565), 2 surface water locations (216 and 245).
Feb 15, 2005	3,360	System restarted for 2005 pumping season (well field pumping rate set at ~10 gpm)	NA

Table 3–2 (continued). Moab Sampling Chronology

Date	Colorado River Flow (daily mean cfs)	Activity	Samples Collected
Feb 22−24, 2005	3,690 to 3,700	Completed monthly sampling	The 10 Configuration 1 extraction wells, 6 observation wells (403, 407, 483, 557, 559, 560), 4 piezometers (562 thru 565), 4 surface water locations (216, 245, 537 [wick system], and 547 [evaporation pond inlet]). Recirculation pump not running.
Feb 28, 2005	3,390	Wells set to pump at maximum sustainable flow rate (well field pump rate ~25 gpm)	NA
Mar 14−16, 2005	3,790 to 4,000	Completed monthly sampling	The 10 Configuration 1 extraction wells, 6 observation wells (403, 407, 483, 557, 559, 560), 4 piezometers (562 thru 565), 3 surface water locations (216, 245, and 547 [evaporation pond inlet]). Recirculation pump not running
~Apr 5, 2005	na	Well PW02 added to system and started pumping	
Apr 27−28, 2005	~10,000 to 12,000	Completed monthly sampling	The 11 Configuration 1 extraction wells (470 thru 479, and PW02), 4 observation wells (483, 557, 559, 560), 1 surface water location (216), and 2 treatment system locations (547 and 548). (River flow too high to sample piezometers)
May 25, 2005	39,500 (runoff peak)	Completed monthly sampling	The 11 Configuration 1 extraction wells (470 thru 479, and PW02), 6 observation wells (403, 407, 483, 557, 559, 560), 1 surface water location (216), and 2 treatment system locations (547 and 548). (River flow too high to sample piezometers)
June 22, 2005	18,100	Monitoring Well 0596 installed	NA
June 23−24, 2005	19,300 to 19,800	Completed monthly sampling	The 11 Configuration 1 extraction wells (470 thru 479, and PW02), 6 observation wells (403, 407, 483, 557, 559, 560), 1 surface water location (216), and 2 treatment system locations (547 and 548). (River flow too high to sample piezometers)
July 26−28, 2005	5,960 to 6,640	Completed monthly sampling	The 11 Configuration 1 extraction wells (470 thru 479, and PW02), 6 observation wells (403, 407, 483, 557, 559, 560), 1 surface water location (216), 2 piezometers (562 and 563), and 2 treatment system locations (547 and 548). (River flow too high to sample piezometers 564 and 565)
Aug 23−26, 2005	3,400 to 3,570	Completed monthly sampling	The 11 Configuration 1 extraction wells (470 thru 479, and PW02), 6 observation wells (403, 407, 483, 557, 559, 560), 2 surface water locations (216 and 245), 4 piezometers (562 thru 565), and 2 treatment system locations (547 and 548).

Table 3–2 (continued). Moab Sampling Chronology

Date	Colorado River Flow (daily mean cfs)	Activity	Samples Collected
Sept 20−21, 2005	3,460 to 3,730	Piezometers 0606, 0607, 0608, 0611, and 0612 installed in riverbed	NA
Sept 27−30, 2005	3,740 to 6,400 (Sept 28 heavy rainfall)	Completed monthly sampling	The 10 Configuration 1 extraction wells (470 thru 479, [PW02 was shut down]), 6 observation wells (403, 407, 483, 557, 559, 560), 2 surface water locations (216 and 245), 4 piezometers (562 thru 565), and 2 treatment system locations (547 and 548).
Oct 12−13, 2005	4,700 to 5,060	Completed monthly sampling	The 10 Configuration 1 extraction wells (470 thru 479, [PW02 was shut down]), 5 observation wells (484, 557, 558, 560, and 596), 2 surface water locations (216 and 245), 4 piezometers (562, 564, 608, and 612), and 2 treatment system locations (547 and 548).
Oct 25−28, 2005	4,220 to 4,290	Biogeochemical sampling	4 observation wells (403, 407, 483, and 559), and 4 piezometers (563, 565, 606, and 607 [611 was dry]), and 2 treatment system locations (547 and 548).
Nov 8−11, 2005	3,800 to 3,940	Completed monthly sampling	The 11 Configuration 1 extraction wells (470 thru 479, and PW02), 3 observation wells (557, 560, and 596), 5 piezometers (562, 564, 608, 611, and 612), and 2 treatment system locations (547 and 548).
Dec 5−8, 2005	2,650 to 3,720	Completed monthly sampling	The 11 Configuration 1 extraction wells (470 thru 479, and PW02), 5 observation wells (484, 557, 558, 560, and 596), 5 piezometers (562, 564, 608, 611, and 612), and 2 treatment system locations (547 and 548).
Dec 7, 2005	2,800	System shut down for the winter	NA
Configuration 2			
Jan 26−28, 2005	3,000 to 3,290	Injection test monthly sampling	7 observation wells (408, 580, 582, 583, 584, 587, and 589, 4 piezometers (590 thru 593), 1 surface water (236), and injection water (549). Also measured field parameters from 6 observation wells (401, 402, 581, 585, 586, and 588)
Feb 22−25, 2005	3,580 to 3,700	Injection test monthly sampling	10 observation wells (408, 580, 581, 582, 583, 584, 587, 588 [34 feet bgs] and 589 [44 and 52 feet bgs]), 4 piezometers (590 thru 593), 1 surface water (236), and injection water (549). Also measured field parameters from 5 observation wells (401, 402, 585, 586, and 588 [26 feet bgs])

Table 3–2 (continued). Moab Sampling Chronology

Date	Colorado River Flow (daily mean cfs)	Activity	Samples Collected
Mar 14−16, 2005	3,790 to 4,000	Injection test monthly sampling	6 observation wells (408, 580, 581, 584, 588 [34 feet bgs] and 589 [44 feet bgs]), 4 piezometers (590 thru 593), 1 surface water (236), and injection water (549). Also measured field parameters from 9 observation wells (401, 402, 582, 583, 585, 586, 587, 588 [26 feet bgs], and 589 [52 feet bgs])
Apr 26−27, 2005	~10,000 to 12,000	Injection test monthly sampling	9 observation wells (580, 581, 582, 583, 586, 587, 588 [34 feet bgs] and 589 [44 feet bgs]), and 3 injection water locations (550, 572, and 577). Also measured field parameters from 3 observation wells (584, 588 [26 feet bgs], and 589 [52 feet bgs]). (River stage too high to sample piezometers and surface water location 236)
May 24−26, 2005	38,300 to 39,500 (runoff peak)	Injection test monthly sampling	11 observation wells (401, 402, 408, 580, 581, 582, 583, 584, 586, 588 [34 feet bgs] and 589 [44 feet bgs]), 2 Baseline Area locations (488 and 493), and 1 injection water location (550). Also measured field parameters from 4 observation wells (585, 587, 588 [26 feet bgs], and 589 [52 feet bgs]). (River stage too high to sample piezometers and surface water location 236)
June 20−23, 2005	18,100 to 19,000	Observation wells 0600, 0601, and 0602 installed and developed	NA
June 22−24, 2005	19,300 to 19,800	Injection test monthly sampling	12 observation wells (401, 402, 408, 580, 581, 582, 583, 584, 585, 586, 588 [34 feet bgs] and 589 [44 feet bgs]), and 1 injection water location (550). Also measured field parameters from 3 observation wells (587, 588 [26 feet bgs], and 589 [52 feet bgs]). (River stage too high to sample piezometers and surface water location 236)
July 26−28, 2005	5,960 to 6,640	Injection test monthly sampling	11 observation wells (402, 408, 580, 582, 583, 584, 585, 586, 587, 588 [34 feet bgs] and 589 [44 feet bgs]), 1 piezometer (590), and 1 injection water location (550). Also measured field parameters from 4 observation wells (401, 581, 588 [26 feet bgs], and 589 [52 feet bgs]). (River stage too high to sample piezometers 591 – 593 and surface water location 236)

Table 3–2 (continued). Moab Sampling Chronology

Date	Colorado River Flow (daily mean cfs)	Activity	Samples Collected
Aug 23−26, 2005	3,400 to 3,570	Injection test monthly sampling	10 observation wells (401, 402, 408, 580, 583, 585, 586, 587, 588 [34 feet bgs] and 589 [44 feet bgs]), 2 piezometers (590 and 591), 1 surface water (236) and 1 injection water location (550). Also measured field parameters from 5 observation wells (581, 582, 584, 588 [26 feet bgs], and 589 [52 feet bgs]). (piezometers 593 buried)
Sept 20−21, 2005	3,460 to 3,730	Piezometers 0603, 0613 (replaces 0592, which was altered during runoff), 0614 (replaces 0593, which was buried during the runoff), 0604, 0615, 0616, and 0605 installed	NA
Sept 27−29, 2005	3,740 to 6,400	Injection test monthly sampling	10 observation wells (401, 408, 580, 581, 582, 583, 584, 586, 588 [34 feet bgs] and 589 [44 feet bgs]), 2 piezometers (590 and 591), 2 surface waters (236 and 240). Injection line down, 550 not sampled. Also measured field parameters from 5 observation wells (402, 585, 587, 588 [26 feet bgs], and 589 [52 feet bgs]).
Oct 18−21, 2005	4,200 to 4,870	Injection test monthly sampling	15 observation wells (401, 402, 408, 580 through 587, 588 [34 feet bgs], 589 [44 feet bgs], 600, and 601), 5 piezometers (590, 605, 613, 615, 616), 3 surface waters (236, 239, 240) and 1 injection water location (550). First time 600, 601, 605, 613, 615, 616 sampled.
Oct 25−28, 2005	4,220 to 4,290	Biogeochemical sampling	3 observation wells (588 [26 feet bgs], 589 [44 feet bgs], 602 [18 feet bgs], 4 piezometers (591, 603, 604, and 614). First time 602 sampled.
Nov 8−10, 2005	3,800 to 3,940	Injection test monthly sampling	15 observation wells (401, 402, 408, 580 through 587, 588 [30 feet bgs], 589 [48 feet bgs], 600, and 601), 5 piezometers (590, 605, 613, 615, 616), and 1 injection water location (550).
Nov 28−29, 2005	3,560 to 3,590	Biogeochemical sampling	3 observation wells (588 [26 feet bgs], 589 [44 feet bgs], and 602 [18 feet bgs]), 4 piezometers (591, 603, 604, and 614).
Dec 6−9, 2005	2,630 to 3,240	Injection test monthly sampling	15 observation wells (401, 402, 408, 580 through 589, 600, and 601), 5 piezometers (590, 605, 613, 615, 616), and 1 injection water location (550).
Dec 12−16, 2005	2,660 to 2,900	Biogeochemical sampling	3 observation wells (588 [26 feet bgs], 589 [44 feet bgs], and 602 [18 feet bgs]), 4 piezometers (591, 603, 604, and 614).

Table 3–2 (continued). Moab Sampling Chronology

Date	Colorado River Flow (daily mean cfs)	Activity	Samples Collected
Configuration 3			
June 21−29, 2005	15,100 to 19,800	Installed extraction wells 670 – 679, observation wells 688 and 689	NA
July 6−14, 2005	6,050 to 10,500	Developed extraction wells 670 – 679, observation wells 688 and 689	NA
Aug 2−3, 2005	3,860 to 4,120	Observation wells 0684 and 0685 installed	NA
Aug 9−10, 2005	3,970 to 4,330	Observation wells 0682 and 0683 installed	NA
Aug 9−10, 2005	3,970 to 4,330	Baseline profile sampling	Extraction wells 670 thru 679 (16, 30, and 44 feet bgs), observation wells 688 (31 and 39 feet bgs) and 689 (46 and 54 feet bgs)
Aug 11−12, 2005	4,290 to 4,750	Preliminary Step Tests	Tests completed on well 670, 673, 675, 677, and 679
Aug 16−17, 2005	4,070 to 4,420	Observation wells 0680, 0681, 0686 and 0687 installed	NA
Aug 18, 2005	4,280	Well field started @ 13:00, at a total pumping rate of 118 gpm for 1 hr, then reduced to 54 gpm until the afternoon of Aug 19, 2005, shut down at that point	NA
Aug 22, 2005	3,590	System re-started at ~54 gpm	NA
Aug 23, 2005	3,570	Started 100 gpm test for all well fields (CF3 running at ~72 gpm)	NA
Aug 26, 2005	3,540	Well field shut down @ 0700, end of 100 gpm test	NA
Aug 29, 2005	3,590	Started well field @ ~65 gpm	NA
Sept 29−30, 2005	6,210 to 6,400	Monthly sampling	10 extraction wells (670 thru 679), 9 observation wells (404 and 680 thru 687).
Oct 17, 2005	4,280	Reduced well field flow rate to ~22 gpm	NA
Oct 18−21, 2005	4,200 to 4,870	Monthly sampling	10 extraction wells (670 thru 679), 2 observation wells (688 and 689), 4 piezometers (639, 696, 697, and 698), and 1 surface water (259).
Oct 25−28, 2005	4,220 to 4,290	Biogeochemical sampling	2 observation wells (686 and 687) and 4 piezometers (691, 692, 694, and 695)
Nov 8−11, 2005	3,800 to 3,940	Monthly sampling	10 extraction wells (670 thru 679), 2 observation wells (688 and 689), and 4 piezometers (639, 696, 697, and 698).
Dec 6−8, 2005	2,650 to 3,240	Monthly sampling	10 extraction wells (670 thru 679), 2 observation wells (688 and 689), and 4 piezometers (639, 696, 697, and 698).
Dec 7, 2005	2,800	System shut down for the winter	NA
Dec 12−16, 2005	2,660 to 2,900	Biogeochemical sampling	2 observation wells (686 and 687) and 4 piezometers (691, 692, 694, and 695)

Table 3–2 (continued). Moab Sampling Chronology

Date	Colorado River Flow (daily mean cfs)	Activity	Samples Collected
Baseline Area			
May 24−26, 2005	38,300 to 39,500 (runoff peak)	Well sampling	Wells 488 (33 feet bgs) and 493 (46 and 54 feet bgs). Field parameters were measured from 405 (18 feet bgs), and 488 (26 and 39 feet bgs). River stage too high to sample piezometers
Sept 20−21, 2005	3,460 to 3,730	Piezometers 0597, 0598, 0599, 0617, and 0618 installed in riverbed	NA
Oct 11−13, 2005	4,700 to 5,260	Monthly sampling	6 observation wells (488, 493, SMI-PW01, SMI-PZ1S, SMI-PZ1M, and SMI-PZ1D2), 6 piezometers (496, 497, 598, 599, 617, and 618), and 1 surface water sample (243).
Oct 25−28, 2005	4,220 to 4,290	Biogeochemical sampling	2 observation wells (405 and 488 [26 feet bgs]) and 2 piezometers (495 and 597).
Nov 8−10, 2005	3,880 to 3,940	Monthly sampling	6 observation wells (488, 493, SMI-PW01, SMI-PZ1S, SMI-PZ1M, and SMI-PZ1D2) and 6 piezometers (496, 497, 598, 599, 617, and 618).
Dec 6−8, 2005	2,650 to 3,240	Monthly sampling	6 observation wells (488, 493, SMI-PW01, SMI-PZ1S, SMI-PZ1M, and SMI-PZ1D2), 6 piezometers (496, 497, 598, 599, 617, and 618), and 1 surface water location (243).
Dec 12−16, 2005	2,660 to 2,900	Biogeochemical sampling	2 observation wells (405 and 488 [26 feet bgs]) and 2 piezometers (495 and 597).
Matheson Events			
Dec 12−16, 20−21, 2005 and Jan 25−26, 2006	Flows ranged from 2,600 to 3,500	DOE event	Wells BL1-S, -M, -D, BL2-S, -M, -D, BL3-M, -D, M11-4.8, -7, -12, -14, N2-1.5, -4.3, -6.5, -12.8, N3-4.3, -8.3, N4-3.2, -12, N5-4.4, -7.2, -14, N6-6.4, N7-7, -10, -11, N8-3, -6, -14, W1-4.3, -7,and -10.

*cfs = cubic feet per second
**gpm = gallons per minute

Surface water sampling in 2005 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.

A summary of the surface water sampling conducted in 2005 is displayed in Table 3–2. Most samples were analyzed for the site-related analytes uranium, ammonia, chloride, sulfate, and total dissolved solids. In addition, alkalinity, dissolved oxygen, oxidation-reduction potential, pH, specific conductance, temperature, and turbidity were measured in the field at most locations. Surface and ground water locations sampled during 2005 are shown in Figure 3–3.

3.2.2 Ground Water

A summary of the ground water sampling conducted in 2005 is displayed in Table 3–2. Ground water sampling and analysis was extensive, but focused on purposes other than environmental compliance with ground water or drinking water standards (see discussion below). Most samples

were analyzed for the site-related analytes uranium, ammonia, chloride, sulfate, and total dissolved solids. In addition, alkalinity, dissolved oxygen, oxidation-reduction potential, pH, specific conductance, temperature, and turbidity were measured in the field at most locations. Surface and ground water locations sampled during 2005 are shown in Figure 3–3. An evaluation of ground water data collected during 2005 was conducted to serve several purposes: (1) to validate or revise the site conceptual model presented in the *Site Observational Work Plan* (SOWP [DOE 2003b]), (2) to assess the performance of the ground water interim action systems, (3) to determine the natural variability of the ground water system due to changes in Colorado River stage, and (4) to better understand ground water and surface water interactions. Data used in these evaluations was presented in a variety of calculation sets (DOE 2006a, and b).

Ground water sampling and analysis was not actually performed for the purposes of assessing compliance with ground water standards or other numerical criteria for ground water. Because ground water at the site is saline and qualifies for supplemental standards under 40 CFR 192 ground water regulations, ground water is only required to be protective where it discharges to the surface—i.e., the Colorado River. Therefore, ground water data are not presented here. Data are available at (http://gj.em.doe.gov/Moab). However, surface water data were collected to evaluate the effect of ground water discharge on surface water quality, particularly in sensitive habitat areas. One purpose for operating the interim actions was to determine if active ground water remediation could effectively improve surface water quality. Selected surface water data are presented in Section 5 and Appendix A for purposes of evaluating surface water quality against applicable standards.

3.3 Sediment and Soil Characterization

In 2002, DOE initiated a radiological assessment of the surface soils at the Moab Site in accordance with the *Moab Project, Moab Millsite Radiological Assessment Plan* (DOE 2002a). These radiological assessment activities included land surveys, gamma scans, borehole logging, and exposure-rate surveys. A grid system was developed for the entire Moab Site to ensure a systematic and thorough assessment of the entire mill property. The purpose of the radiological surface assessment was to confirm known areas/quantities of contamination and to estimate total volumes of site contaminated soils that are yet to be remediated.

Due to funding constraints, these radiological assessment activities were discontinued in September 2002. At the time assessment activities were suspended, approximately 60 percent of the site had been surveyed. There were no funded site characterization activities occurring at the Moab Site during CY 2003; however, during CY 2004, DOE completed the radiological assessment of the former millsite in preparation of commencing the Interim Soils Remediation Project at the Moab Site that was conducted in CY 2005.

In CY 2005, approximately 133,000 cubic yards of contaminated soils were remediated at the Moab Site, resulting in a reduction of the contaminated footprint by 29 acres.

3.4 Waste Management

During 2005, DOE conducted operations consistent with DOE's *Waste Management Guidance for the Moab Project Site* and the *Waste Management Plan for the Moab Project Site* (DOE 2005g). Formal training in the requirements of the *Waste Management Plan for the Moab Project Site* was also provided to on-site staff and subcontractors.

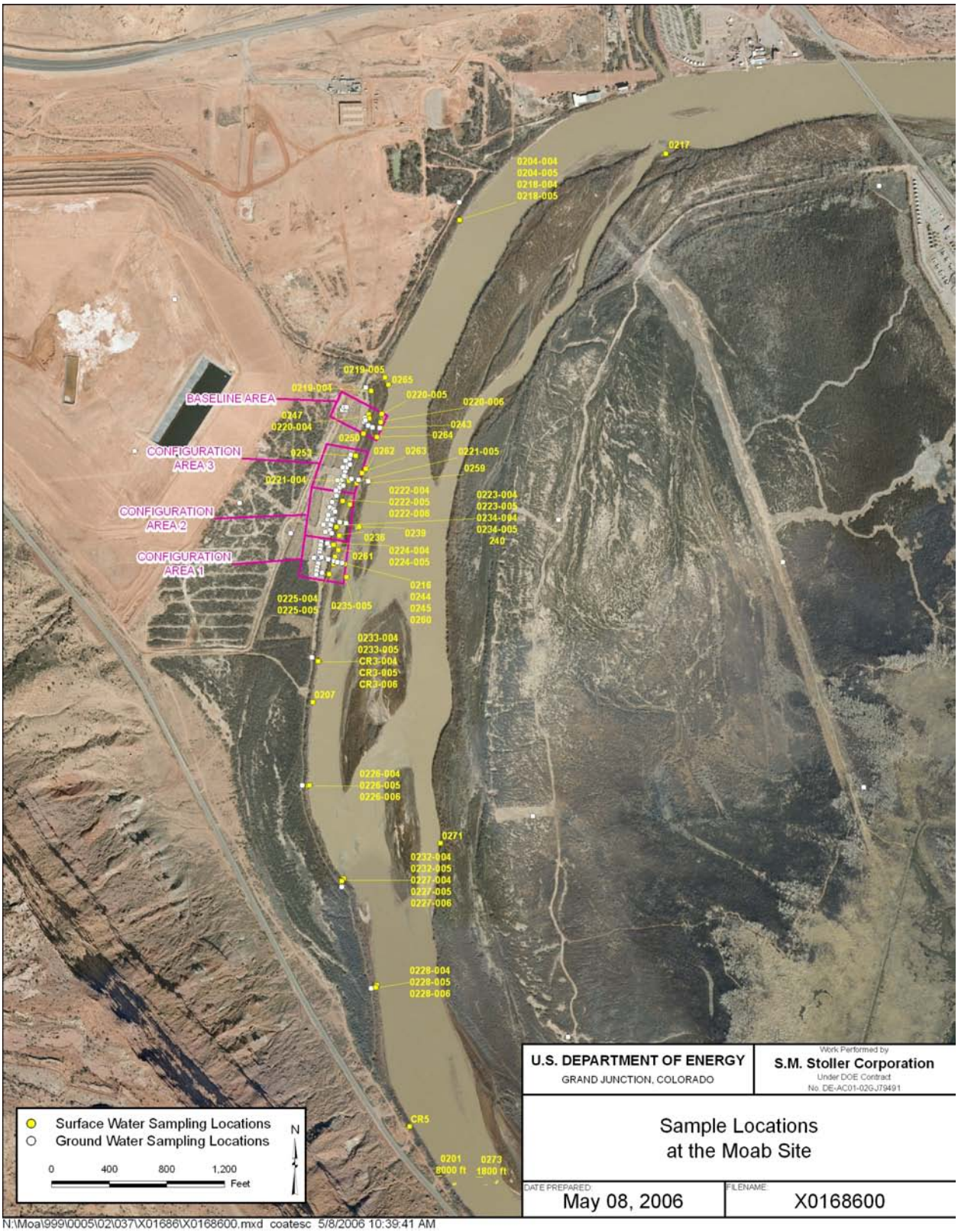

Figure 3–3. Surface Water and Ground Water Sampling Locations 2005

3.4.1 Residual Radioactive Materials

RRM, defined at 40 CFR 192.01(a), is waste that DOE determines as radioactive and related to the milling process. RRM generally refers to uranium mill tailings but may also consist of contaminated soil and debris. Contaminated ground water beneath the Moab Site is also considered RRM. Requirements for the control and cleanup of RRM are provided in 40 CFR 192 Subparts A through C. RRM in the form of uranium mill tailings, contaminated soil and associated materials, and contaminated ground water were remediated at the Moab Site during 2005 as described in Sections 2.1.15 and 2.1.17.

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 in 2005 were considered RRM and were managed in a safe manner that protected site workers and the environment. When necessary, DOE ensured that all such materials were adequately labeled, segregated for compatible storage, and secured by secondary containment.

Legacy Chemicals and Industrial Products

At the end of 2004, approximately 40 containers of legacy chemicals and industrial products remaining from pre-DOE site historical operations. All were considered RRM and were segregated in safe storage within the contaminated area. These included unknown materials, certain known materials, and used oil. During 2005, disposition of all legacy chemicals at the Moab Site was completed. Approximately 10 containers of legacy materials were identified for onsite use, and 20 containers were disposed of onsite in a manner that was protective of workers and the environment.

Approximately eleven 55-gallon containers of legacy used oil and a small amount of oil-contaminated soil were stored in the BMPA during 2005. The non-radioactive legacy used oil was burned onsite as needed during colder months using oil-burning shop heaters.

Polychlorinated Biphenyls and Asbestos

No PCBs or asbestos-contaminated wastes were managed at the Moab Site in 2005. As a best management practice, DOE will continue to manage any PCBs or asbestos found at the site in a manner that is protective of human health and the environment.

3.4.2 Low-Level Waste Management

Low-level radioactive waste does not exist at the Moab Site. All radioactive waste at the site is classified as RRM and is regulated by UMTRCA and 40 CFR 192. The management of RRM is discussed in Sections 2.1.2 and 3.4.1.

3.4.3 Best Management Practice Area

The BMPA is a dedicated storage area constructed within the contaminated area approximately 300 feet east of the warehouse/shop building. It measures approximately 75 feet by 16 feet, is surrounded by a 2-feet -high earthen berm, and is lined with 30-mil plastic sheeting. The BMPA

is intended as a temporary storage area for wastes that require further characterization or for which a disposal strategy has not yet been selected. Once adequate characterization data are obtained and a disposal strategy is selected, wastes are removed from the BMPA.

Wastes stored in the BMPA may come from existing structures, equipment, soil, or uranium mill tailings found onsite. The BMPA is not meant to store materials that are regulated by RCRA or TSCA (i.e., non-RRM waste); such waste must be stored in another area according to applicable state and federal regulations. Wastes are stored in the BMPA in a manner that is protective of human health and the environment. Other BMPA storage areas may be constructed at the Moab Site to store additional wastes generated during remediation activities.

3.5 Pollution Prevention

Pollution prevention is part of the waste management strategy for the Moab Site. Operations are evaluated to identify technically and economically feasible opportunities for source reduction, recycling, decontamination, or treatment. Disposal is the final solution after other disposition options have been considered. Pollution prevention is also achieved through affirmative procurement and energy conservation.

3.5.1 Source Reduction

Source reduction generally means any change in products, services, or actions that reduces, eliminates, or prevents the amount or toxicity or waste being generated. The Moab Site primarily achieves source reduction by using work practices that minimize the amount of radioactive waste that is generated. The ALARA (as low as reasonably achievable) principle is emphasized to keep materials from becoming radioactively contaminated. Using administrative controls such as establishing radioactive materials areas, limiting the use of materials in the contaminated area (especially hazardous materials such as chemicals), and surveying wastes to segregate radioactive waste from nonradioactive waste reduces the volume of radioactive waste generated. Certain materials that must be taken into the contaminated area can be protected from becoming radioactively contaminated. Decontamination is performed if warranted, feasible, and cost-effective.

An additional example of source reduction at the Moab Site during 2005 consisted of using 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.

3.5.2 Reuse and Recycling

Approximately 250 pounds of office paper and 50 pounds of aluminum were generated at the Moab Site during 2005. These materials were recycled at a local recycling center. In addition, three automotive batteries were recycled at a local auto parts store. All these recycled materials were nonradioactive.

During 2005, DOE generated approximately 75 gallons of used oil from the maintenance of on-site vehicles and equipment. Approximately 150 gallons of nonradioactive used oil, consisting of used oil generated during 2005 and legacy used oil remaining from pre-DOE site historical operations, were burned during colder months in onsite oil-burning space heaters.

A legacy radioactive calibration source constructed of radium was transferred to DOE's Idaho National Laboratory in Idaho Falls, Idaho, for reuse.

3.5.3 Affirmative Procurement

The affirmative procurement process favors the acquisition of environmentally friendly 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. The Contracts and Procurement group 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. Examples of affirmative procurement are provided in Sections 3.5.1 and 3.5.4.

3.5.4 Energy Conservation

During 2005, DOE supported the use of renewable energy by purchasing a portion of the Moab Site's electrical power through the Utah Power/PacifiCorp Blue Sky Program. This program enabled DOE to purchase electricity generated by wind turbines that operate within the western United States power grid. DOE also supported renewable energy by testing biodiesel fuel in one of the onsite vehicles during part of 2005. Additional use of biodiesel fuel is planned if cumulative test results are favorable.

The majority of site electrical power is used for pumping dust control water from the Colorado River and pumping contaminated ground water for remediation purposes. Plans have been made to conserve electricity by purchasing more energy efficient pumps for these activities.

End of current text

4.0 Environmental Monitoring Summary

This section presents a summary of the monitoring data collected as a result of DOE's environmental air monitoring (including atmospheric radon, direct gamma radiation, airborne radioparticulates, and meteorological conditions), and surface water sampling programs conducted at the Moab Site during 2005. Ground water monitoring results for 2005 are described in Section 5.0.

4.1 Environmental Air Monitoring

DOE continued its environmental air monitoring activities at the Moab Site during 2005 as described in the *Moab Project Environmental Air Monitoring Sampling and Analysis Plan* (DOE 2003a). This sampling and analysis plan was prepared to identify monitoring goals and objectives, and to document DOE's strategy for monitoring various airborne contaminants. This section presents a summary of the environmental air monitoring data that DOE collected at the Moab Site and throughout the Moab community during 2005.

DOE initiated environmental air monitoring activities at the Crescent Junction in the fall of 2005 to collect initial baseline data at and near the site before construction activities commence. Evaluation of the Crescent Junction monitoring data will begin in 2006, and is therefore not included in this report.

4.1.1 Atmospheric Radon

DOE derived a site-specific guideline for atmospheric radon concentration for the Moab Site of 3.6 pCi/L (see Section 3.1.1). During 2005, the annual average atmospheric radon concentration exceeded the site-specific standard at three of the on-site locations (Table 4–1); however, the radon guideline was not exceeded at any of the off-site locations.

The elevated radon concentrations observed along the site boundary are consistent with the elevated radon levels that Atlas Corporation measured for many years. During the time it operated the mill, Atlas made several documented requests seeking a variance or an exemption from the radon limits that were specified by NRC in their operating permit. Although a temporary soil cover was placed over the tailings pile, it did little to attenuate radon emissions stemming from the radioactive decay of the buried uranium mill tailings. It should be noted; however, the tailings pile does not have an engineered radon barrier, nor is the existing cover designed to control radon flux. Consequently, it is not surprising that radon concentrations continue to be elevated at various locations within the Moab Site property and along the site perimeter.

Although radon levels are elevated along the site boundary, an important finding resulting from DOE's monitoring is that radon concentrations decrease rapidly within one-half mile of the millsite. Radon monitoring locations directly across the Colorado River within the boundaries of the Matheson Wetlands Preserve (i.e., monitoring locations MPS-0119, MPS-0124, and MPS-0125) and at the MEI location (adjacent to millsite's eastern property line) demonstrate that radon concentrations are below the applicable guideline. Also, none of the other off-site monitoring locations show any indication that the average annual atmospheric radon levels are elevated significantly above background concentrations.

Table 4–1. Summary of Environmental Radon and Gamma Monitoring Data for the Moab Site for Calendar Year 2005

Station Number	1st Quarter 2005 (01/18/05 - 04/06/05)		2nd Quarter 2005 (04/06/05 - 07/11/05)		3rd Quarter 2005 (07/11/05 - 11/08/05)		4th Quarter 2005 (11/08/05 - 01/04/06)		2005 Annual Average	
	Radon pCi/L	Gamma mrem/91 d[3]	Radon pCi/L	Gamma mrem/91 d[3]	Radon pCi/L	Gamma mrem/91 d[3]	Radon pCi/L	Gamma mrem/91 d[3]	Radon pCi/L	Gamma mrem/yr
On-Site Locations										
0101	2.2	72.5	2.1	64.8	3.0	65.9	4.1	59.6	2.8	263
0102	1.6	23.6	1.3	24.2	1.3	25.0	1.9	28.9	1.5	102
0103	1.4	24.5	1.3	24.2	1.4	26.1	2.6	28.5	1.7	103
0104	1.6	30.6	1.6	26.5	2.0	26.8	3.6	28.6	2.2	112
0105	2.2	46.1	2.1	49.1	2.9	49.9	5.1	54.8	3.1	200
0106	5.8	39.7	5.3	41.2	7.6	43.4	11.5	48.6	7.6	173
0107	2.2	49.2	4.3	58.0	5.2	57.5	10.6	66	5.6	231
0108	2.7	117.4	4.7	139.4	5.0	131.9	6.0	136.4	4.6	525
0109	1.7	51.3	1.8	59.4	2.3	55.7	2.1	60.3	2.0	227
0110	1.4	81.2	3.4	89.6	2.3	89.7	1.9	89.5	2.2	350
0111	0.6	63.7	1.3	NDA	1.0	71.5	0.8	63.7	0.9	265
0112	1.3	37.3	1.9	38.1	2.3	42.3	2.1	39	1.9	157
0113	1.7	79.6	2.4	74.6	2.8	73.6	3.6	81.5	2.6	309
Off-Site Locations										
0117[1]	0.7	21.1	0.7	24.4	0.8	23.5	0.8	26	0.8	95
0118	0.5	15.1	0.8	18.9	0.9	17.3	0.8	22.1	0.8	73
0119	0.6	21.6	1.0	26.0	1.0	25.3	1.7	28.9	1.1	102
0120	0.4	16.6	0.7	25.1	0.9	19.9	0.9	22.9	0.7	84
0121	0.4	19.2	0.6	21.8	0.9	21.3	0.8	22.7	0.7	85
0122	0.4	16.4	0.6	19.1	0.5	19.0	<0.5	20.4	0.5	75
0123[1]	0.4	18.0	0.4	18.3	0.6	20.4	<0.5	19.2	0.5	76
0124	0.8	18.8	NDA	23.9	1.4	22.2	1.9	27.4	1.4	92
0125	0.9	23.1	1.5	25.4	2	25.4	2.7	28.4	1.8	102
0126	0.9	20.4	1.7	24.5	2	23.2	4.0	26.5	2.2	95
0127	0.4	17.8	0.8	25.8	1.1	21.2	1.8	28.9	1.0	94
MEI[2]	1.2 dup	14.2	0.8 dup	16.3	1.5 dup	19.2	2.3 dup	16.1	1.5	66

[1] Designated background monitoring locations. Background locations are located at sufficient distances away from the millsite to be free from any affects or influences from potential site contaminants.
[2] The maximally exposed individual (MEI) is the continually occupied residential property that is closest to the DOE property boundary.
[3] mrem value is prorated to a 91 day exposure period.
NA = Not Applicable.
NDA = No Data Available.

Based on these data, it can be demonstrated that radon emissions from the mill tailings stored at the Moab Site are not affecting the general population of the city of Moab. However, unacceptable exposures to the public may result to individuals who camp or reside for extended periods of time along the southern property line (between SR-279 and the Colorado River and within one-half mile of the DOE property boundary). Although this is private land, it has long been used as an area for camping and other recreational activities. As a result of this potential for public exposure, DOE (after having received permission from the property owner) has fenced off and posted this area as being off limits to the public. The area is not entirely secure, however, as there are numerous points of entry to this area from SR-279. To determine radon concentrations in this area that is frequented by the public, DOE initiated radon monitoring on this adjacent

property in 2003 at varying distances from the site boundary. Monitoring locations MPS-0126 and MPS-0127 indicate that the annual *average* radon concentrations observed in this area are below the DOE guideline; however, radon concentrations become elevated during the winter and early spring months. Therefore, to prevent unauthorized trespass within this area, and to minimize the potential for excessive public exposures to radon gas, DOE will continue (to the extent that is possible) to implement and enforce the institutional controls (e.g., warning signs, fences, and other physical barriers) that already exist.

The elevated radon emissions within and along the Moab Site boundary are expected to decrease once the contaminated materials have been removed. Radon monitoring data collected at both on-site and off-site locations are shown in Figure 4–1 and Figure 4–2, respectively.

4.1.2 Direct Gamma Radiation

The DOE standard for direct gamma radiation at the site boundary (and at any off-site location) is 181 mrem/yr (see Section 3.1.2). As can be seen from Table 4–1, during 2005 direct gamma radiation measurements exceeded this limit at eight of the on-site locations; however, the limit was not exceeded at any of the off-site locations.

Due to the large volume of uranium mill tailings stockpiled at the Moab Site and their reported gamma activity, it is expected that gamma radiation measurements will be elevated at and near the site boundary. However, as with DOE's findings with respect to radon emissions, the off-site monitoring locations show that gamma exposure rates are consistent with background values observed for the Moab region. Therefore, the gamma emanation or "shine" associated with the tailings at the Moab Site is not detected at any of the off-site monitoring locations.

Based on DOE's environmental monitoring data, it can be demonstrated that the levels of direct gamma radiation associated with the mill tailings stored at the Moab Site are not affecting the general population of the city of Moab. Unacceptable exposures may result to individuals who camp or reside for extended periods of time along the southern property line (between SR-279 and the Colorado River and within one-half mile of the DOE property boundary).

The elevated levels of direct gamma radiation observed within and along the Moab Site property boundary are expected to decrease once the contaminated materials have been removed. Direct gamma radiation monitoring data collected at both on-site and off-site locations are shown in Figure 4–3 and Figure 4–4, respectively.

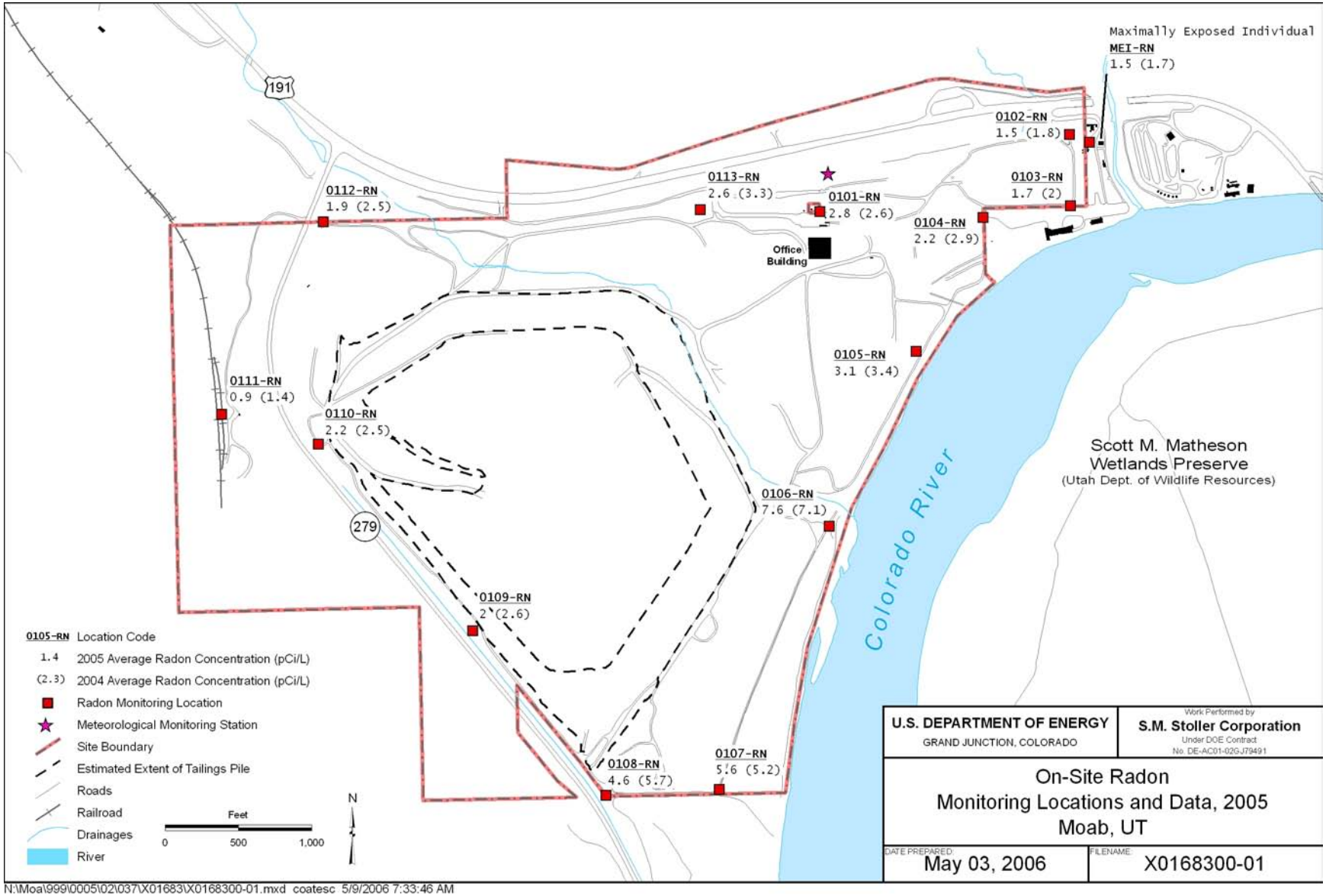

Figure 4–1. On-Site Radon Monitoring Locations and Data, 2005

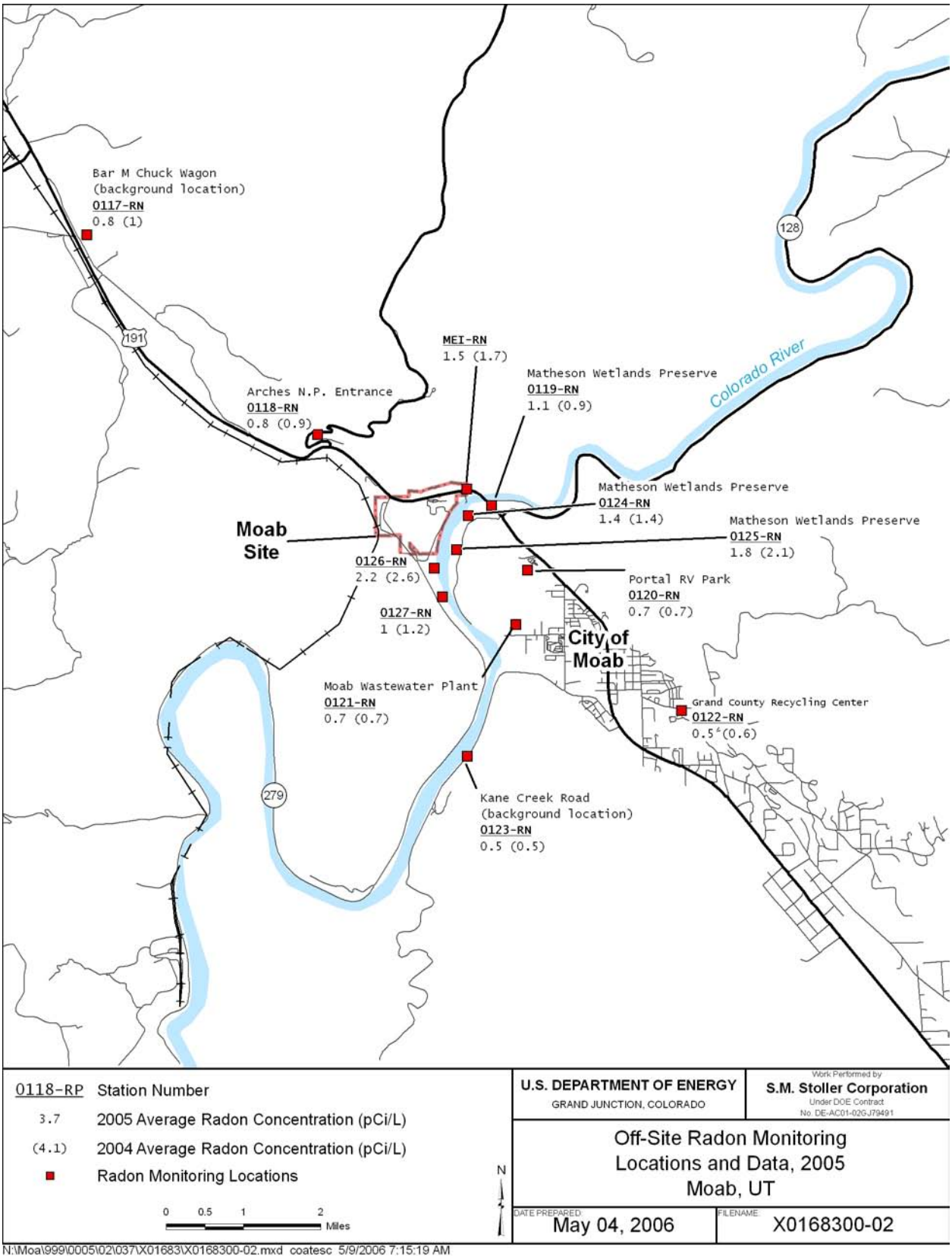

Figure 4–2. Off-Site Radon Monitoring Locations and Data, 2005

4.1.3 Air Particulates

Airborne radioparticulate matter is also sampled at specific locations near the Moab Site and throughout the surrounding community (see Section 3.1.3). Radioparticulate data are of particular interest to DOE because it provides information relative to the dose that the public may be receiving from the inhalation of radioactive particulate matter. The radionuclides that are common constituents of uranium mill tailings and are of interest to DOE are Ra-226, Th-230, Po-210, and U-nat.

DOE has published DCG values for inhaled air for various radioisotopes. A DCG value represents the concentration from a specific 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 radionuclides included in DOE monitoring program at the Moab Site are shown in Table 4–2.

Table 4–2. Summary of Derived Concentration Guides for Inhaled Air Radionuclides Monitored at the Moab Site

Radionuclide	Derived Concentration Guides (µCi/mL)[a]
Ra-226	1.E-12
Th-230	4.E-14
Po-210	1.E-12
U-nat	2.E-12

[a]µCi/mL = microcuiries per milliliter

Radioparticulate data collected at the Moab Site during 2005 are summarized in Table 4–3. As can be seen from Table 4–3, the annual averages for airborne radioparticulate concentrations do not exceed the DCG values for any of the on-site or off-site locations. These data demonstrate that emissions of airborne radioparticulate matter do not exceed levels or concentrations that would result in an unacceptable public exposure. To the contrary, the monitoring data show that actual airborne concentrations were consistently from two to four orders of magnitude below their respective DCG values. Radioparticulate monitoring data collected at both on-site and off-site locations are shown in Figure 4–5 and Figure 4–6, respectively.

4.1.4 Public Radiological Dose/Exposure Summary

Radiological exposures to the public resulting from uranium mill tailings stored at the Moab Site consist of two components: direct gamma radiation and airborne emissions of radioparticulates. As provided in DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (Chapter II: Requirements for Radiation Protection of the Public and Environment), radiation associated with radon exposures (and its decay products) is to be addressed independently and is not considered in the DOE public dose limit (see discussion in Section 4.1.1).

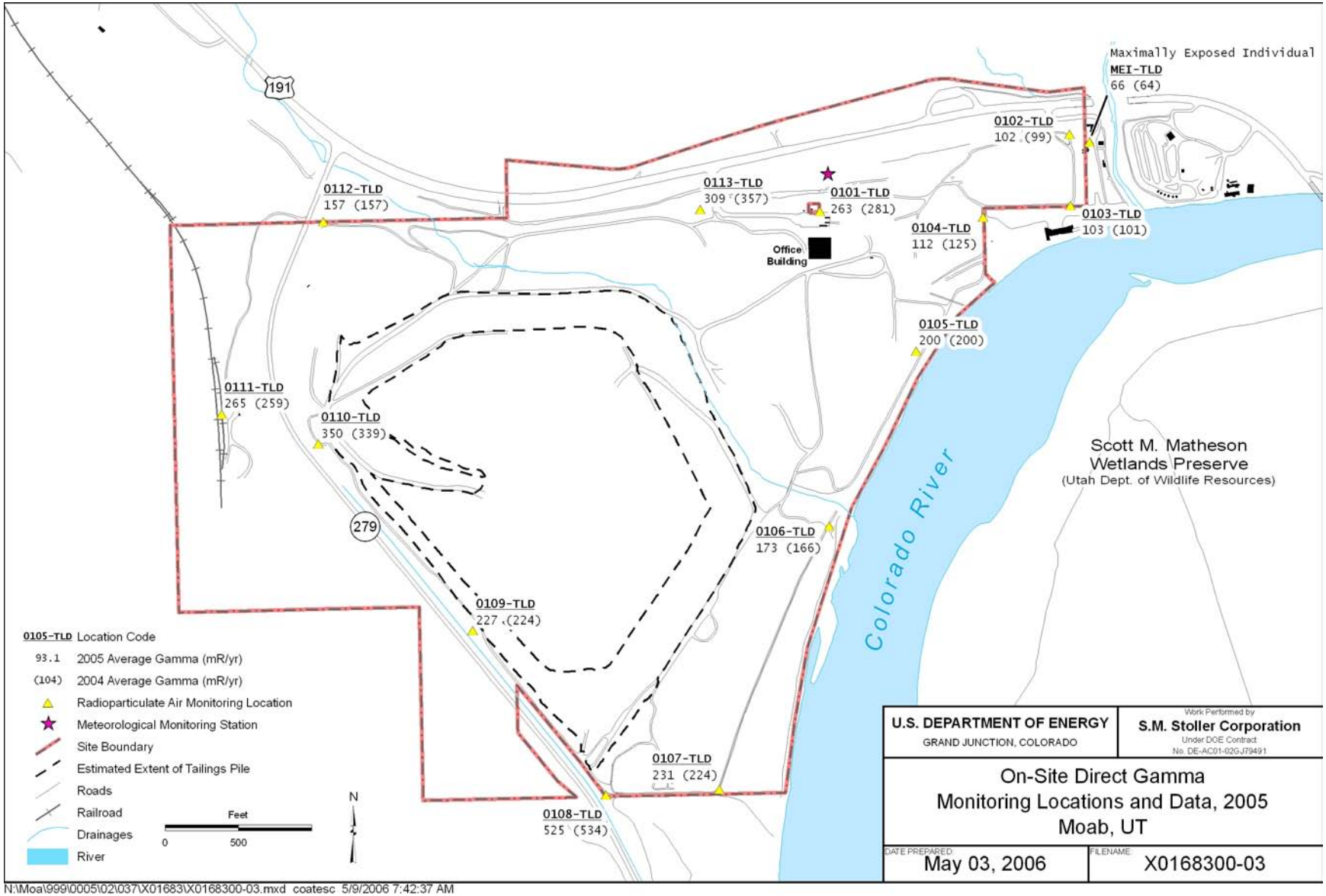

Figure 4–3. On-Site Direct Gamma Monitoring Locations and Data, 2005

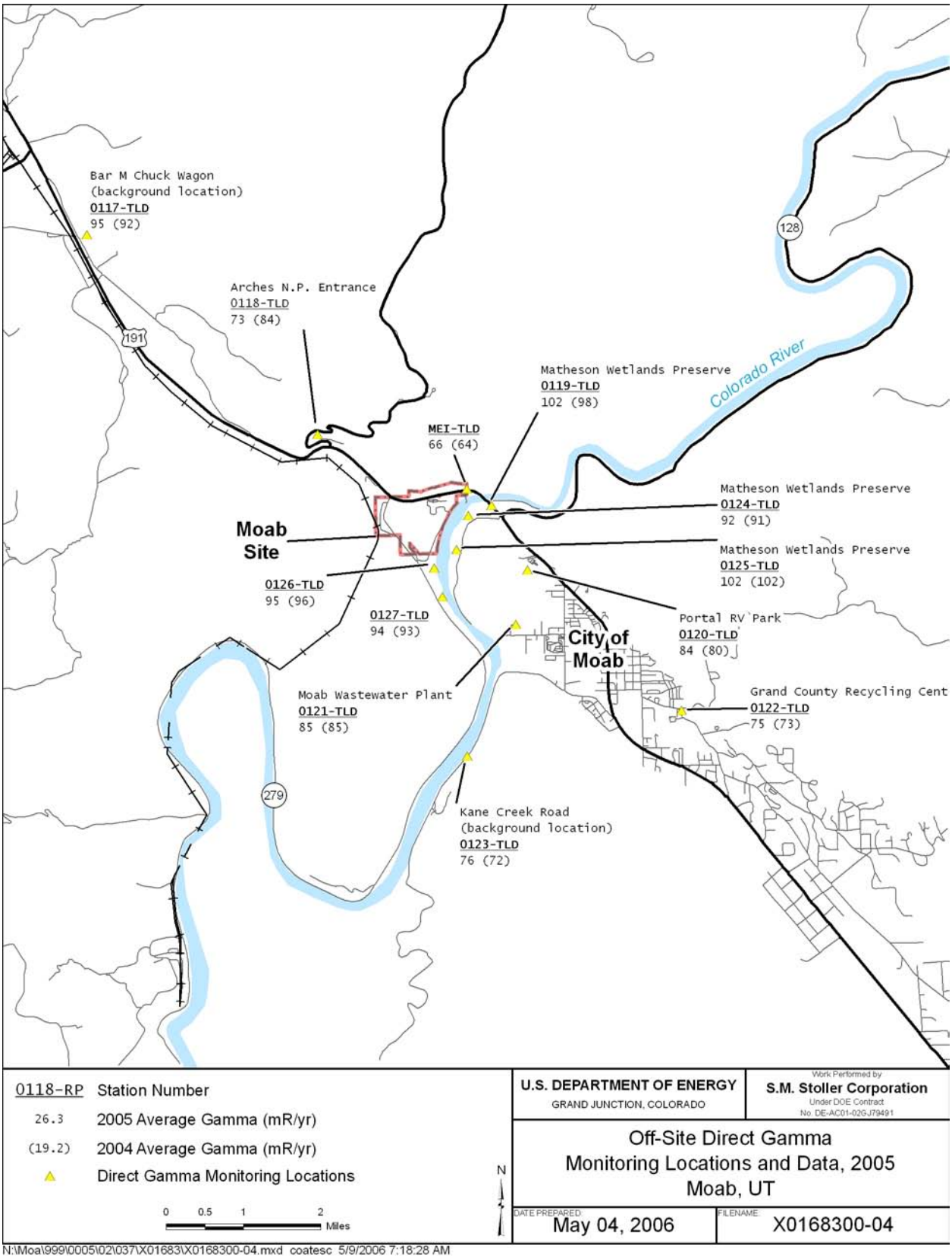

Figure 4–4. Off-Site Direct Gamma Monitoring Locations and Data, 2005

Table 4–3. Summary of Radioparticulate Air Monitoring Data for the Moab Site for Calendar Year 2005

Station Number	Isotope	First Quarter 2005 (µCi/mL)[5]	Second Quarter 2005 (µCi/mL)	Third Quarter 2005 (µCi/mL)	Fourth Quarter 2005 (µCi/mL)	Annual Average (µCi/mL)
On-Site Locations						
MPS-0102 (East Property Line)	Uranium[1]	6.5E-17	8.1E-17	8.1E-17	5.0E-17	6.9E-17
	Thorium-230[2]	3.7E-17	1.9E-16	2.0E-16	8.8E-17	1.3E-16
	Radium-226[3]	1.2E-16	6.2E-17	1.3E-16	9.8E-17	1.0E-16
	Polonium-210[4]	9.5E-15	2.9E-15	2.3E-15	5.0E-15	5.0E-15
MPS-0105 (River Berm)	Uranium[1]	2.3E-16	2.7E-16	2.4E-16	9.6E-17	2.1E-16
	Thorium-230[2]	1.1E-16	4.1E-16	4.3E-16	1.3E-16	2.7E-16
	Radium-226[3]	1.0E-16	1.9E-16	1.4E-16	1.4E-16	1.4E-16
	Polonium-210[4]	1.1E-14	2.9E-15	2.2E-15	3.6E-15	5.0E-15
Off-Site Locations						
MPS-0117 (Bar M Chuck Wagon)	Uranium[1]	2.2E-17	8.8E-18	2.4E-17	2.1E-17	1.9E-17
	Thorium-230[2]	5.0E-17	1.0E-16	1.1E-16	6.4E-17	8.1E-17
	Radium-226[3]	8.3E-17	6.5E-17	9.8E-17	1.1E-16	8.8E-17
	Polonium-210[4]	1.2E-14	2.6E-15	4.7E-15	3.2E-15	5.5E-15
MPS-0118 (Arches National Park Entrance)	Uranium[1]	9.7E-17	2.9E-17	4.6E-17	2.4E-17	4.9E-17
	Thorium-230[2]	7.9E-17	1.7E-16	2.2E-16	9.7E-17	1.4E-16
	Radium-226[3]	1.2E-16	7.7E-17	1.4E-16	9.9E-17	1.1E-16
	Polonium-210[4]	1.5E-14	4.0E-15	4.9E-15	5.3E-15	7.3E-15
MPS-0119 (Scott Matheson Wetlands Preserve)	Uranium[1]	2.9E-17	1.5E-17	2.2E-17	1.7E-17	2.1E-17
	Thorium-230[2]	5.5E-17	1.4E-16	9.7E-17	7.6E-17	9.1E-17
	Radium-226[3]	1.1E-16	6.8E-17	1.2E-16	1.4E-16	1.1E-16
	Polonium-210[4]	1.4E-14	3.6E-15	3.2E-15	5.5E-15	6.6E-15
MPS-0120 (Portal RV Park)	Uranium[1]	2.6E-17	1.1E-17	2.5E-17	1.6E-17	1.9E-17
	Thorium-230[2]	3.9E-17	2.2E-16	8.7E-17	9.4E-17	1.1E-16
	Radium-226[3]	1.2E-16	8.7E-17	1.3E-16	1.3E-16	1.2E-16
	Polonium-210[4]	1.2E-14	2.6E-15	3.1E-15	3.7E-15	5.3E-15
MPS-0121 (Moab Wastewater Treatment Plant)	Uranium[1]	2.4E-17	1.4E-17	3.3E-17	1.8E-17	2.3E-17
	Thorium-230[2]	6.2E-17	5.8E-17	1.8E-16	4.3E-17	8.5E-17
	Radium-226[3]	1.2E-16	7.5E-17	1.2E-16	1.1E-16	1.0E-16
	Polonium-210[4]	1.4E-14	4.0E-15	3.0E-15	4.1E-15	6.3E-15
MPS-0122 (Grand County Recycling Center)	Uranium[1]	2.7E-17	1.2E-17	2.4E-17	1.5E-17	2.0E-17
	Thorium-230[2]	8.3E-17	9.9E-17	7.6E-17	9.2E-17	8.8E-17
	Radium-226[3]	1.3E-16	6.4E-17	1.4E-16	9.5E-17	1.1E-16
	Polonium-210[4]	1.3E-14	2.9E-15	3.1E-15	4.3E-15	5.9E-15
MPS-0123 (Kane Creek Road)	Uranium[1]	1.9E-17	1.1E-17	2.1E-17	1.3E-17	1.6E-17
	Thorium-230[2]	6.9E-17	8.8E-17	1.2E-16	1.2E-16	1.0E-16
	Radium-226[3]	1.2E-16	1.0E-16	1.0E-16	9.3E-17	1.0E-16
	Polonium-210[4]	1.5E-14	2.3E-15	3.8E-15	5.2E-15	6.4E-15

[1]DOE DCG for Total Uranium = 2.E-12
[2]DOE DCG for Thorium-230 = 4.E-14
[3]DOE DCG for Radium-226 = 1.E-12
[4]DOE DCG for Polonium-210 = 1.E-12
[5]µCi/mL = microCuries per milliliter

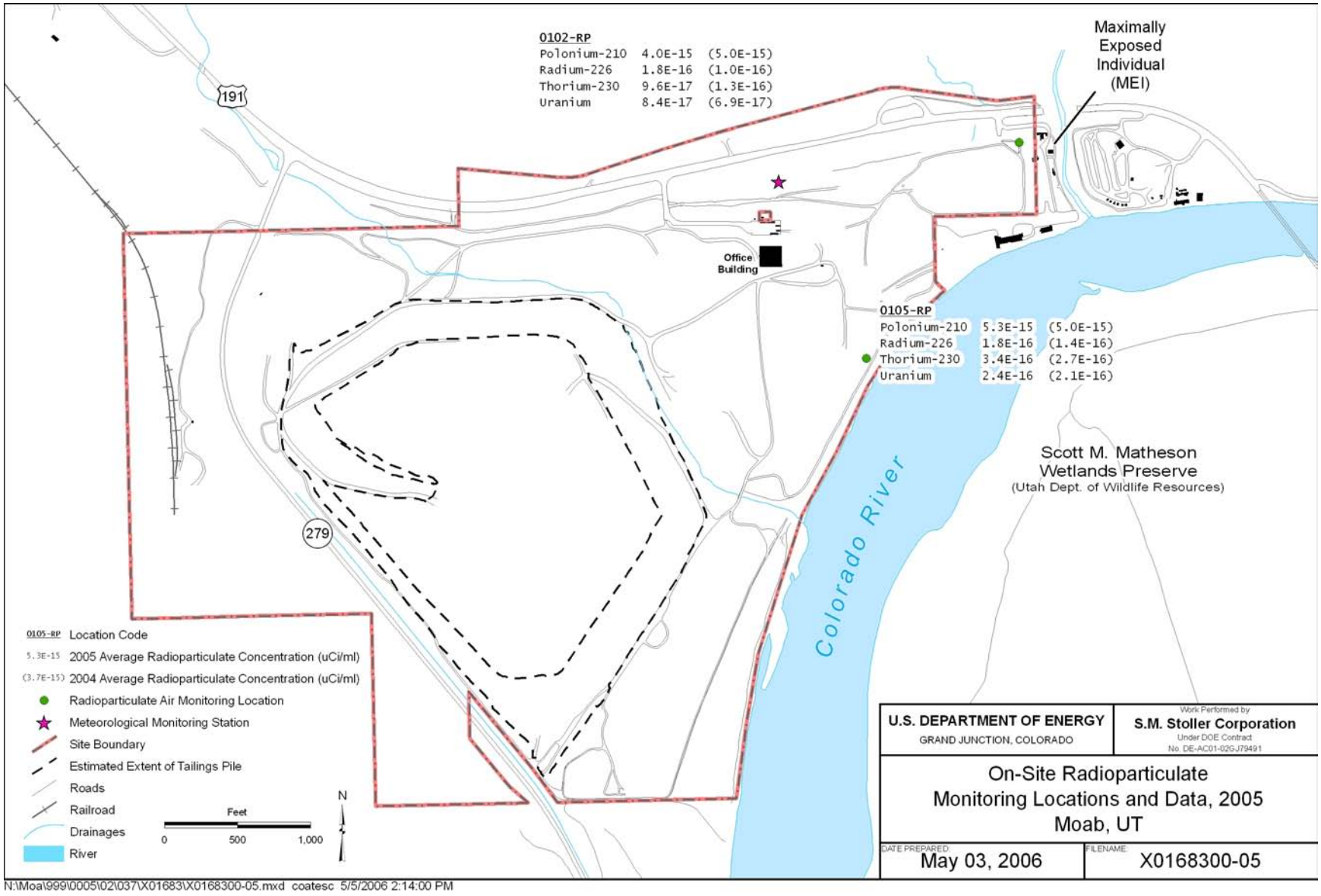

Figure 4–5. On-Site Radioparticulate Monitoring Locations and Data, 2005

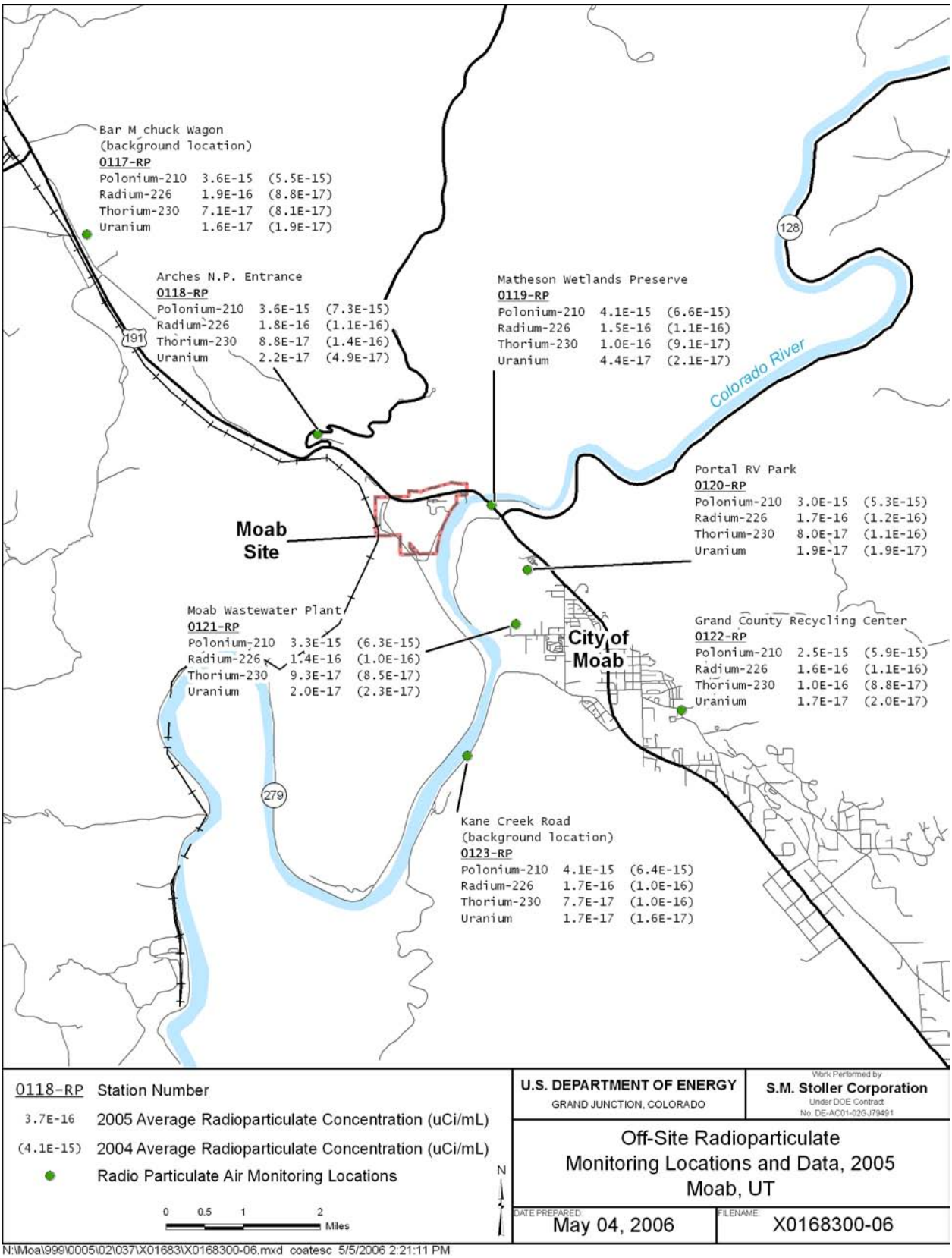

Figure 4–6. Off-Site Radioparticulate Monitoring Locations and Data, 2005

Direct Gamma Radiation

The public dose limit for all exposure modes (100 mrem/yr above background) described in DOE Order 5400.5 applies to "… dose from exposures to radiation sources from routine activities including remedial actions and naturally occurring radionuclides released by DOE processes and operations."

As discussed in Section 4.1.2, elevated gamma exposure rates were measured at several locations along the Moab Site boundary; however, the annual average direct gamma radiation measurements for all off-site locations were below the DOE public dose limit that has been calculated for the Moab Site of 181 mrem/yr. Direct gamma radiation measurements were also collected at the MEI location (MPS-MEI) during 2005. The monitoring data collected at MPS-MEI indicate that the annual average gamma radiation dose at this location was 66 mrem/yr, well below the calculated site limit of 181 mrem/yr.

Airborne Emissions

DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (Chapter II: Requirements for Radiation Protection of the Public and Environment), also provides that "… the exposure of members of the public to radioactive materials released to the atmosphere as a consequence of routine DOE activities shall not cause members of the public to receive in a year, an effective dose equivalent greater than 10 mrem."

To demonstrate compliance with this airborne emissions standard, DOE conducts radioparticulate air monitoring at key onsite and off-site locations as discussed in Section 4.1.3. The DOE airborne emissions limit is 10 mrem/yr. As shown in Table 4–3, the annual average concentrations of radionuclides measured at both on- and off-site locations were several orders of magnitude below their respective DCG values. A DCG value is that concentration from a specific radionuclide that would cause a member of the public, residing at the point of collection, to receive a dose of 100 mrem/yr. Therefore, air emissions for any single location cannot exceed one-tenth of the DCG value for any given radionuclide.

Radioparticulate data from monitoring location MPS-0102 are representative of the airborne concentrations received by the MEI. The monitoring data collected at MPS-0102 during CY 2005 indicate that the exposure for each radionuclide was less than one percent of its respective DCG value, well below the 10 mrem/yr emissions limit in DOE Order 5400.5.

In summary, environmental monitoring data collected for direct gamma radiation and radioparticulate air emissions during CY 2005 were well below the public dose limits applicable to the Moab Site.

Meteorology

A meteorological monitoring station was installed at the Moab site in July 2002. The monitoring station is located approximately 300 feet north of the access control trailer (Figure 3–1). Meteorological parameters monitored at the Moab Site include average air temperature, relative humidity, average solar radiation, evapotranspiration potential, average wind speed, average wind direction, standard deviation of wind speed, and total rainfall. Table 4–4 summarizes 2005 meteorological data for temperature, wind speed, and precipitation.

Table 4–4. Meteorological Data Summary for the Moab Site for Calendar Year 2005

Temperature					Wind Speed		Precipitation (inches)
Month	Avg. High	Avg. Low	Max. Temp.	Min. Temp.	Avg.	Peak Gust	
January	51.3	32.6	58.7	25.4	3.2	31.0	*
February	52.6	32.6	60.9	23.1	3.4	26.7	*
March	60.5	36.0	74.7	29.7	4.2	42.1	*
April	70.3	43.5	82.7	29.7	5.0	48.9	0.01
May	82.0	51.5	99.0	39.0	4.4	47.1	1.19
June	87.8	58.3	104.5	45.7	4.5	58.9	*
July	101.9	67.4	109.6	56.2	4.0	44.2	*
August	92.7	64.7	102.9	57.0	3.8	42.1	*
September	86.1	56.8	95.0	45.8	3.9	38.5	*
October	73.0	45.5	87.4	35.8	3.4	46.4	*
November	58.4	33.1	72.1	16.8	3.5	33.5	*
December	45.9	21.6	61.4	9.1	2.9	36.0	1.14

* - instrument malfunction

End of current text

5.0 Surface Water Monitoring Program

5.1 Hydrogeology

A basin-fill aquifer (alluvial aquifer) directly underlies the Moab Site. This aquifer is divided into three hydrochemical facies (based on total dissolved solids data). A relatively thin zone at the top of the aquifer includes an upper fresh to moderately saline facies and an intermediate facies of very saline water. A thick briny facies dominates the aquifer. All three facies existed beneath the site prior to milling activities. The deeper brine water results mostly from dissolution of the underlying salt beds of the Paradox Formation present beneath most of the site. Navajo Sandstone, Kayenta Formation, and Wingate Sandstone of the Glen Canyon Group comprise the principal bedrock aquifer in the region and locally are present upgradient at the site's northern boundary. While the high salinity nature of the ground water precludes beneficial use of the aquifer, it must still be protective of surface water quality where it discharges to the Colorado River. Data collected from the river adjacent to the Moab Site have indicated that site-related contaminants elevated in the ground water have had a locally detrimental effect on surface water quality.

In general, water of the Colorado River near the Moab Site is characterized as very turbid and of considerable hardness, high suspended solids loading, fairly high salinity for a freshwater river (due to a large extent to high sulfate levels), and often wide fluctuations in the concentrations of all of these constituents. Historically, water quality standards for several constituents have been exceeded upstream of the site.

5.2 Surface Water Analytical Results

The alluvial aquifer beneath the Moab Site has been contaminated from former uranium milling operations. Ground water standards for a number of constituents, particularly molybdenum, nitrate, and uranium, have been routinely exceeded in the past in ground water at the site. Fluids in the tailings pile are elevated in constituents such as ammonia, nitrate, sulfate, and uranium, as evidenced by analysis of pore fluids during 2003. Results presented in the *Site Observational Work Plan for the Moab, Utah Site* (DOE 2003b) indicate that fluids from the pile continue to contaminate ground water beneath the site, which, in turn, can affect surface water quality. The standard analytical suite of constituents for surface water adjacent to the site includes ammonia, chloride, sulfate, total dissolved solids, and uranium. Maximum concentrations for these constituents observed in the Colorado River in 2005 are included in Table 5–1.

The site-related constituent of greatest concern at the site is ammonia because of its toxicity to aquatic life. Historic and recent sampling results indicate that ammonia is elevated in some areas immediately adjacent to the site. Areas that can serve as habitat for endangered fish are of particular concern. Surface water sampling conducted in 2005 was designed specifically to address areas that are potential fish habitat. DOE met with fish experts from other federal and state agencies to help identify areas with the greatest habitat potential. During routine sampling events, efforts were made to sample locations judged to provide the best habitat at the time of sampling. Favorable habitat is characterized by fairly shallow, low velocity waters. Other samples were collected within the river channel ("compliance sampling") to assess the effect of ground water discharge on the overall quality of surface water.

Table 5–1. Comparison of State of Utah Water Quality Standards[a] with 2005 Maximum Concentrations in Colorado River[b]

Constituent	State Standard[a,b]	2005 Maximum[c] in River
Ammonia Total as N[d]	2-4 mg/L	170
Chloride	na[e]	1,800
Sulfate	na	6,400
Total dissolved solids	1,200 mg/L	6,900
Uranium	na	1.1

[a]mg/L = milligrams per liter
[b]State of Utah Water Quality Standards for the Colorado River and its tributaries, U.A.C. Section R317-2-13. Not all state standards are listed in this table.
[c]The values are in units shown under the State Standard column.
[d]Ammonia Total as N "standard" is the Federal Ambient Water Quality Acute criterion. Criterion varies with sample pH and temperature; 2-4 mg/L is a typical range for conditions adjacent to the Moab Site.
[e]not available

Table 5–2 presents data for locations where the ammonia exceeded background concentrations during 2005. The data provided in Table 5–2 show that 10 samples exceeded the ambient water quality criteria (AWQC; EPA 1999) for ammonia (either acute, chronic, or both). Of these exceedences, 70% were attributed to two locations. Locations 0236 and 0216 had the highest observed ammonia concentrations and exceeded acute AWQC. Of the remaining samples, one location exceeded both the acute and chronic criteria on one occasion, and a second location met the acute criteria, but exceeded the chronic criteria on one occasion. All other locations had concentrations less than the applicable acute and chronic criteria.

Location 0236 is in the vicinity of Configuration 2 injection wellfield. This location was a fairly well-developed backwater area when it was sampled throughout CY 2005. During 2005, this backwater was largely filled with sediment and was progressively isolated from the river channel. However, when water was present in this area, it was sampled to provide continuity in data. During CY 2005 while the Configuration 2 injection system was operating, samples collected from this location demonstrated a near steady decline in ammonia concentrations. However, ammonia concentrations at location 0236 often still exceeded applicable acute criteria.

Location 0216 is found downgradient of the Configuration 2 injection well field. The two samples collected at this location that had ammonia concentrations exceeding the background level (Table 5–2) were taken during early 2005 (January and February). Subsequent samples collected at location 0216 showed consistently low concentrations of ammonia (all but one less than the detection limit of 0.1 mg/L).

All exceedences of acute or chronic ammonia AWQC occurred during base flow (lowest flow) conditions. Only one location (0234-005) had an ammonia concentration exceeding the background concentration under flow conditions above base flow; the concentration at this time and location was below both acute and chronic AWQC. All locations, including 0236, dropped below the AWQC (and generally detection limits) during some sampling event(s). Complete results for ammonia in surface water are presented in Appendix A.

Table 5–2. Surface Locations with Ammonia Concentrations Exceeding Background During 2005

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	1/27/2005	57	8.4	2.4
0216	2/22/2005	7.6	5.7	1.7
0222-006	11/2/2005	10	5.1	1.5
0234-005	7/12/2005	0.31	4.0	0.7
0236	1/26/2005	150	13.3	3.3
0236	2/22/2005	170	7.5	1.6
0236	3/14/2005	67	7.6	2.2
0236	8/24/2005	35	12.6	0.9
0236	11/2/2005	11	4.4	1.3
0240	10/19/2005	20	25.9	5.0
0245	1/27/2005	4.6	5.7	1.7
0245	2/22/2005	0.36	6.4	1.9
0261	11/2/2005	0.33	3.7	1.1
0265	11/2/2005	0.79	4.5	1.4

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6.0 Quality Assurance

A QA Program providing a structured approach for the application of QA principles to work performed on the Moab UMTRA Project by DOE's TAC is implemented through the *Quality Assurance Manual* (STO 1). The QA Program is based on DOE Order 414.1B, *Quality Assurance*, requirements and refers to documents that implement the QA Program. The *Moab Project Quality Assurance Program Plan* (QAPP) (DOE 2005c) specifies project-specific implementation of the QA program. Implementation of the QAPP ensures that environmental data are valid and traceable and that they fulfill the requirements of the QA program. All work for the Moab UYMTRA Project is conducted under the QAPP.

6.1 Sampling

Strategies and objectives for effluent monitoring and environmental sampling at the Moab Site are described in the following planning documents:

- *Site Observational Work Plan for the Moab, Utah, Site* (DOE 2003b)
- *Ground Water and Surface Water Sampling and Analysis Plan for GJO Projects* (DOE 2002d)
- *Moab Project Environmental Air Monitoring and Sampling and Analysis Plan* (DOE 2003a)

Procedures prepared by the organization responsible for the work address field quality control, sampling methods, sampling equipment decontamination, sample identification, chain-of-custody, sample protection, equipment calibration, and independent data verification.

6.2 Laboratory Analysis

The TAC ensures high-quality 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 participation in proficiency testing programs. Laboratories that implement a documented QA plan, employ technically competent staff, maintain suitable facilities and equipment, and follow written procedures are selected. The TAC continually evaluates the quality of the data received from the laboratories through a formal data validation process.

The Sample Coordinator ensures that the laboratory has all the pertinent information, the samples are shipped, the proper analyses requested, and that the report and electronic data are received as requested. Laboratory analytical results of environmental samples are received electronically into an Oracle database. These data are maintained, protected, and archived by the Information Management group. Data validation is performed by the sampling organization or by the sample coordinator.

6.3 Data and Records Management

Records are created both on paper and electronically in a retrievable format. They are protected against deterioration, damage, and loss. Records generated in support of environmental monitoring are subject to the requirements of 36 CFR 1220−1234. The *Records Management Manual* (STO 9) and the Moab working file index implement applicable records regulations.

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Appendix A

2005 Ammonia Sampling Results for Surface Water

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE MOA01, Moab Site
REPORT DATE: 4/17/2006 9:15 am

PARAMETER	UNITS	LOCATION ID	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Ammonia Total as N	mg/L	0201	04/21/2005	0001	0.13			#	0.1	-
	mg/L	0201	07/11/2005	0001	0.1	U		#	0.1	-
	mg/L	0204-004	04/21/2005	0001	0.14			#	0.1	-
	mg/L	0204-004	04/21/2005	0002	0.12			#	0.1	-
	mg/L	0204-005	07/14/2005	0001	0.1	U		#	0.1	-
	mg/L	0207	11/03/2005	0001	0.1	U		#	0.1	-
	mg/L	0216	01/27/2005	0001	57			#	2	-
	mg/L	0216	02/22/2005	0001	7.6			#	0.2	-
	mg/L	0216	03/14/2005	0001	0.54			#	0.1	-
	mg/L	0216	04/27/2005	0001	0.1	U		#	0.1	-
	mg/L	0216	05/25/2005	0001	0.1	U		#	0.1	-
	mg/L	0216	06/23/2005	0001	0.1	U		#	0.1	-
	mg/L	0216	07/27/2005	0001	0.1	U		#	0.1	-
	mg/L	0216	08/24/2005	0001	0.1	U		#	0.1	-
	mg/L	0216	09/27/2005	0001	0.1	U		#	0.1	-
	mg/L	0216	10/13/2005	0001	0.1	U		#	0.1	-
	mg/L	0217	04/21/2005	0001	0.13			#	0.1	-
	mg/L	0217	07/15/2005	0001	0.1	U		#	0.1	-
	mg/L	0218-004	04/21/2005	0001	0.13			#	0.1	-
	mg/L	0218-005	07/14/2005	0001	0.1	U		#	0.1	-
	mg/L	0219-004	04/19/2005	0001	0.2			#	0.1	-
	mg/L	0219-005	07/14/2005	0001	0.1	U		#	0.1	-
	mg/L	0219-005	07/14/2005	0002	0.1	U		#	0.1	-
	mg/L	0220-004	04/19/2005	0001	0.21			#	0.1	-
	mg/L	0220-005	07/14/2005	0001	0.1	U		#	0.1	-
	mg/L	0220-006	11/03/2005	0001	0.1	U		#	0.1	-
	mg/L	0220-006	11/03/2005	0002	0.1	U		#	0.1	-
	mg/L	0221-004	04/20/2005	0001	0.21			#	0.1	-
	mg/L	0221-005	07/14/2005	0001	0.1	U		#	0.1	-

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE MOA01, Moab Site
REPORT DATE: 4/17/2006 9:15 am

PARAMETER	UNITS	LOCATION ID	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Ammonia Total as N	mg/L	0222-004	04/20/2005	0001	0.16			#	0.1	-
	mg/L	0222-005	07/13/2005	0001	0.1	U		#	0.1	-
	mg/L	0222-006	11/03/2005	0001	10			#	0.5	-
	mg/L	0223-004	04/20/2005	0001	0.18			#	0.1	-
	mg/L	0223-005	07/12/2005	0001	0.1	U		#	0.1	-
	mg/L	0224-004	04/20/2005	0001	0.18			#	0.1	-
	mg/L	0224-005	07/12/2005	0001	0.1	U		#	0.1	-
	mg/L	0225-004	04/20/2005	0001	0.17			#	0.1	-
	mg/L	0225-005	07/12/2005	0001	0.1	U		#	0.1	-
	mg/L	0226-004	04/20/2005	0001	0.17			#	0.1	-
	mg/L	0226-005	07/12/2005	0001	0.1	U		#	0.1	-
	mg/L	0226-006	11/03/2005	0001	0.1	U		#	0.1	-
	mg/L	0227-004	04/20/2005	0001	0.16			#	0.1	-
	mg/L	0227-005	07/11/2005	0001	0.1	U		#	0.1	-
	mg/L	0227-006	11/03/2005	0001	0.1	U		#	0.1	-
	mg/L	0228-004	04/20/2005	0001	0.17			#	0.1	-
	mg/L	0228-005	07/11/2005	0001	0.1	U		#	0.1	-
	mg/L	0228-006	11/03/2005	0001	0.1	U		#	0.1	-
	mg/L	0232-004	04/20/2005	0001	0.17			#	0.1	-
	mg/L	0232-005	07/11/2005	0001	0.1	U		#	0.1	-
	mg/L	0233-004	04/20/2005	0001	0.17			#	0.1	-
	mg/L	0233-005	07/12/2005	0001	0.1	U		#	0.1	-
	mg/L	0234-004	04/20/2005	0001	0.17			#	0.1	-
	mg/L	0234-005	07/12/2005	0001	0.31			#	0.1	-

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE MOA01, Moab Site
REPORT DATE: 4/17/2006 9:15 am

PARAMETER	UNITS	LOCATION ID	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA QA	DETECTION LIMIT	UN-CERTAINTY
Ammonia Total as N	mg/L	0235-005	07/12/2005	0001	0.1	U	#	0.1	-
	mg/L	0236	01/26/2005	0001	150		#	10	-
	mg/L	0236	02/22/2005	0001	170		#	20	-
	mg/L	0236	03/14/2005	0001	67		#	10	-
	mg/L	0236	07/27/2005	0001	0.1	U	#	0.1	-
	mg/L	0236	08/24/2005	0001	35		#	5	-
	mg/L	0236	09/28/2005	0001	0.1	U	#	0.1	-
	mg/L	0236	10/18/2005	0001	0.13		#	0.1	-
	mg/L	0236	11/02/2005	0001	11		#	0.5	-
	mg/L	0239	10/18/2005	0001	0.1	U	#	0.1	-
	mg/L	0240	07/27/2005	0001	0.1	U	#	0.1	-
	mg/L	0240	09/28/2005	0001	0.1	U	#	0.1	-
	mg/L	0240	10/19/2005	0001	20		#	1	-
	mg/L	0243	10/12/2005	0001	0.1	U	#	0.1	-
	mg/L	0243	12/08/2005	0001	0.32		#	0.1	-
	mg/L	0245	01/27/2005	0001	4.6		#	0.1	-
	mg/L	0245	02/22/2005	0001	0.36		#	0.1	-
	mg/L	0245	03/14/2005	0001	0.24		#	0.1	-
	mg/L	0245	08/24/2005	0001	0.1	U	#	0.1	-
	mg/L	0245	09/27/2005	0001	0.1	U	#	0.1	-
	mg/L	0245	10/13/2005	0001	0.1	U	#	0.1	-
	mg/L	0259	10/18/2005	0001	0.1	U	#	0.1	-
	mg/L	0260	11/03/2005	0001	0.1	U	#	0.1	-
	mg/L	0261	11/02/2005	0001	0.33		#	0.1	-
	mg/L	0262	11/02/2005	0001	0.1	U	#	0.1	-
	mg/L	0263	11/02/2005	0001	0.1	U	#	0.1	-
	mg/L	0264	11/02/2005	0001	0.1	U	#	0.1	-
	mg/L	0265	11/03/2005	0001	0.79		#	0.1	-
	mg/L	0271	12/16/2005	0001	0.1	U	#	0.1	-
	mg/L	0273	12/15/2005	0001	0.32		#	0.1	-
	mg/L	CR1	04/19/2005	0001	0.25		#	0.1	-
	mg/L	CR1	07/11/2005	0001	0.1	U	#	0.1	-
	mg/L	CR1	11/04/2005	0001	0.1	U	#	0.1	-
	mg/L	CR3-004	04/20/2005	0001	0.15		#	0.1	-
	mg/L	CR3-005	07/12/2005	0001	0.1	U	#	0.1	-
	mg/L	CR3-006	11/03/2005	0001	0.1	U	#	0.1	-
	mg/L	CR5	04/21/2005	0001	0.14		#	0.1	-
	mg/L	CR5	07/11/2005	0001	0.1	U	#	0.1	-

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE MOA01, Moab Site
REPORT DATE: 4/17/2006 9:15 am

PARAMETER	UNITS	LOCATION ID	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Ammonia Total as N	mg/L	CR5	11/04/2005	0001	0.1	U		#	0.1	-

RECORDS: SELECTED FROM USEE800 WHERE site_code='MOA01' AND quality_assurance = TRUE AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND cas in('NH3+NH4-N') AND DATE_SAMPLED between #1/1/2005# and #12/31/2005#

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- + Correlation coefficient for MSA < 0.995.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- M GFAA duplicate injection precision not met.
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
- P > 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
- S Result determined by method of standard addition (MSA).
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
- Y Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
- Z Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

- F Low flow sampling method used.
- J Estimated value.
- Q Qualitative result due to sampling technique
- U Parameter analyzed for but was not detected.
- G Possible grout contamination, pH > 9.
- L Less than 3 bore volumes purged prior to sampling.
- R Unusable result.
- X Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.