DOE–EM/GJ889–2005

Moab Project

Annual Site Environmental Report for Calendar Year 2004

June 2005

Atlas Millsite, 1984

Atlas Millsite, 1996

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U.S. Department of Energy
Moab Project

Annual Site Environmental Report
for Calendar Year 2004

June 2005

Work Performed by S.M. Stoller Corporation under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office, Grand Junction, Colorado

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Appendix

Appendix A—2004 Ammonia Sampling Results for Surface Water

End of current text

Acronyms

ACM	asbestos-containing-material
ALARA	as low as reasonably achievable
BA	Biological Assessment
BMPA	best management practice area
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
E.O.	Executive Order
EPA	U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
ft	feet
MEI	maximally exposed individual
mrem	millirem
mrem/yr	millirem per year
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
SOWP	Site Observational Work Plan
SWP^3	Storm Water Pollution Prevention Plan
TAC	Technical Assistance Contractor
TDS	total dissolved solids
TLD	thermoluminscent dosimeter
TSCA	Toxic Substances Control Act
U.A.C.	Utah Administrative Code
UDOT	Utah Department of Transportation
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 during calendar year (CY) 2004 at the Moab Project site (Moab site) located in Moab, Utah. The Moab site is owned by the U.S. Department of Energy (DOE) and is operated by DOE's Office of Environmental Management (EM) located in Grand Junction, Colorado. 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 2004.

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 2004 included site management and public involvement; site security, stabilization, and maintenance actions; site assessment and characterization; waste management and minimization; 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 2004 were conducted in compliance with applicable federal, state, and local regulations and requirements, and with applicable DOE orders.

During CY 2004, the Moab site received no notices of violation and did not have any occurrences that required reporting to outside agencies.

Site Activities and Highlights for Calendar Year 2004

Significant highlights, accomplishments, and activities conducted by DOE at the Moab site during 2004 are as follows:

Site Management and Public Involvement

- Continued to host stakeholder/public involvement activities.
- Reformatted the Moab Project website at http://gj.em.doe.gov/moab to enhance the usability of information available to the public. A Current Status section was added to provide a monthly update to various site activities.

- In accordance with the National Environmental Policy Act (NEPA) process for evaluating major federal actions, DOE prepared and issued a draft 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 draft EIS.

Site Security, Stabilization, and Maintenance

- Maintained physical security of the site perimeter (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.
- Stabilized site conditions (implemented fugitive dust controls, storm water runoff controls, established radiological barriers) and facilities (locked former mill buildings, made needed improvements to on-site roads, ponds, etc.).
- Maintained a site access control facility consisting of a decontamination trailer, office trailers, and several sea-land storage units for storing equipment.
- Performed general ongoing maintenance of roads, utilities, fences, water diversion structures, pipelines, and pumps.
- Upgraded the electrical power supply to various on-site locations (pond, river pump, tailings pile, etc.).
- Installed electrical power to the second pump in the river diversion structure to supply water for on-site dust suppression activities.
- Disposal of legacy laboratory chemicals left on site from previous operators of the former mill site.

Site Remediation and Construction Activities

- Assisted the Utah Department of Transportation (UDOT) in the clean up and removal of approximately 19,000 cubic yards of contaminated soils from the U.S. Highway 191 right-of-way clean-up project. These contaminated materials were remediated from the portion of the U.S. Highway 191 right-of-way that passes through the northern portion of the millsite property. All contaminated materials were stockpiled and stabilized on-site for disposal at a later date.
- Conducted testing of the systems associated with operation of the "Initial Action" ground water remediation project. The purpose of this Initial Action project is to dilute "hot spots" of ammonia contaminated ground water as they seep into the Colorado River with clean water diverted from the Colorado River. Due to sustained low river flows, the Initial Action system was not operational during CY 2004.
- Implemented the "Interim Action" ground water remediation project. This effort consisted of installing a 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. During 2004, the Interim Action ground water remediation system pumped and treated (through evaporation) approximately 10,000,000 gallons of contaminated ground water. Treatment of this volume of contaminated ground water resulted in the removal of approximately 30,000 Kg (66,139 pounds) of total ammonia and 100 Kg (221 pounds) of uranium during CY 2004.

Waste Management and Minimization

- Shipped approximately 343 containers of non-residual radioactive material (non-RRM) legacy chemicals and industrial products (i.e., materials remaining from former site operations, including the onsite analytical chemistry and assay laboratories) totaling 1,185 kilograms (2,612 pounds) for off-site treatment and disposal.
- Disposed of approximately 516 containers of nonhazardous radiologically contaminated legacy materials in the onsite tailings pile.
- Maintained the Best Management Practice Area (BMPA), a lined and bermed impoundment designed to safely store and isolate potential waste materials until they can be permanently disposed of. DOE stored approximately 11 containers of legacy used oil in the BMPA at the end of 2004.
- Recycled approximately 100 pounds of paper and 50 pounds of aluminum.
- Accumulated approximately 55 gallons of used oil for recycling or reuse.
- Donated two computer systems to the Utah Geological Survey.
- Participated in a program offered by the Utah Power electric utility to purchase electricity generated by a renewable source (wind power) for 100 percent of the site's electrical needs.

Environmental Compliance

- Maintained site dust controls in accordance with the *Moab Site Fugitive Dust Control Plan* (submitted to State of Utah in 2002).
- Maintained site storm water controls and conducted weekly inspections in accordance with the *Moab Site Storm Water Pollution Prevention Plan*.
- Prepared and submitted *Temporary Change Applications* 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.
- Prepared and submitted two *Underground Injection Control Program Inventory Information* applications to the State of Utah, Department of Environmental Quality, Division of Water Quality, Ground Water Protection Section. The Underground Injection Control (UIC) Program coordinator subsequently issued two Approval and Authorization letters for activities associated with DOE's interim ground water remedial action efforts.
- Initiated formal consultation with the U.S. Fish and Wildlife Service to ensure protection of threatened and endangered species and critical habitat at and near the Moab site. The formal consultation process has resulted in the preparation of a Biological Assessment and subsequent Biological Opinion.

- Updated the *Floodplain and Wetlands Assessment for Interim Actions at the Moab Project Site* (DOE 2003a) report for the Moab site.
- Continued to conduct site activities and operations in compliance with three NEPA Environmental Checklists (which resulted in separate categorical exclusions) that were prepared for specific on-site activities: (1) operation and maintenance activities, (2) management of laboratory chemicals, and (3) relocation of Long-Term Surveillance and Maintenance calibration pads.
- Prepared NEPA Determination to conduct Interim Action Ground Water remediation activities.
- Completed preparation of the *Draft Environmental Impact Statement (EIS) for the Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties, Utah.* In accordance with NEPA regulations, the Draft EIS was distributed for public review and comment.

Environmental Air Monitoring

- Conducted both on-site and off-site environmental air monitoring activities in accordance with the *Moab Project Environmental Air Monitoring Sampling and Analysis Plan* (DOE 2003b). Parameters monitored at the Moab site include radon-222, direct gamma radiation, and radioparticulate matter (polonium-210, radium-226, thorium-230, and total uranium). The air monitoring network is designed to collect data from the Moab site, the surrounding community, and background locations. During 2004, DOE also continued the collection of meteorological monitoring data from a monitoring station that was installed at the Moab site in 2002.
- Prepared quarterly environmental air monitoring reports that summarize and trend the air monitoring data collected from the Moab site and the surrounding community. 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).
- Conducted interior radon monitoring at the Maximally Exposed Individual (MEI) location. These data are collected from the nearest, continuously occupied residence that is located closest to the Moab site property boundary. The MEI location represents a worst-case exposure scenario to a member of the general public.

Ground Water and Surface Water Monitoring

- Conducted extensive ground water and surface water monitoring and field investigations throughout 2004.
- Installed wellfields and operated two interim action ground water remediation systems during 2004 and collected monthly performance data.
- Prepared 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).
- Collected samples from potential endangered fish habitat to evaluate effects from discharge of contaminated ground water.

Compliance Summary for Calendar Year 2004

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 with concentrations that are most consistently elevated in the Colorado River is ammonia.

Extensive ground water and surface water monitoring was conducted during 2004 to serve several purposes. Two interim action active ground water remediation systems were operated during 2004. 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 2004 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 ammonia 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 at the Moab site 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 environmental air monitoring network consists of on-site, off-site, and background sampling locations.

During 2004, DOE's monitoring data 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 worse-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 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.

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 2004. DOE's radioparticulate monitoring targeted specific radionuclides that are common constituents of uranium mill tailings. Radio-particulate monitoring data collected at all sampling locations during 2004 were below the 10 mrem/yr emissions limit.

In summary, environmental data collected for direct gamma radiation and radioparticulate air emissions during 2004 were below the public dose limits applicable to the Moab site at all off-site monitoring locations.

Waste Management/Minimization

During 2004, DOE continued to manage and remove legacy wastes to better protect the public, site workers, and the environment. These materials included laboratory chemicals, industrial products, used petroleum products, fire retardants, and asbestos. The non-RRM hazardous legacy wastes were shipped for offsite treatment and disposal. The nonhazardous legacy wastes that were considered RRM were disposed of in the onsite tailings pile. The estimated 40 containers of legacy materials that remained at the end of 2004 were safely stored within the site's warehouse/shop building or the BMPA. Disposition options for these radiologically contaminated materials will be further evaluated in 2005.

Certain wastes such as paper products and aluminum cans were collected and recycled at a local recycling center. Used oil was accumulated for onsite or offsite recycling. Electricity generated by a pollution-free renewable source (wind power) was purchased from the electric utility to supply 100 percent of the site's electrical needs.

Distribution of this Document

This document may be viewed in its entirety at the DOE Moab Project website at http://gj.em.doe.gov/moab. Hard copies may be obtained by contacting Mr. Don Metzler, DOE Moab Federal Project Manager (970-248-7612), at 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 site lies approximately 30 miles south of Interstate 70 (I-70) on U.S. Highway 191 (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. During its years of operation, the facility produced approximately 10.5 million tons of uranium mill tailings. 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 (ft) above the Colorado River terrace (4,076 ft above mean sea level) and is located in the 100-year floodplain of the Colorado River about 750 ft 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 11.9 million tons and a volume of approximately 8.9 million cubic yards (yd^3). 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.).

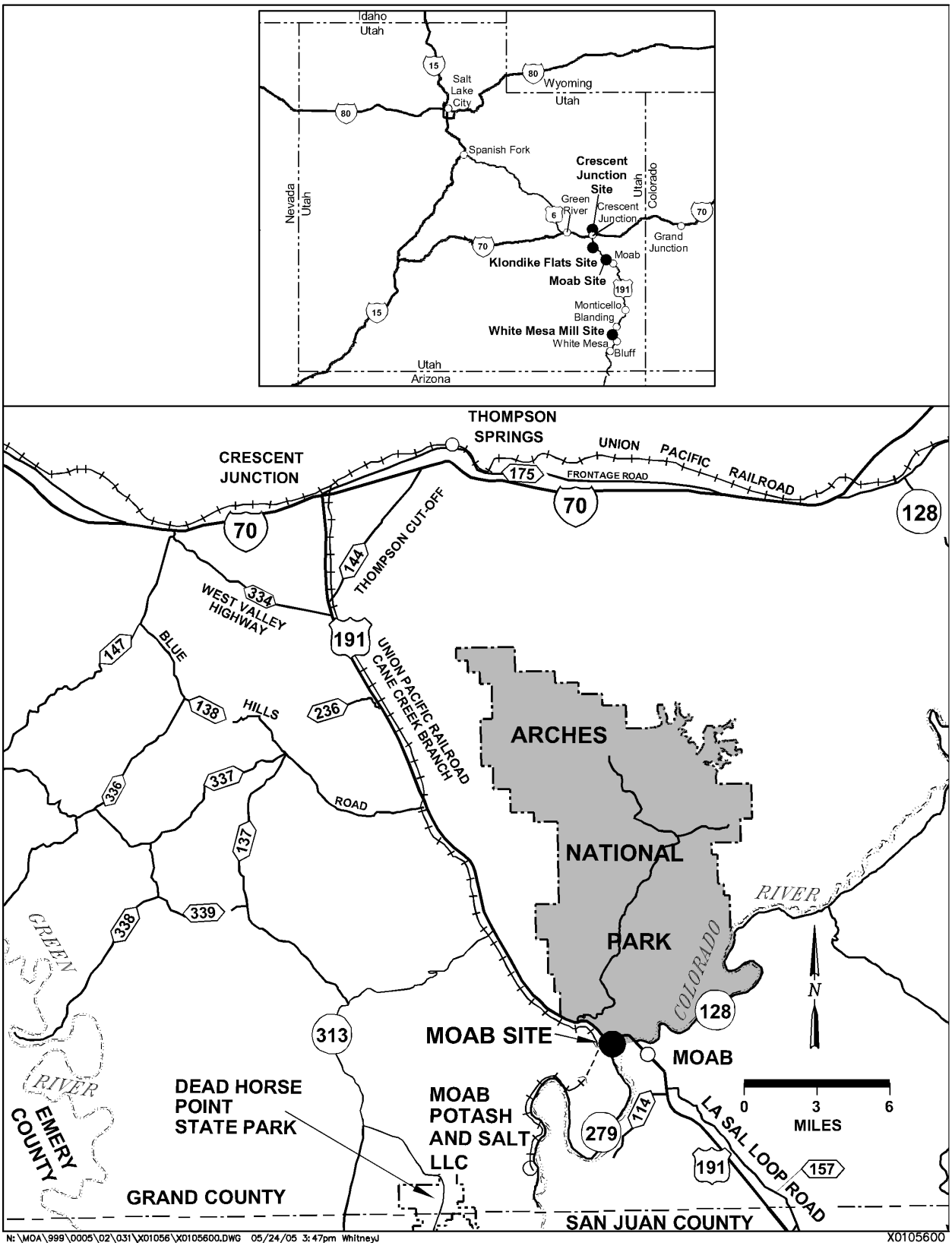

Figure 1–1. Location of the Moab Site in Grand County, Utah

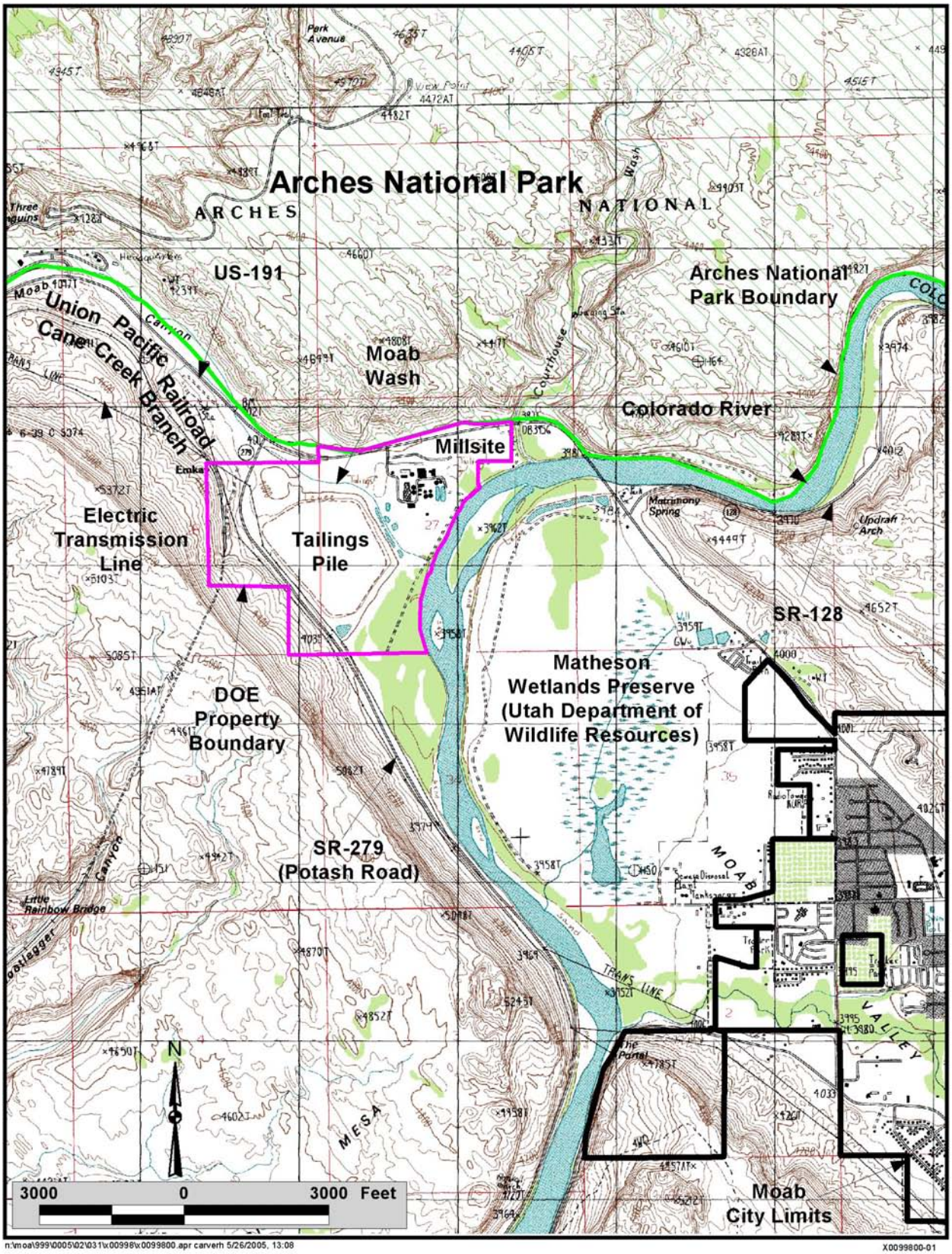

Figure 1–2. Location of the Moab Site in Relation to the City of Moab, Utah

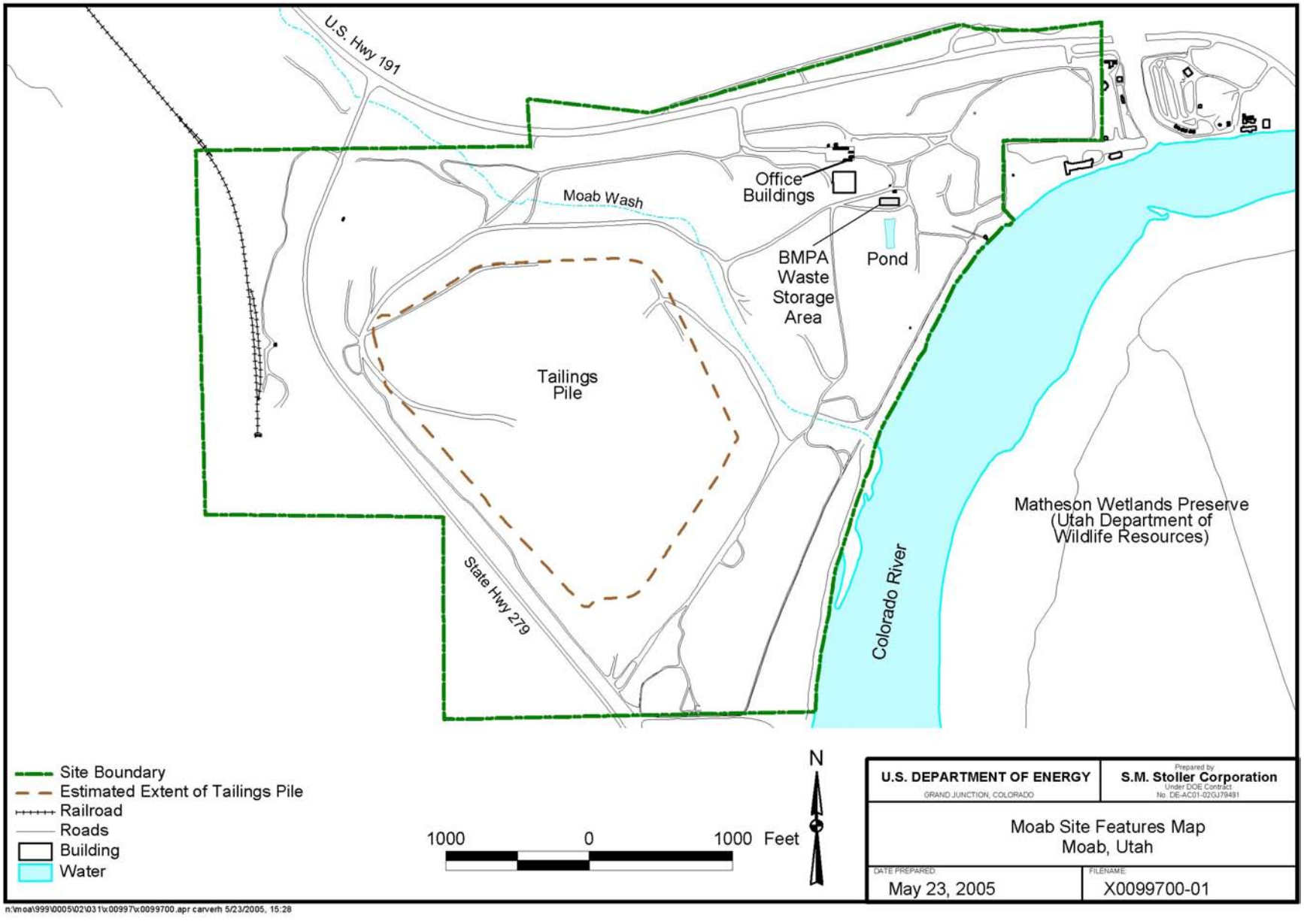

Figure 1–3. Moab Site Features Map

Contaminants are currently seeping from the tailings pile at low rates and may be adversely affecting three environmental media—air, 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.

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. At the end of calendar year (CY) 2004, small quantities of legacy chemicals used for laboratory operations remained at the site. 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* (EIS) (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 U.S. Fish and Wildlife Service (USF&WS) completed a Biological Opinion that was included in the final version of the EIS. The USF&WS concluded in the Final Biological Opinion 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.

1.3 Current Status of the Moab Site

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 National Environmental Policy Act (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 during 2004 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 during 2004 with the various cooperating agencies. Specific comments or questions regarding the Moab site and DOE's activities may be directed to Mr. Don Metzler, DOE Moab Federal Project Manager, at (970) 248-7612. Interested individuals may also submit comments via e-mail to the following address: moabcomments@gjo.doe.gov, or they may call DOE's Moab Project toll-free at 1-800-637-4575.

Federal and state regulatory agencies have 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, have also expressed concern regarding the status of the site. DOE is committed to establishing and maintaining clear lines of communication with all stakeholders.

The purpose of this report is to provide DOE, state officials, and interested members of the public with current information regarding DOE activities at the Moab site. This report will summarize environmental activities conducted at the Moab site during CY 2004, environmental monitoring data collected during 2004, 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 site operated during CY 2004 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 (H.R. 4205), which amended UMTRCA. This act specifies that the license for the 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. UMTRCA required the EPA to establish standards for both disposal of residual radioactive materials (RRM) and cleanup of associated ground water. Remediation of the Moab site must conform with these requirements.

A plan for remediation was also a requirement of the Floyd D. Spence Act. The remediation plan was 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, NAS provided recommendations for DOE to consider during its assessment of remediation alternatives for the Moab site. DOE addressed the NAS recommendations in the draft EIS for remediation which was released for public comment in November 2004.

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 was known). UMTRCA also directed EPA to promulgate cleanup standards (now codified at 40 CFR 192) and assigned NRC to oversee the cleanup and license the completed disposal cells. Remediation of the Moab site will comply with these standards.

Within this document, "contaminant" or "contamination" refers to RRM, unless specified otherwise. RRM is defined by UMTRCA and the 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. Contaminated materials include soils, tailings, facility components, buildings or building materials, equipment, legacy chemicals, and other wastes. Contaminated ground water, which is ground water in the uppermost aquifer that is contaminated with RRM, is also within the scope of the regulations.

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 Uranium Mill Tailings Remedial Action Ground Water Project was published in a Record of Decision (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 concentrations 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 2002, DOE prepared three environmental checklists that resulted in separate categorical exclusions for on-site activities: (1) operation and maintenance activities, (2) management of laboratory chemicals, and (3) relocation of Long-Term Surveillance and Maintenance calibration pads. During 2003, all activities and operations at the Moab site were conducted in compliance with applicable NEPA requirements. In April 2004, DOE approved additional Interim Actions in accordance with NEPA which focus on the reduction of site-related ground water contamination (e.g., ammonia) that is currently discharging to the Colorado River. Under DOE's NEPA procedures found at 10 CFR 1021.211, interim actions concerning a proposal that is the subject of an EIS may be undertaken before issuing a ROD, provided that they do not (1) have an adverse environmental impact, or (2) limit the choice of reasonable alternatives being addressed in the draft EIS.

In 2003, DOE completed a pre-decisional working draft *Remediation of the Moab Uranium Mill Tailings, Grand County, Utah, Environmental Impact Statement*, which addresses alternatives for

both surface and ground water remediation. The draft was a collaborative effort involving 12 Federal, state, tribal and local cooperating agencies, in compliance with Council On Environmental Quality (CEQ) regulations. In November 2004, DOE distributed the Final Draft EIS to the public for review.

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. In compliance 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* 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 2004, DOE diligently implemented the controls outlined in the *Moab Project Site Fugitive Dust Control Plan* (DOE 2002b) 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.

Radon

During 2004, 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.

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 2004 indicate that radon concentrations are elevated above this guideline at several on-site locations along the millsite property boundary. Off-site monitoring data also indicate that, although radon levels are elevated at the DOE property boundary, these concentrations attenuate rapidly within a relatively short distance from the millsite boundary. Radon concentrations are observed to be reduced essentially to background levels within a distance of one-half mile of the millsite boundary. During 2004, DOE also conducted radon monitoring at the residential property located closest to the millsite property. This location is known as the maximally exposed individual (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 2004 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 2004 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 2004.

As with the radon data for CY 2004, 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 2004.

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 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 CY 2004. Heavy rains damaged the mill tailings pile soil cover and runoff from the pile resulted in the development of significant erosional features (i.e., rills and gullies) on the side slopes of the tailings pile. Several on-site roads were also damaged and required repairs. Erosional features were repaired by filling the eroded areas with clean fill material and re-grading damaged areas with heavy equipment. 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. All jurisdictional wetlands at the Moab Site were delineated in 2004 according to U.S. Army Corps of Engineers' guidelines (USACE 1987). Approximately 4.7 acres of wetlands were delineated along the shore of the Colorado River, below the tamarisk-dominated bench that borders the site. It was confirmed that no jurisdictional wetlands exist within the boundary of the contaminated area. Formal

delineations were done to aid in preparation of a Floodplain and Wetlands Assessment for Additional Interim Actions to be performed in the floodplain in 2005.

No dredge or fill activities were conducted within jurisdictional wetlands at the Moab Site in 2004. Maintenance was performed on the water intake structure supplying the on-site holding pond, and this involved accessing the Colorado River through a very small portion of the wetlands. This activity was covered by a State of Utah Streambank Alteration Permit and resulted in minor vegetation disturbance.

In 2004, ground water monitoring and injection wells were installed in the floodplain between the tailings pile and the Colorado River. Most of the jurisdictional wetland acreage is located below this section of the floodplain. These activities had no discernable impact, with the exception of reducing the levels of ammonia entering the wetland.

2.1.7 Resource Conservation and Recovery Act

RRM is and will continue to be the primary waste generated at the Moab Site. All waste generated within the boundary of the contaminated area, which consists of uranium mill tailings, contaminated soils, mill debris, and other materials, is considered RRM. RRM in the form of contaminated ground water also exists beneath the Moab Site. UMTRCA (discussed in Section 2.1.2 of this document) and 40 CFR 192 define and regulate RRM. Wastes that are RRM are not subject to the Resource Conservation and Recovery Act (RCRA) regulations.

Non-RRM waste, generated outside the boundary of the contaminated area in the MPS support area, is subject to RCRA regulations. Non-RRM waste that has hazardous components may be subject to the RCRA hazardous waste regulations at 40 CFR 261 and the corresponding State of Utah hazardous waste regulations. Non-RRM waste shall be managed in compliance with applicable federal, state, and local regulations.

2.1.8 Executive Orders

Executive Order (E.O.) 13148, *Greening the Government Through Leadership in Environmental Management*, and E.O. 13101, *Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition*

During 2004, DOE accumulated approximately 55 gallons of used oil generated from onsite vehicles and equipment. Used oil that is not radiologically contaminated may be recycled offsite or used in onsite oil-burning shop heaters (during colder months). Used oil determined to be radiologically contaminated may be burned in onsite shop heaters during colder months. Office paper and aluminum cans were also accumulated for offsite recycling. The DOE also benefited the environment by purchasing electricity generated by a pollution-free source (wind power) for 100% of the site's electrical needs.

2.1.9 Legacy Chemical Management

Disposition of more than 1,400 containers of legacy chemicals and industrial products that were left behind by the former operators of the Moab site began in 2003. At the end of 2003, approximately 900 containers of these materials remained at the site. During 2004,

approximately 343 containers of these remaining materials were shipped offsite for treatment and disposal as non-RRM waste; approximately 516 containers, considered to be relatively non-hazardous RRM, were disposed of in the onsite tailings pile. Approximately 40 containers of the legacy chemicals and industrial products remained safely stored at the Moab site at the end of 2004. Disposition solutions for these remaining materials, which are likely radiologically contaminated, will be further evaluated in 2005.

2.1.10 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, and roofing, were generated from the demolition of millsite structures when Atlas terminated milling operations at the site. It is suspected that ACM is still present in historical buildings and utilities that remain on-site. It is suspected that PCBs are present in fluorescent light ballasts in the warehouse/shop building. The ACM and PCBs at the Moab site are associated with past milling activities. If these materials are radiologically contaminated, they are considered RRM and not subject to TSCA regulation. Vinyl asbestos floor tiles removed from abandoned rooms in the warehouse/shop building that were safely sealed and stored in three 55-gallon drums in the BMPA in 2003 were disposed of in the tailings pile in 2004.

2.1.11 Superfund Amendments and Reauthorization Act, Title III

Executive Order 12856 *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*

DOE reviews the Moab site chemical inventory on an annual basis to determine if Superfund Amendments and Reauthorization Act (SARA) Title III reporting requirements are applicable. During 2004, no extremely hazardous substances or hazardous chemicals were stored at the Moab site in amounts exceeding the threshold planning quantities established in Sections 311 and 312 of SARA Title III, nor were toxic chemicals used at the site in excess of applicable threshold quantities established in Section 313 of SARA Title III. No reportable releases of hazardous substances (as defined by Section 304 of SARA Title III) occurred at the Moab site in 2004. Therefore, the SARA Title III reporting requirements for CY 2004 are as follows:

- Sections 302−303: Planning Notification—not required.
- Section 304: Extremely Hazardous Substance Release Notification—not required.
- Sections 311−312: Material Safety Data Sheets/Chemical Inventory—not required.
- Section 313: Toxic Chemical Release Inventory Reporting—not required.

2.1.12 Endangered Species Act

Section 7 of the Endangered Species Act requires that every federal agency, in consultation with the U.S. Fish and Wildlife Service (USF&WS) ensures that any action it authorizes is not likely to jeopardize the continued existence of any listed species, or modifies or destroys critical habitat. 50 CFR 402 sets forth the regulations that implement the Endangered Species Act.

A Biological Assessment (BA) was completed in 1995 and a Final Biological Opinion was issued by the USF&WS in 1998. Four aquatic and two avian threatened or endangered wildlife species were identified that may occur in the vicinity of the Moab site. The aquatic species are the razorback sucker, Colorado pikeminnow, humpback chub, and bonytail chub. The Colorado River and adjacent floodplain are designated as critical habitat for these species. Of the two avian species identified, the southwest willow flycatcher and the peregrine falcon, the peregrine falcon has since been delisted.

By letter dated February 8, 2001, the USF&WS withdrew its Biological Opinion pending additional formal consultation to evaluate proposed interim actions that would mitigate risks to the endangered fish. Since DOE assumed control of the site, informal consultation with the USF&WS has also been ongoing for various interim actions to ensure protection of threatened and endangered species and critical habitat.

In 2003, a BA was initiated in conjunction with the draft EIS (See Section 2.1.3). The assessment, which was attached as Appendix A-1 to the EIS, evaluates potential impacts to threatened and endangered species for all remediation alternatives being considered. The final BA was transmitted to the USF&WS in August 2004. A Biological Opinion is expected in April 2005.

2.1.13 Executive Order

Executive Order 11988, *Floodplain Management*

DOE regulation 10 CFR 1022 implements the requirements of Executive Order 11988, *Floodplain Management,* for actions that may affect floodplains. Small-scale routine maintenance activities, such as re-grading existing roads, occurred within the 100-year floodplains of the Colorado River and Moab Wash (base floodplain) in 2004.

Also in 2004, ground water monitoring and injection wells were installed in the base floodplain between the tailings pile and the Colorado River. These wells constitute a portion of the ground water treatment system, which utilizes evaporation and fresh water injection to reduce ammonia concentrations in the ground water. Some monitoring wells were installed in 2003; additional monitoring and injection wells were installed in 2004. A Floodplain and Wetlands Assessment was prepared (DOE 2003a), and a State of Utah Streambank Alteration Permit was obtained for this work. Tamarisk was removed from the well field with heavy machinery prior to well construction, and the surface was smoothed and reseeded with native grasses. In addition, a small flooded plot (less than ¼ acre) was constructed within the disturbed area to test the success of native riparian plantings (cottonwoods, willows, and native shrubs and grasses).

Work was begun on a Floodplain and Wetlands Assessment for additional interim actions scheduled to begin in 2005 that will include soils remediation and native habitat restoration in portions of the floodplain located on the northern and eastern portions of the site.

2.1.14 Safe Drinking Water Act

The provisions of the Safe Drinking Water Act (40 CFR 141−143) 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 2004.

2.1.15 National Historic Preservation Act

In 2004, DOE subcontracted professional archaeologists to complete an inventory of cultural resources on its Moab Project site. The results of that inventory were published in two documents: *A Documentation of Two Structures and Their Archaeological Components at the Former Atlas Uranium Mill Site Near Moab, Grand County, Utah* (Christensen 2004) and *A Cultural Resources Inventory of the Department of Energy Moab Project Site Near Moab, Grand County, Utah* (Christensen and Lindsay 2004). DOE determined that a historic log cabin, dating from the 1930s through 1950s, as well as the remaining structures associated with the former uranium mill were eligible for inclusion in the National Register of Historic Places. The remaining mill structures include a general office/warehouse/machine shop building, scale house, uranium ore loadout structure, and water pump station and associated water line. Before disturbing these structures, DOE will consult with the State Historic Preservation Officer to determine how they will be managed.

2.1.16 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 calcium chloride, 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 2004, 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, DOE submitted a *Temporary Change Application* to appropriate water to the State of Utah, Department of Natural Resources, Division of Water Rights in August 2004. Approval for the *Temporary Change Application* was received from the State of Utah, Department of Natural Resources, Division of Water Rights on

August 13, 2004. DOE will renew the *Temporary Change Application* for ongoing Interim Action ground water remediation activities on or before August 12, 2005. During 2004, the Interim Action ground water remediation system pumped and treated (through evaporation) approximately 10,000,000 gallons of contaminated ground water. Through the end of CY 2004, a total of approximately 14,000,000 gallons of contaminated ground water have been extracted and evaporated.

Also during CY 2004, DOE began testing and implementation of the "Initial Action" ground water remediation project. The Initial Action is a non-consumptive water use activity wherein clean river water is used to dilute "hot spots" of ammonia where they are known 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, 2004, DOE submitted a *Temporary Change Application* to appropriate water to the State of Utah, Department of Natural Resources, Division of Water Rights. Approval for the *Temporary Change Application* was received from the State of Utah, Department of Natural Resources, Division of Water Rights on May 25, 2004. The *Temporary Change Application* is approved only in one year increments, and must be renewed annually for as long as the activity is continued. DOE will renew the *Temporary Change Application* for ongoing Initial Action Ground Water remediation activities on or before May 24, 2005.

2.1.17 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. There were no applications of restricted-use pesticides at the Moab site in 2004.

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. Activities examined in 2004 related to environmental compliance included laboratory analyses, radiation protection, document control and records management.

In December 2003, the on-site analytical laboratory was closed and new contracts were established for future laboratory services. Several laboratory service providers were evaluated against DOE, State, and national consensus standards during the process of subcontractor selection. A subcontract to provide analytical services to support DOE's Moab site activities and operations was awarded in January 2004.

2.2.1 Summary of Moab Site Permits

Table 2–1 shows the permits and agreements that were active at the Moab site during 2004.

Table 2–1. Permits/Agreements Active in 2004 at the Moab Site

Permit/Agreement	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	34[a]
Access agreements providing ingress/egress to wells and air monitoring equipment for data collection purposes	Bureau of Land Management, Private Landowners	10
EPA Hazardous Waste Generator Identification Number (UTP 000001244)	EPA	1
Stream Channel Alteration Permit Number 03-01-03SA for diversion/intake maintenance and dredging on the Colorado River in Grand County	State of Utah, Department of Natural Resources, Division of Water Rights	1
Stream Channel Alteration Permit Number 02-01-01SA for intake structure in the Colorado River	State of Utah, Department of Natural Resources, Division of Water Rights	1
Scientific Research and Collecting Permit Number ARCH-2003-SCI-002 to collect background air samples at the Arches National Park	National Park Service	1
Temporary change application to appropriate water for initial action ground water remediation activities (t26538,01-40)	State of Utah, Department of Natural Resources, Division of Water Rights	1
Temporary change application to appropriate water for interim action (t28074,01-40) ground water remediation activities	State of Utah, Department of Natural Resources, Division of Water Rights	1
Ingress and egress to railroad property to conduct subsurface soil sediment sampling and gamma scans	Union Pacific Railroad	1
Stream Channel Alteration Permit Number 03-01-058A for an Interim Action ground water extraction system	State of Utah, Department of Natural Resources, Division of Water Rights	1

[a]This is the number of monitor wells that have been authorized and installed by DOE in 2004. Since taking over the site, DOE has installed 97 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.

End of current text

3.0 Environmental Program Information

Environmental programs at the Moab site include environmental air/radiological monitoring, surface water and ground water monitoring, waste management, and pollution prevention. This section provides descriptions of all program elements 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 2003c), 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*.

To accomplish these objectives, 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 Moab site to the general population center of the City of Moab. Off-site monitoring locations were specifically located downwind of the 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 6 miles north of the Moab site on US-191), and at another location approximately 2 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 2004, the monitoring network was decreased from 27 total monitoring locations to 24 monitoring locations. Three monitoring locations (0114, 0115, and 0116) located on top of the tailings pile were discontinued. As expected, monitoring data from these locations were observed to be consistently elevated and provided no useful information relative to exposure conditions at the site boundary; therefore, continued monitoring at these locations was considered to be unnecessary. Table 3–1 summarizes the types of data collected at the various monitoring locations.

Table 3–1. Summary of On-site, Off-site, and Background 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 Chuck Wagon (Background location 6 miles north of Moab Site.)	Rn, G, RP
0118	Arches National Park Entrance.	Rn, G, RP
0119	Utah Division of Wildlife Resources, Matheson Wetlands	Rn, G, RP
0120	Portal RV Park	Rn, G, RP
0121	City of Moab, Wastewater Treatment Plant	Rn, G, RP
0122	County Recycle Center.	Rn, G, RP
0123	Kane Creek Road (background location 2 miles southwest of millsite.)	Rn, G, RP
0124	Matheson Wetlands	Rn, G
0125	Matheson Wetlands	Rn, G
0126	Private lands south of millsite.	Rn, G
0127	Private lands south of millsite.	Rn, G
MEI	Maximally Exposed Individual-Caretaker Housing at Tex's River Tours	Rn, G

Summary:

Total on-site monitoring stations: 13
Total off-site monitoring stations: 11[a]
Total radon monitoring stations: 24[a]
Total gamma monitoring stations: 24[a]
Total radioparticulate monitoring stations: 9 (two on-site and seven off-site)

[a]Does not include the MEI location.

A meteorological monitoring station is also located at the Moab site. Wind speed and direction, evaporative transpiration potential, solar radiation, relative humidity, temperature, and precipitation are monitored.

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 2004, atmospheric radon was measured at 24 locations (13 on-site locations and 11 off-site locations) 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 91 days (i.e., quarterly exposures). Upon collection, the radon cups are sent to an off-site laboratory for analysis; analytical data are usually returned by the laboratory within 30 to 45 days. These data are compiled along with other environmental air monitoring data, and are published on DOE's website on a quarterly basis.

DOE has determined that a "background" radon concentration that is representative of the Moab region is approximately 0.6 pCi/L. This value was derived from averaging monitoring data collected at the two background monitoring locations for a 1-year period. Averaging the data for an entire year eliminates any bias that may be associated with variations associated with seasonal and/or climatic conditions. On-site, off-site, and background 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 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 caretakers 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.

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.

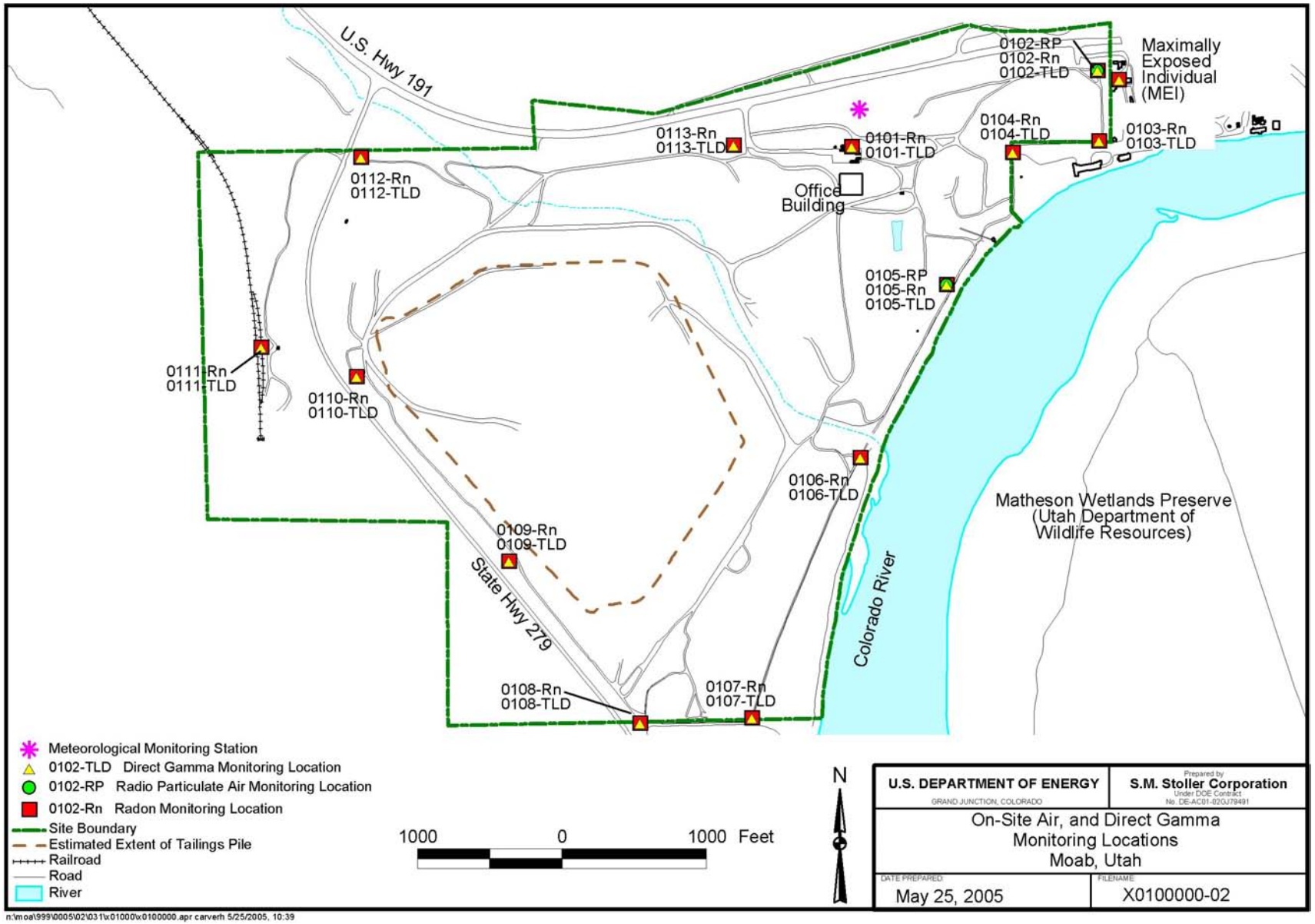

Figure 3–1. On-Site Air and Direct Gamma Monitoring Locations

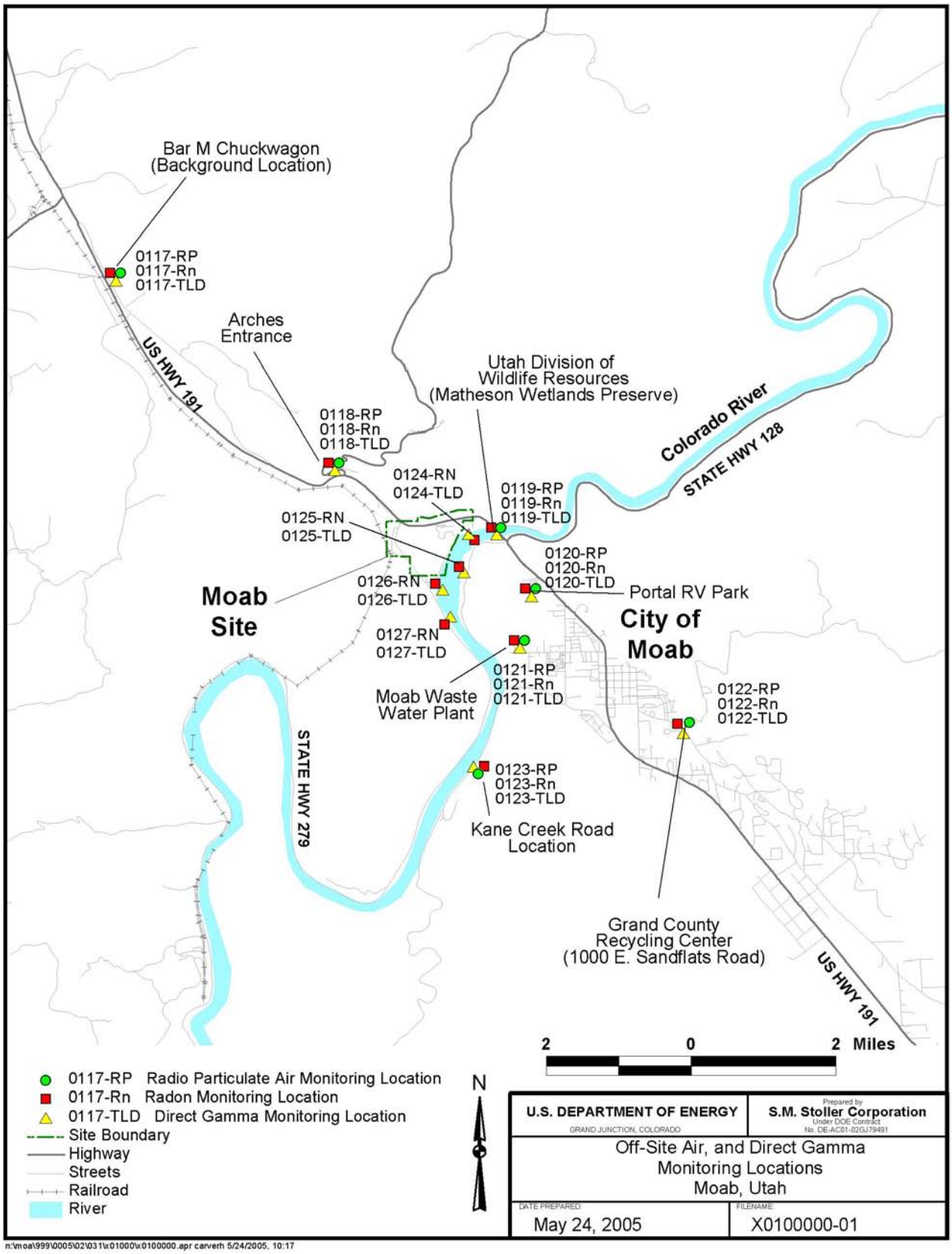

Figure 3–2. Off-Site Air and Direct Gamma Monitoring Locations

Direct gamma radiation monitoring is conducted to assess the potential gamma radiation dose to persons on and near the Moab site. During 2004, direct gamma radiation was measured at 24 locations (13 on-site locations and 11 off-site locations) using a single calcium sulfate dysprosium ($CaSO_4$:Dy) 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 91 days (i.e., quarterly exposures). Upon collection, the TLDs are sent to an off-site laboratory for analysis; analytical data are usually returned by the laboratory within 30 to 45 days. These data are compiled along with other environmental air monitoring data, and are published on DOE's website on a quarterly basis.

DOE has determined that a background gamma radiation value that is representative of the Moab region is approximately 81 millirem per year (mrem/yr). This value was derived from averaging monitoring data collected at the two background monitoring locations for a 1-year period. Averaging the data for an entire year eliminates any bias that may be associated with variations in seasonal and/or climatic conditions. The DOE site standard for direct gamma radiation at the site boundary (and at any off-site location) is 181 mrem/yr. On-site, off-site, and background direct gamma radiation monitoring locations are shown in Figure 3–1 and Figure 3–2.

3.1.3 Airborne Radioparticulates

In 2004, 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 are 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 on DOE's website on a quarterly basis. The analytical data (the annual average values) are then compared with DOE's derived concentration guides (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 R307-3094, *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. 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 site 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 2004 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 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 system based on changes in Colorado River stage. Several calculation sets were completed that analyzed the data collected (DOE 2005a, b, c).

3.2.1 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. 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. Surface water sampling in 2004 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 2004 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 2004 are shown in Figure 3–3.

Table 3–2. Summary of 2004 Surface Water and Ground Water Sampling Events
Moab 2004 Sampling Chronology

Date	Colorado River Flow (daily mean cfs)	Activity	Samples Collected
Interim Action Configuration 1			
Dec 27, 03	2170	System shut down for winter	NA
April 5-8, 04	4970 to 6100	Completed profile baseline sampling	All extraction wells sampled at 3 depths, observation wells at a single depth
May 3-7, 04	4230 to 7170	Developed extraction wells 470 – 479, completed small scale injection test	NA
Week of May 24, 04	6540 to 8080	Started pumping from well field, flow rates set at ~ 1 gpm for each well	NA
June 3, 04	5090	Completed monthly sampling	Extraction wells 470 thru 479, observation wells 480 thru 485, pond inlet sample 547, pond recirculation pump 548, and surface water location 216)
Week of June 7, 04	7890 to 9250	Flows increased to maximum rates (varies for each well)	NA
July 6-7, 04	3080 to 3350	Completed monthly sampling	Same as June 3, 04 sampling effort
Late July 04	2400 to 2800	Installed and developed 4 deep observation wells (557, 558, 560, and 561), 7 shallow observation wells (551 – 556, and 559), and 6 floodplain piezometers (562 thru 567)	NA
August 3-4, 04	2400	Completed monthly sampling	Same as June 3, 04 sampling effort
August 18-19, 04	2240 to 2480	Baseline profile sampling for selected new observation wells and piezometers	Observation wells 557 thru 561 (from two depths). Measured field parameters from piezometers 562 thru 567 (samples collected for analysis only from 563 and 565, remaining never recharged after initial purge).
Sept 1-2, 2004	2180 to 2250	Completed monthly sampling	Same as June 3, 04 sampling effort plus added observation wells 557 thru 561 (installed in August 2004).
Oct 13-14, 04	3360 to 3500	Completed monthly sampling	Same as Sept 1-2, 04 sampling effort, water levels were measured in PZ's 562 thru 565.
Nov 18-19, 04	3300 to 3410	Completed monthly sampling	The 10 CFI extraction wells, 7 Obs wells (403, 407, 483, 484, 557, 559, and 560), 3 PZ's (only 563 thru 565, 562 did not recharge after purge), 3 surface water locations (216, 547, and 548). Also measured surface water field parameters off PZ locations.
Dec 15-16, 04	2790 to 2850	Completed monthly sampling	The 10 CFI extraction wells, 6 Obs wells (403, 407, 483, 557, 559, and 560), 4 PZ's (562 thru 565), 3 surface water locations (216, 547, and 548). Also measured surface water field parameters at sw locations 244 and 245
Dec 23, 04	2480	System Shut Down for Winter	NA

Table 3–2 (continued). Summary of 2004 Surface Water and Ground Water Sampling Events
Moab 2004 Sampling Chronology

Date	Colorado River Flow (daily mean cfs)	Activity	Samples Collected
Interim Action Configuration 2			
Late July 2004	2400 to 2800	10 Extraction wells, 7 shallow observation wells, 2 deep observation wells, and 6 floodplain piezometers (590 thru 595) installed and developed in late July 2004	NA
Aug 5-6, 17-20, 04	2400 to 2800 2180 to 2680	Completed profile baseline sampling	Collected profile baseline data from extraction wells 570 - 579 (sampled from 3 depths), deep observation wells 588 and 589 (sampled from 2 depths), and piezometers 590 thru 595.
Sept 2, 04	2180	Started pumping from extraction wells	NA
Sept 3, 04	2180	Collected discharge baseline samples	Extraction wells 570 - 579, shallow observation well 580. System shut down for weekend.
Sept 8, 04 10:00	3580	Started extraction deep well test	NA
Sept 13, 04 17:00	3100	Shut down extraction deep well test	Extraction wells 571, 573, 575, and 579 (577 pump not working), observation well 580 at end of deep test
Sept 14, 04 10:00	3010	Started extraction shallow well test	Extraction wells 570, 572, 574, 576, and 578 at the beginning of shallow test. Collected SW sample from location 236 for ESL NH_3 analysis
Sept 22, 04 16:00	5780	Shut down extraction shallow well test	Extraction wells 570, 572, 574, 576, and 578 at the end shallow test. Collected SW sample off PZ 592 (subsequently called location 236) for ESL NH_3 analysis. Observation wells 581-587 and piezometers 590-593 were also sampled prior to full scale test startup (data could be used for injection test background also)
Sept 23, 04 12:00	5790	Started extraction full scale test	NA
Oct 5, 04 16:00	4770	Shut down extraction full scale test	Extraction wells 570 - 579 and shallow observation well 580 at end of test
Oct 6, 04	4840	Pre-Injection Test sampling	Measured field parameters (only) of all shallow obs wells prior to test startup,
Oct 6, 04 13:00	4840	Started injection test	Injection water sample (location 549) collected at beginning of test
Oct 14-15, 04	3360 to 3470	Injection test midpoint sampling	Shallow observation wells 401, 402, 580, 582, 583, and 585-587 submitted for analysis, measured field parameters in all other shallow obs wells, injection water sample (549) collected. Also sampled SW location 236 (split analyzed by ESL).
Oct 19, 04	3610	Injection test midpoint sampling, cont.	Piezometers 590, 591, and 593 (592 was dry). Also sampled SW location 236.
Nov 2-3, 04	3620 to 3720	Injection test sampling	Observation wells 401, 402, and 580 thru 589, piezometers 590 thru 593, SW locations 236 and 240, and 549 (injection water sample) collected

Table 3–2 (continued). Summary of 2004 Surface Water and Ground Water Sampling Events
Moab 2004 Sampling Chronology

Date	Colorado River Flow (daily mean cfs)	Activity	Samples Collected
Dec 15, 16, and 17, 04	2780 to 2850	Injection test sampling	8 Observation wells (402, 408, 580 thru 584, and 589), 4 piezometers (590 thru 593), 2 surface waters (236 and 240), and inj water (549). Also measured field params from 5 obs wells (401, 585, 586, 587, and 588)
Baseline Area			
Late July 04	2400 to 2800	Installed and developed 2 deep observation wells (488 and 493), and 6 floodplain piezometers (494 thru 499)	NA
August 18-19, 04	2240 to 2480	Baseline profile sampling for wells and piezometers	Observation wells 557 thru 561 (from two depths). Measured field parameters from piezometers 562 thru 567 (samples collected for analysis only from 563 and 565, remaining never recharged)
Oct 15 and 19, 04	3470 to 3610	Well and piezometer sampling	Wells 405 and 488 (one depth) and well 493 (two depths). PZ 494 was dry and PZ 496 never recharged after purging. Samples were collected from PZ's 495 and 497.
Routine Sampling			
May 3 – 11, 2004	Flows ranged from 4,230 cfs (on May 4, 2004) to 10,100 cfs (on May 11, 2004).	Sampling corresponded to Colorado River flows on the increasing side of the hydrograph.	Millsite wells: 0437, 0439, ATP-2-S, ATP-2-D, and TP-02 Offsite Wells: 0401, 0402, 0403,0404, 0405, 0406, 0407, 0408, 0492, TP-17, TP-18, and TP-19 Surface Water Locations: CR1, CR3, CR5, 0201, 0204, 0217, 0219, 0220, 0221, 0222, 0223, 0224, 0225, 0226, 0227, 0228, 0229, 0230, 0231, 0232, 0233, and 0234
August 9 - 14, 2004	Flows ranged from 2,070 cfs (on August 14, 2004) to 2,590 cfs (on August 9, 2004).	Sampling corresponded to Colorado River flows on the decreasing side of the hydrograph.	Millsite wells: 0437, 0439, ATP-2-S, ATP-2-D, and TP-02 Offsite Wells: 0401, 0402, 0404, 0405, 0406, 0408, 0492, TP-17, TP-18, and TP-19 (note: 0403 and 0407 sampled previous week) Surface Water Locations: CR1, CR3, CR5, 0201, 0217, 0218, 0219, 0220, 0221, 0222, 0224, 0225, 0226, 0227, 0228, 0232, 0233, 0234 and 0235
Oct 26 – 29, and Nov 1 and 2, 2004	Flows ranged from 3,550 cfs (on October 26, 2004) to 4,170 cfs (on October 29, 2004).	Sampling corresponded to Colorado River low flow conditions.	Millsite wells: 0437, 0438, 0439, ATP-2-S, ATP-2-D, and TP-02 Offsite Wells: 0401, 0402, 0403, 0404, 0405, 0406, 0407, 0408, 0492, TP-17, TP-18, and TP-19 Surface Water Locations: CR1, CR3-003, CR5, 0201, 0204-003, 0217-003, 0218-003, 0219-003, 0220-003, 0222-003, 0223-003, 0224-003, 0225-003, 0226-003, 0227-003, 0228-003, 0232-003, 0233-003, 0234-003, 0235-003, and 0236

Figure 3–3. Surface Water and Ground Water Sampling Locations 2004

3.2.2 Ground Water

A summary of the ground water sampling conducted in 2004 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 2004 are shown in Figure 3–3. An evaluation of ground water data collected during 2004 was conducted to serve several purposes: (1) to validate or revise the site conceptual model presented in the SOWP (DOE 2003), (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 2005a, b, and c).

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. 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 (to be conducted in CY 2005).

3.4 Waste Management

During 2004, operations were conducted in accordance with DOE's *Waste Management Policy for the Moab Project Site* (DOE 2002d), which DOE developed to provide guidance for the proper management of wastes generated at the Moab site. DOE plans to rescind the *Waste Management Policy for the Moab Project Site* in early 2005 and replace it with a modified waste management guidance document. In addition, the draft *Waste Management Plan for the Moab Project Site* is scheduled to be finalized in early 2005. These new waste management documents will provide a more flexible approach for managing Moab site waste that is generated within the boundary of the contaminated area (i.e., RRM), particularly waste that may be combined with hazardous or toxic components other than radioactivity.

3.4.1 Residual Radioactive Materials

RRM, defined at 40 CFR 192.01(a), is waste that DOE determines to be radioactive and related to the milling process. RRM generally refers to uranium mill tailings but may also refer to contaminated soil and mill debris. All waste generated within the boundary of the Moab site's contaminated area is considered RRM unless determined otherwise by radiological surveys and designated as non-RRM by DOE. Requirements for the control and cleanup of RRM are provided in 40 CFR 192 Subparts A through C.

Some RRM may be combined with other hazardous or toxic components related to the milling process. As a best management practice, DOE manages RRM that is combined with other hazardous or toxic components in a manner that is protective of human health and the environment. For example, the legacy chemicals and industrial products that were stored in the Moab site warehouse/shop building in 2004 were inventoried, segregated for compatible storage, and secured with secondary containment.

Legacy Chemicals and Industrial Products

The former operators of the Moab millsite left over 1,400 containers of laboratory chemicals and industrial products, many of which had hazardous components. Disposition of these materials began in 2003. Approximately 900 containers of the legacy chemicals and industrial products remained stored at the Moab site at the end of 2003. During March 2004, approximately 343 of the 900 remaining containers were determined to be non-RRM waste and were shipped offsite by ONYX Environmental Services for treatment and disposal. Approximately 516 of the 900 remaining containers were considered to be relatively nonhazardous RRM and were disposed of in the onsite tailings pile in a manner that was protective of the environment. At the end of 2004, approximately 40 containers of legacy chemicals and industrial products, all considered RRM, remained segregated in safe storage at the site. These included unknown materials, certain known materials that have been identified for reuse at the site, and used oil. The unknown materials and used oil will be further evaluated in 2005 to determine the best disposition solutions.

Polychlorinated Biphenyls and Asbestos

No PCB wastes were identified at the Moab site in 2004.

During 2004, three 55-gallon drums of radiologically contaminated vinyl asbestos floor tiles that were safely stored in the BMPA in 2003 were disposed of in the onsite tailings pile. It is suspected that radiologically contaminated ACM in the form of siding, roofing, transite piping, lagging, and insulation is present in the buildings and utilities that remain onsite. DOE will continue to manage any ACM found at the site in a manner that is protective of human health and the environment.

3.4.2 Low-Level Waste

No low-level waste exists 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 that was constructed within the contaminated area approximately 300 feet east of the warehouse/shop building in 2002. It measures approximately 75 ft by 16 ft, is surrounded by a 2-ft-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 identified. Once adequate characterization data are available and a disposal strategy has been identified, 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 outside the contamination 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.

Eleven 55-gallon containers of legacy used oil were stored in the BMPA at the end of 2004. Approximately 18 containers of other materials were stored in the BMPA at the end of 2003, including fire retardant, grease, petroleum-contaminated soils, vinyl asbestos floor tiles and some unknown materials. These materials were either shipped offsite for treatment and disposal as non-RRM waste, recycled onsite, or disposed of onsite as RRM waste.

3.5 Pollution Prevention

Pollution prevention and waste minimization are 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.

3.5.1 Source Reduction

Source reduction at the Moab site is achieved primarily 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 radiologically 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 at the Moab site. Certain materials that must be taken into the contaminated area can be protected from becoming radiologically contaminated. Decontamination is performed if warranted, feasible, and cost-effective.

3.5.2 Reuse and Recycling

DOE activities at the Moab site during 2004 generated approximately 100 pounds of office paper and 50 pounds of aluminum, which were recycled at a local recycling center in Moab. In addition, two computer systems were donated to the Utah Geological Survey. Radiologically contaminated materials are not recycled offsite.

During 2004, DOE accumulated approximately 55 gallons of used oil that was generated by the maintenance of onsite vehicles and equipment. This used oil remained stored in the warehouse/shop building at the end of 2004. The estimated 500 gallons of legacy used oil that was generated by past site operations remained stored in the BMPA during 2004. Arrangements are being made to recycle the used oil in 2005, either by offsite recycling or by burning the oil onsite in oil-burning shop heaters during colder months. Radiologically contaminated used oil is not recycled offsite.

3.5.3 Affirmative Procurement

The Moab Project purchases materials with recycled content whenever practical. These efforts are coordinated under the Contracts and Procurement group at DOE's Grand Junction site as part of DOE's affirmative procurement program. The affirmative procurement program favors the acquisition of environmentally preferable and energy-efficient products and services. 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.

As an example of affirmative procurement, in 2004 the Moab site participated in the Utah Power/PacifiCorp Blue Sky Energy Program to support the use of renewable energy. This Program enabled the DOE to purchase electricity generated by wind turbines that operate within the western United States power grid in an amount equal to 100% of the site's electrical needs. The purchase of pollution-free energy such as wind power helps the DOE to achieve its pollution prevention goals.

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 2004. Ground water monitoring results for 2004 are described in Section 5.0.

4.1 Environmental Air Monitoring

DOE continued its environmental air monitoring activities at the Moab site during CY 2004 as described in the *Moab Project Environmental Air Monitoring Sampling and Analysis Plan* (DOE 2003b). 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 2004.

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 2004, 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 dirt 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 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 2004

Station Number	1st Quarter 2004 (1/07/04 - 04/07/04)		2nd Quarter 2004 (04/07/04 - 07/21/04)		3rd Quarter 2004 (07/21/04 - 10/13/04)		4th Quarter 2004 (10/13/04 – 01/18/05)		2004 Annual Average	
	Radon pCi/L	Gamma mR/91 d (EAA)[5]	Radon pCi/L	Gamma mR/91 d (EAA)	Radon pCi/L	Gamma MR/91 d (EAA)	Radon pCi/L	Gamma MR/91 d (EAA)	Radon pCi/L	Gamma (mR/yr)
On-Site Locations										
MPS- 0101[1]	2.5	77.5(311)	2.6	60.6(242)	2.3	74.6(299)	3.0	68.0(273)	2.6	281
MPS-0102[1]	2.1	27.5(110)	1.4	20.7(83)	1.2	24.0(96)	2.4	26.4(106)	1.8	99
MPS-0103[1]	2.0	28.8(116)	1.6	20.8(83)	1.5	24.7(99)	2.7	26.8(108)	2.0	101
MPS-0104[1]	3.4	34.9(140)	2.3	25.8(103)	3.0	32.2(129)	2.9	32.3(130)	2.9	125
MPS-0105[1]	5.3	53.6(215)	2.9	44.4(178)	2.4	49.0(197)	3.1	52.8(212)	3.4	200
MPS-0106[1]	9.8	43.2(173)	5.7	36.3(145)	6.4	40.9(164)	6.5	45.3(182)	7.1	166
MPS-0107[1]	6.9	57.1(229)	4.3	50.5(202)	4.5	54.2(217)	5.2	61.9(248)	5.2	224
MPS-0108[1]	6.2	135.0(542)	4.8	125.9(504)	5.6	134.1(538)	6.3	139.0(558)	5.7	534
MPS-0109[1]	2.3	56.6(227)	3.5	53.0(212)	2.5	53.8(216)	2.2	60.2(242)	2.6	224
MPS-0110[1]	1.5	84.3(338)	3.3	78.7(315)	2.7	83.0(333)	2.5	93.1(373)	2.5	339
MPS-0111[1]	1.7	70.8(284)	1.5	57.2(229)	1.0	65.0(261)	1.2	66.2(266)	1.4	259
MPS-0112[1]	2.5	45.0(181)	2.8	33.6(134)	2.4	39.4(158)	2.2	39.1(157)	2.5	157
MPS-0113[1]	3.1	101.8(408)	3.4	79.1(316)	NDA damaged	85.5(343)	3.5	90.1(361)	3.3	357
Off-Site Locations										
MPS-0117[2,3]	1.1	25.3(102)	1.2	19.4(78)	0.7	20.5(82)	0.8	26.3(106)	1.0	92
MPS-0118[2]	0.4	28.0(112)	1.0	18.1(72)	0.8	14.8(59)	1.3	22.6(91)	0.9	84
MPS-0119[2]	0.8	26.5(106)	0.7	22.0(88)	1.0	21.1(85)	1.0	28.2(113)	0.9	98
MPS-0120[2]	0.7	20.0(80)	0.6	16.8(67)	0.7	17.7(71)	0.9	25.3(102)	0.7	80
MPS-0121[2]	0.9	23.4(94)	0.3	18.0(72)	0.8	19.1(77)	0.9	24.4(98)	0.7	85
MPS-0122[2]	0.6	20.9(84)	0.6	14.1(56)	0.4	16.9(68)	0.6	20.7(83)	0.6	73
MPS-0123[2,3]	0.4	21.4(86)	0.4	14.3(57)	0.4	17.5(70)	0.6	19.2(77)	0.5	72
MPS-0124[2]	1.5	24.2(97)	1.0	20.6(82)	1.2	19.3(77)	1.7	26.7(107)	1.4	91
MPS-0125[2]	2.5	28.7(115)	2.3	21.4(86)	1.8	23.6(95)	1.9	27.9(112)	2.1	102
MPS-0126[2]	3.1	27.1(109)	1.8	20.5(82)	2.0	22.0(88)	3.5	26.4(106)	2.6	96
MPS-0127[2]	1.6	24.8(100)	0.7	21.0(84)	1.1	19.2(77)	1.3	28.1(113)	1.2	93
MEI[4]	1.5 1.8 (dup)	19.0(76)	0.9 0.8 (dup)	12.2(49)	1.7 1.6 (dup)	14.4(58)	2.5 (2.2 dup)	17.9(72)	1.7 (1.6 dup)	64

[1] On-site monitoring location. Located within DOE property boundary.
[2] Off-site monitoring location.
[3] Designated background monitoring location. Background locations are located at sufficient distances away from the millsite to be free from any affects or influences from potential site contaminants.
[4] The maximally exposed individual (MEI) is the continually occupied residential property that is closest to the DOE property boundary.
[5] "EAA" is the estimated annual average and is calculated by dividing the actual reading by the number of days of the exposure period, then multiplying by 365. Values for annual averages are in units of mrem/yr. For example, the EAA for MPS-0108 is calculated as follows: 135 mR (observed value) / 91 days (exposure period) × 365 days = 542.
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 State Highway 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 State Highway 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 and approach the guideline during the winter and early spring months. This time frame also coincides with the time period when this area is most frequently used by the public for recreational purposes. 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 a remedy for either stabilization or relocation of the contaminated materials has been implemented. 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 2004 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 State Highway 279 and the Colorado River and within one-half mile of the DOE property boundary).

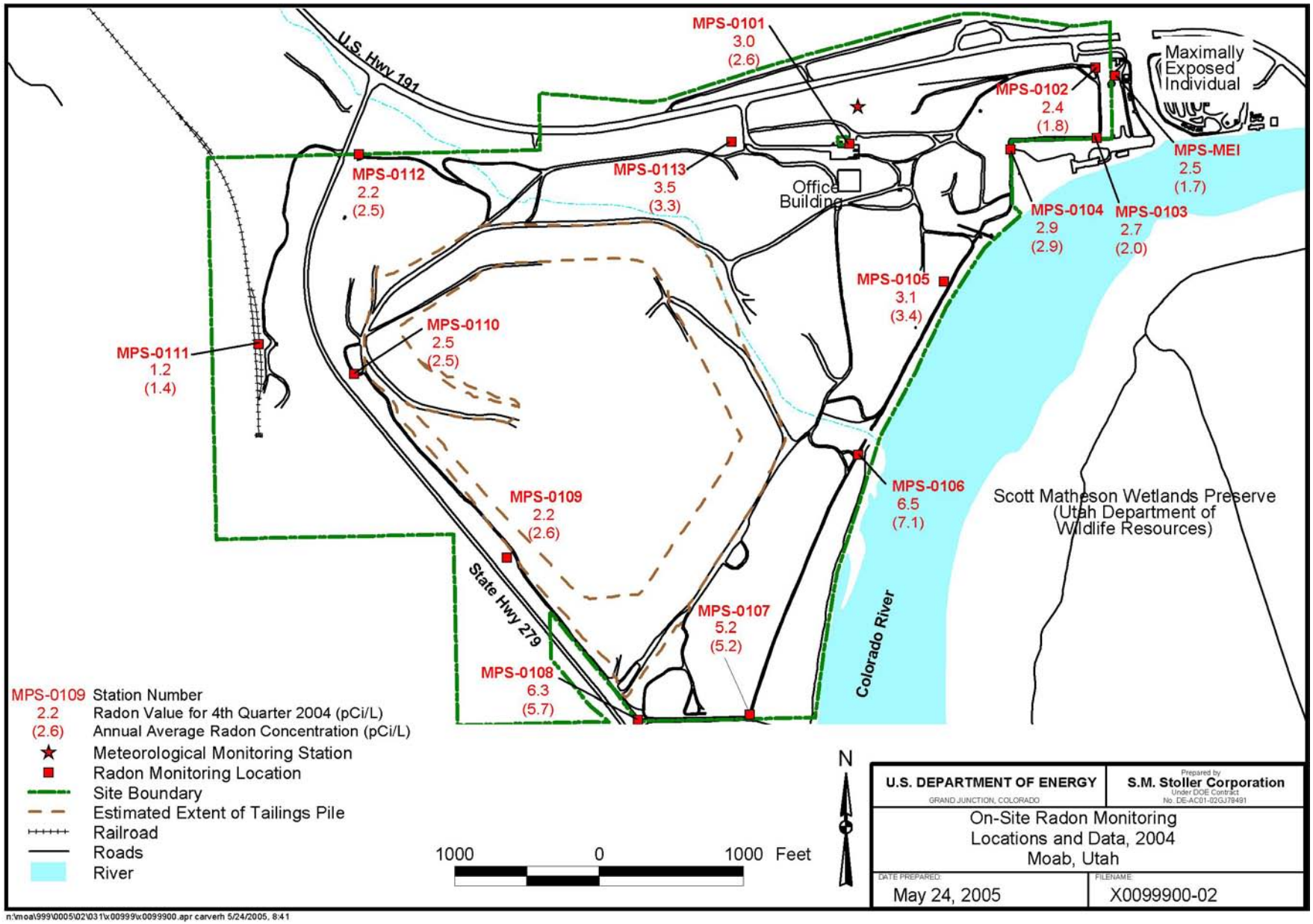

Figure 4–1. On-Site Radon Monitoring Locations and Data, 2004

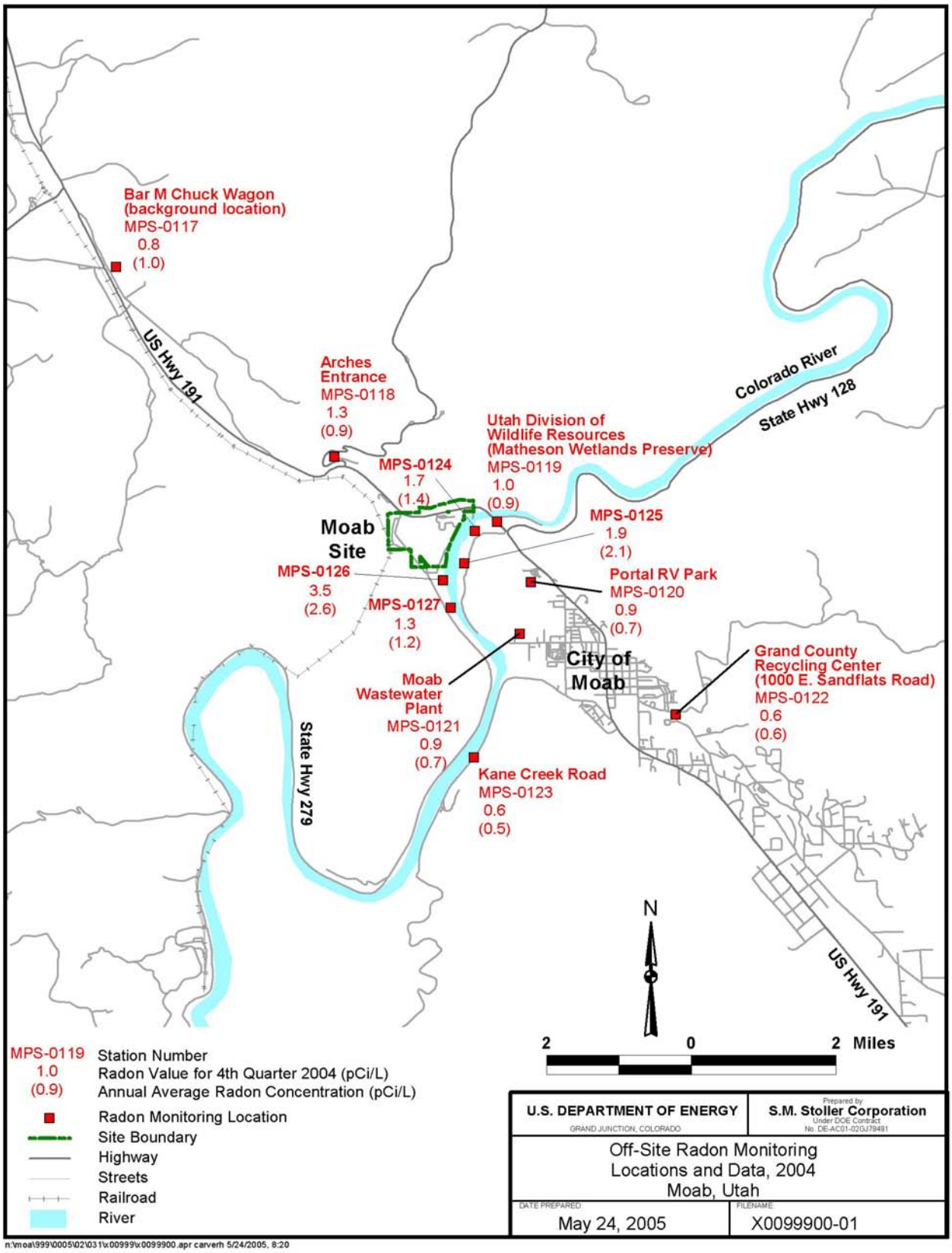

Figure 4–2. Off-Site Radon Monitoring Locations and Data, 2004

The elevated levels of direct gamma radiation observed within and along the Moab site property boundary are expected to decrease once a remedy for either stabilization or relocation of the contaminated materials has been implemented. 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.

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 radium-226, thorium-230, polonium-210, and total uranium.

DOE has published derived concentration guide (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 2004 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).

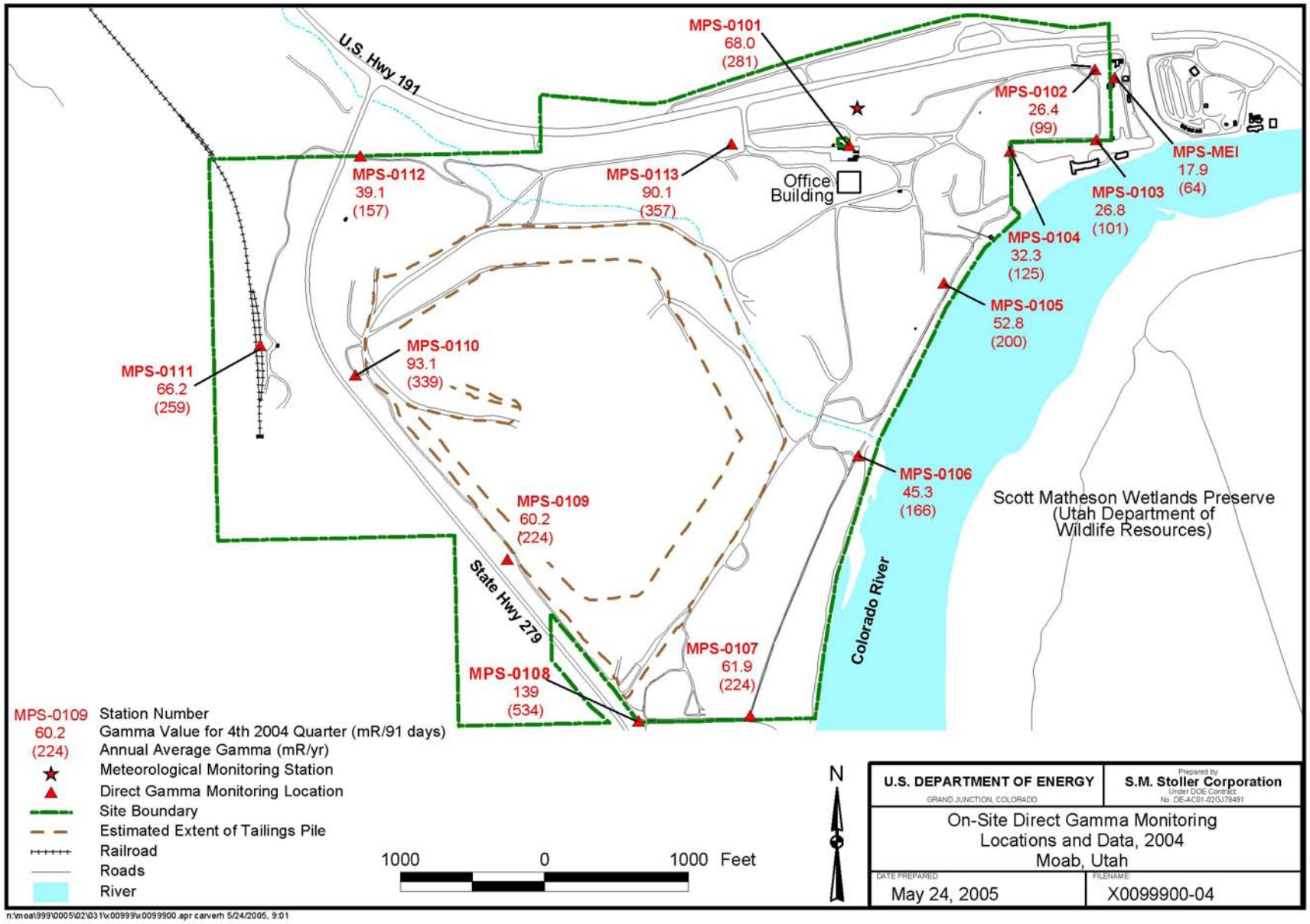

Figure 4–3. On-Site Direct Gamma Monitoring Locations and Data, 2004

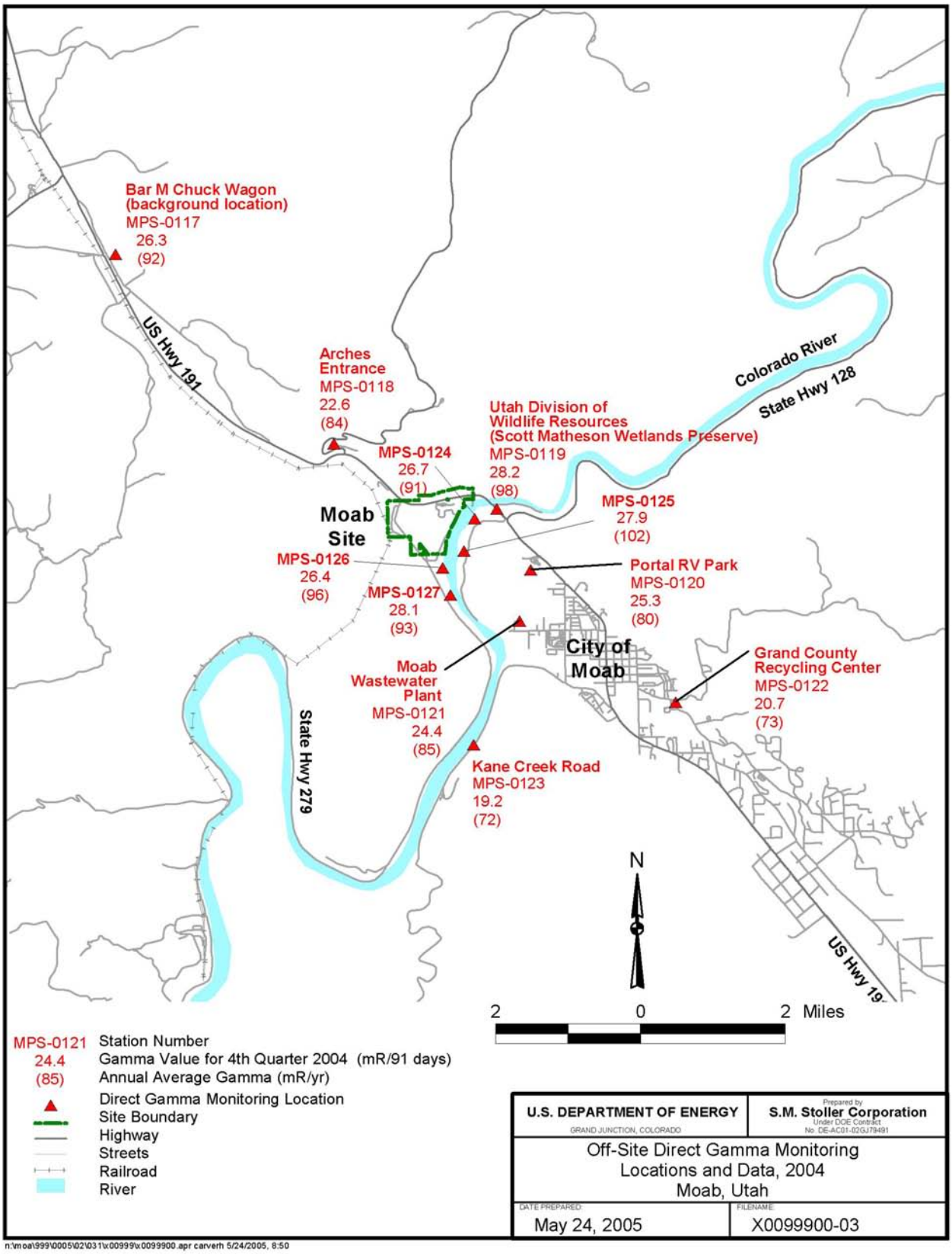

Figure 4–4. Off-Site Direct Gamma Monitoring Locations and Data, 2004

Table 4–3. Summary of Radioparticulate Air Monitoring Data for the Moab Site for Calendar Year 2004

Station Number	Isotope	First Quarter 2004 (µCi/mL)[5]	Second Quarter 2004 (µCi/mL)	Third Quarter 2004 (µCi/mL)	Fourth Quarter 2004 (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

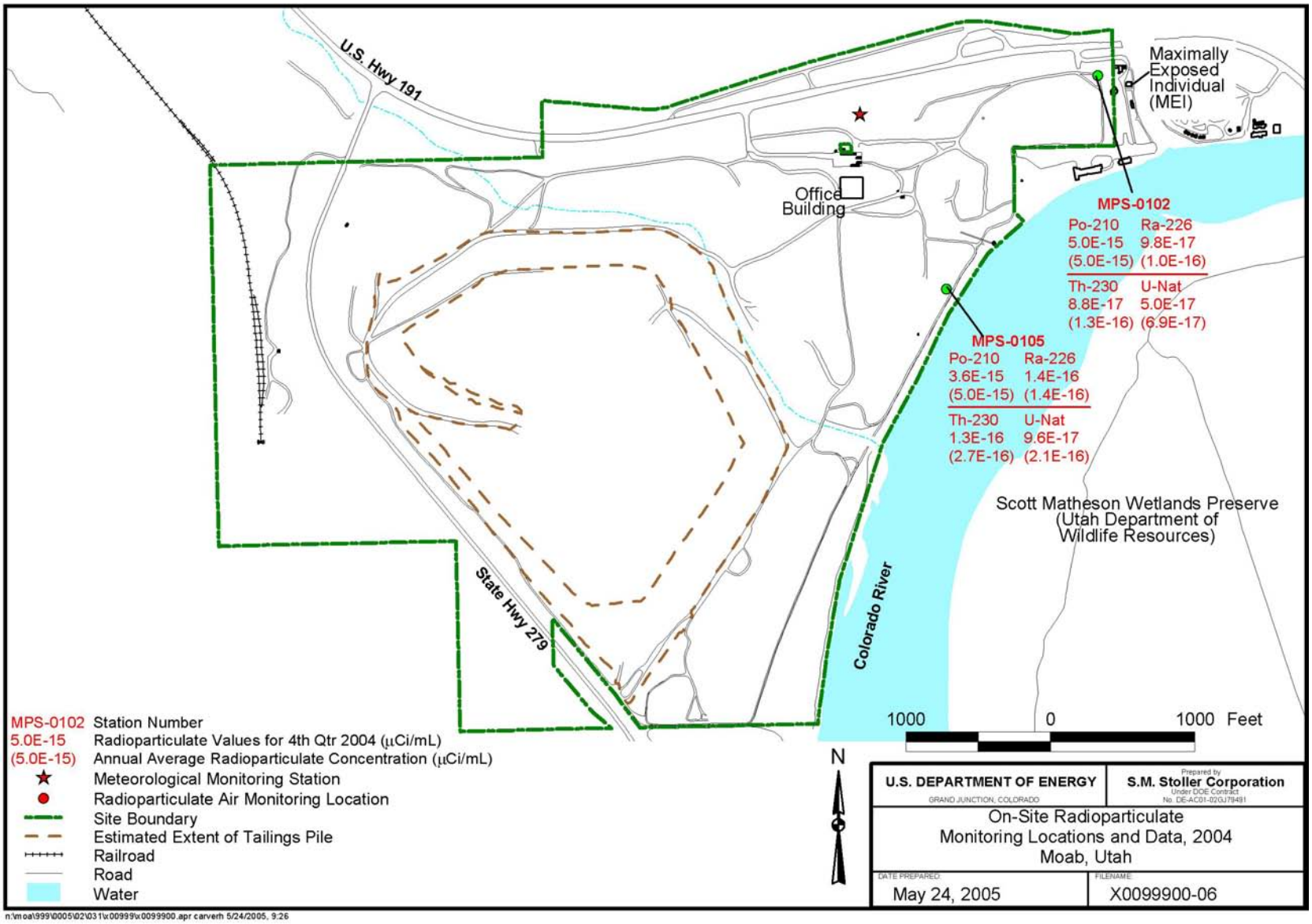

Figure 4–5. On-Site Radioparticulate Monitoring Locations and Data, 2004

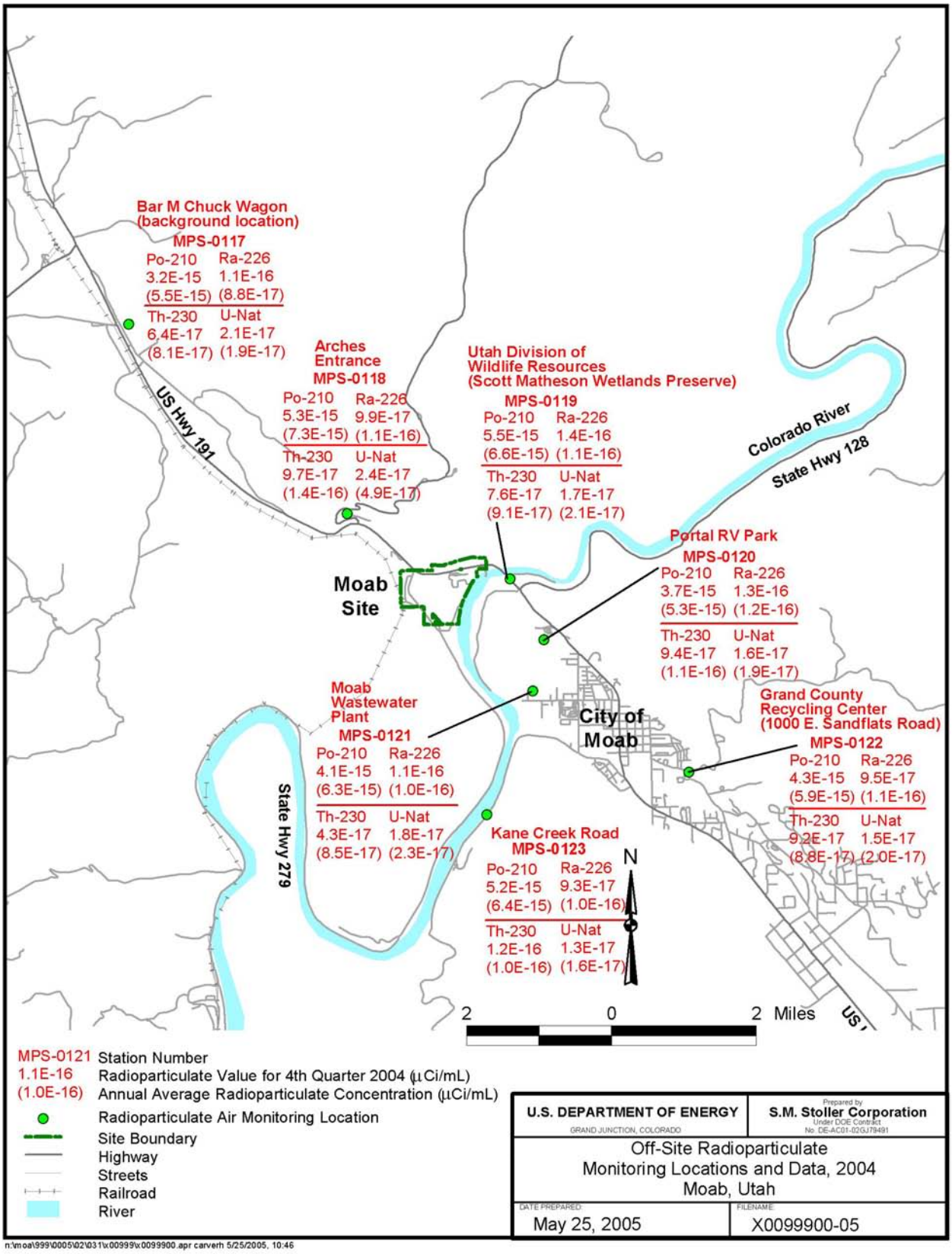

Figure 4–6. Off-Site Radioparticulate Monitoring Locations and Data, 2004

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 2004. The monitoring data collected at MPS-MEI indicate that the annual average gamma radiation dose at this location was 64 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 on- 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 2004 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 2004 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 ft 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 2004 meteorological data for temperature, wind speed, and precipitation.

Table 4–4. Meteorological Data Summary for the Moab Site for Calendar Year 2004

Month[1]	Temperature (F°)				Wind Speed (mph)		Precipitation Totals (inches/month)
	Avg High	Avg Low	Max Temp	Min Temp	Avg	Peak Gust	
January	36.7	19.1	49.4	11.9	3.2	31.0	0.08
February	45.9	26.5	58.8	12.1	3.6	33.5	0.66
March	68.5	38.8	86.7	28.4	3.7	41.4	0.08
April	70.7	46.2	83.7	35.3	4.8	42.1	1.53
May	81.2	53.9	90.4	39.8.	4.9	45.0	0.52
June	92.5	59.7	101.2	45.1	4.3	43.9	0.0[2]
July	97.5	66.9	106.7	55.5	4.3	39.6	0.0[2]
August	94.9	64.4	103.4	51.6	4.4	40.3	0.0[2]
September	86.1	55.4	98.4	41.9	4.0	43.2	0.0[2]
October	72.2	48.3	84.6	34.1	4.0	37.8	0.0[2]
November	54.7	34.1	65.9	27.0	3.1	30.7	0.0[2]
December	45.7	24.2	57.4	12.8	3.0	38.2	0.0[2]

[1] Meteorological monitoring at the Moab site began in July 2002.

[2] No data available due to malfunctioning rain gauge.

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. Surface-water chemistry data collected in 2004 are presented in Appendix A.

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 SOWP (DOE 2003) indicate that fluids from the pile continue to contaminate ground water beneath the site, which, in turn, can effect 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 in 2004 are included in Table 5–1. Complete results are presented in Appendix A.

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 2004 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 2004 Maximum Concentrations in Colorado River[b]

Constituent	State Standard[a,b]	2004 Maximum[c] in River
Ammonia Total as N[d]	2-4 mg/L	320
Chloride	na[e]	2,500
Sulfate	na	8,500
Total dissolved solids	1,200 mg/L	17,000
Uranium	na	2.7

[a]mg/L = milligrams per liter
[b]State of Utah Water Quality Standards for the Colorado River and its tributaries, Utah Administrative Code 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; 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 ambient water quality criteria were exceeded during 2004. Approximately 30 percent of all surface water samples analyzed in 2004 exceeded acute or chronic ammonia criteria. Most areas deemed to be suitable fish habitat exceeded the criteria. Results of habitat and compliance sampling are presented in Table 5–3. CY 2004 surface water sample locations are shown on Figure 3–3. An examination of these data indicate that while habitat samples routinely exceed ammonia criteria, samples collected from the river channel only rarely do so. Therefore, it appears that effects of site-related contamination are confined to shallow, slow-moving water adjacent to the site. This is the area in which active groundwater remediation is ongoing.

*Table 5–2. Ammonia Exceedence Table—Surface Water**

Location	Date	Conc. (as N) (mg/L)	Obs/ Std	Description
0229/0236	5/4/04	320	18.49-A 185-C	6-7" depth; v. slight flow to river; almost stagnant; seine location (habitat)
0230	5/4/04	2.8	3.24-C	4" depth; v. slight flow in channel; seine location (habitat)
0223-001	5/5/04	22	4.15-A 19.98-C	6" depth; 20' from bank; low flow; side channel 40-50' across; seine location (habitat)
0224-001	5/5/04	30	5.04-A 32.99-C	6" depth; 9' from bank; low flow; side channel
0225-001	5/5/04	4.3	4.82-C	5-6"; 5' from bank; medium flow; side channel with several shallow gravel bars in area
0216	6/3/04	4.2	4.09-C	N/A
0216	7/6/04	13	2.55-A 22.28-C	N/A
0220-002	8/11/04	0.72	1.14-C	Off base of bank in main channel; 6-12" depth; 5-10' from shore; med. Flow
0233-002	8/11/04	1.1	2.61-C	6-18" depth; side channel 10' from shoreline; med. Flow
0235	8/11/04	1.5	5.21-C	12" depth; 120' from base of bank; backwater open to main channel downstream, closed upstream (habitat); low flow
CR3-002	8/11/04	1.3	3.38-C	Main channel 1' from shoreline; 6" depth; med. Flow
0226-002	8/12/04	1.3	2.59-C	8-12" depth; side channel 5-10' from shoreline; low flow
0227-002	8/12/04	0.49	1.14-C	Main channel, 5' from shore; low flow; unknown depth
0236	9/14/04	0.26	1.38-C	Stagnant pool 18' off bank; 4" depth; no flow
0236	11/1/04	170	22.23-A 78.82-C	Backwater 8-10" deep; calm flow, fairly clear; dead minnows observed
0236	11/3/04	310	28.96-A 108.89-C	6" deep; backwater; low flow
0240	11/3/04	320	23.32-A 94.04-C	4" deep; backwater; little or no flow

Table 5–3. Results of Habitat and In-Stream Compliance Sampling

Location	Date Sampled	Ammonia-N (mg/L)	Chloride (mg/L)	Specific Conductivity (µmhos/cm)	Sulfate (mg/L)	TDS (mg/L)	Uranium (mg/L)
Habitat Samples							
0217	5/7/2004	0.1U	62	818	180	500	0.0031
0217	8/12/2004	0.1U	95	1,467	360	940	0.0061
0229	5/4/2004	320[a]	1,400	4,860	5,800	10,000	1.8
0230	5/4/2004	2.8[a]	84	1,059	250	670	0.023
0231-001	5/4/2004	0.47	70	925	200	580	0.015
0236	11/1/2004	170[a]	2000	12,306	6300	10,000	1.7
0236	11/3/2004	310[a]	2300	19,325	8100	17,000	2.6
0240	11/3/2004	320[a]	2500	19,951	8500	17,000	2.7
Compliance Samples							
0201	5/3/2004	0.1U	74	1,000	190	550	0.0034
0201	8/9/2004	0.1U	99	1,322	360	930	0.0064
0225-002	8/11/2004	0.11	93	1,302	350	920	0.0087
0232-001	5/5/2004	0.1	68	889	190	550	0.0044
0232-002	8/12/2004	0.33	150	1,606	380	1,100	0.01
0232-003	10/27/2004	0.1U	100	1264	320	820	0.0072
0233-001	5/5/2004	0.32	69	893	200	560	0.0055
0233-002	8/11/2004	1.1[a]	150	1,630	370	1,100	0.012
0233-003	10/28/2004	0.1U	100	1257	340	780	0.0078
0234-001	5/5/2004	0.22	68	908	200	550	0.0064
0234-002	8/12/2004	0.39	95	1,397	370	940	0.013
0234-003	11/2/2004	0.1	89	1205	320	770	0.008
CR5	5/3/2004	0.1U	80	873	180	550	0.0038
CR5	8/9/2004	0.1	100	1,323	350	920	0.007
CR5	10/27/2004	0.1U	100	1245	320	810	0.0067

[a]Exceeds ambient water quality for ammonia (see Table 5–2)

End of current text

6.0 Quality Assurance

A QA Program providing a structured approach for the application of QA principles to work performed on the Moab 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 2004) 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 Project is conducted under the QAPP.

6.1 Sampling

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

- *Environmental Compliance Plan for the Moab Project Site*
- *Moab Project Surface and Ground Water Monitoring Plan for the Moab, Utah Site*
- *Moab Project Environmental Air Monitoring and Sampling and Analysis Plan*

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.

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.

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.

End of current text

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Appendix A

2004 Ammonia Sampling Results for Surface Water

Surface Locations	Date	PH	Temp (°C)	Tot NH_3-N (mg/L)	Federal Acute[1]	Federal Chronic[1]	Obs/std Acute	Obs/std Chronic	River Stage (cfs)
0216	4/8/2004	8.2	14.9	0.24	5.7	1.7	0.04	0.14	5,990
0201	5/3/2004	8.32	19.04	0.1	4.5	1.0	0.02	0.10	4,270
CR1	5/3/2004	8.32	18.63	0.1	4.5	1.1	0.02	0.09	4,270
CR5	5/3/2004	8.32	19.15	0.1	4.5	1.0	0.02	0.10	4,270
0226-001	5/4/2004	8.36	19.4	0.21	4.2	1.0	0.05	0.22	4,190
0227-001	5/4/2004	8.37	20.26	0.18	4.1	0.9	0.04	0.20	4,190
0228-001	5/4/2004	8.45	17.67	0.1	3.5	0.9	0.03	0.11	4,190
0229/0236	5/4/2004	7.59	27.53	320	17.3	1.7	18.49	185.04	4,190
0230	5/4/2004	8.31	22.5	2.8	4.6	0.9	0.61	3.24	4,190
0231-001	5/4/2004	8.34	20.8	0.47	4.4	0.9	0.11	0.52	4,190
0223-001	5/5/2004	8.24	20.5	22	5.3	1.1	4.15	19.98	4,660
0224-001	5/5/2004	8.18	25.23	30	6.0	0.9	5.04	32.99	4,660
0225-001	5/5/2004	8.31	21.97	4.3	4.6	0.9	0.93	4.82	4,660
0232-001	5/5/2004	8.43	20.39	0.1	3.7	0.8	0.03	0.13	4,660
0233	5/5/2004	8.41	20.16	0.32	3.8	0.8	0.08	0.38	4,660
0234-001	5/5/2004	8.51	19.76	0.22	3.1	0.7	0.07	0.31	4,660
CR3	5/5/2004	8.41	18.91	0.33	3.8	0.9	0.09	0.37	4,660
0219-001	5/6/2004	8.42	19.59	0.1	3.7	0.8	0.03	0.12	5,650
0220-001	5/6/2004	8.41	20.67	0.1	3.8	0.8	0.03	0.12	5,650
0221-001	5/6/2004	8.47	20.14	0.38	3.4	0.7	0.11	0.51	5,650
0222-001	5/6/2004	8.45	19.76	0.34	3.5	0.8	0.10	0.43	5,650
0217	5/7/2004	8.33	19.04	0.1	4.4	1.0	0.02	0.10	6,940
0204-001	5/11/2004	7.85	16.34	0.1	11.1	2.6	0.01	0.04	9,790
0216	6/3/2004	7.99	28	4.2	8.6	1.0	0.49	4.09	5,160
0216	7/6/2004	8.26	30.4	13	5.1	0.6	2.55	22.28	3,330
0201	8/9/2004	8.16	26.7	0.1	6.2	0.9	0.02	0.12	2,580
CR1	8/9/2004	8.19	27.9	0.1	5.8	0.8	0.02	0.13	2,580
CR5	8/9/2004	8.19	26.6	0.1	5.8	0.8	0.02	0.12	2,580
0218	8/10/2004	8.28	27.4	0.1	4.9	0.7	0.02	0.15	2,430
0219-002	8/11/2004	8.26	24.87	0.1	5.1	0.8	0.02	0.12	2,270
0220-002	8/11/2004	8.35	26.49	0.72	4.3	0.6	0.17	1.14	2,270
0221-002	8/11/2004	8.36	26.79	0.4	4.2	0.6	0.10	0.65	2,270
0222-002	8/11/2004	8.23	28.64	0.39	5.4	0.7	0.07	0.57	2,270
0224-002	8/11/2004	8.36	28.68	0.17	4.2	0.5	0.04	0.31	2,270
0225-002	8/11/2004	8.45	30.31	0.11	3.5	0.4	0.03	0.26	2,270
0233	8/11/2004	8.55	27.5	1.1	2.9	0.4	0.38	2.61	2,270
0235	8/11/2004	8.49	36.23	1.5	3.3	0.3	0.46	5.21	2,270
CR3-002	8/11/2004	8.59	27.9	1.3	2.7	0.4	0.48	3.38	2,270
0217	8/12/2004	8.31	27.45	0.1	4.6	0.6	0.02	0.16	2,110
0226-002	8/12/2004	8.47	26.89	1.3	3.4	0.5	0.38	2.59	2,110
0227-002	8/12/2004	8.49	28.97	0.49	3.3	0.4	0.15	1.14	2,110
0228-002	8/12/2004	8.45	28.1	0.23	3.5	0.5	0.07	0.47	2,110
0232-002	8/12/2004	8.4	28.32	0.33	3.9	0.5	0.08	0.63	2,110

Surface Locations	Date	PH	Temp (°C)	Tot NH_3-N (mg/L)	Federal Acute[1]	Federal Chronic[1]	Obs/std Acute	Obs/std Chronic	River Stage (cfs)
0234-002	8/12/2004	8.29	25.43	0.39	4.8	0.7	0.08	0.52	2,110
0236	9/14/2004	9.15	23.48	0.26	1.1	0.2	0.25	1.38	2,990
0236	9/22/2004	8.22	16.67	0.01	5.5	1.4	0.00	0.01	5,760
0201	10/26/2004	8.46	10.07	0.1	3.5	1.1	0.03	0.09	3530
0204-003	10/26/2004	8.43	10.5	0.1	3.7	1.1	0.03	0.09	3530
0217	11/2/2004	8.46	7.76	0.1	3.5	1.1	0.03	0.09	3700
0218-003	10/26/2004	8.39	11.1	0.1	4.0	1.2	0.03	0.08	3530
0219-003	11/2/2004	8.39	6.47	0.1	4.0	1.2	0.03	0.08	3700
0220-003	11/2/2004	8.48	7.16	0.1	3.3	1.0	0.03	0.10	3700
0222-003	11/1/2004	8.38	7.74	0.1	4.0	1.2	0.02	0.08	3810
0223-003	11/2/2004	8.51	8.51	0.1	3.1	1.0	0.03	0.10	3700
0224-003	11/1/2004	8.41	8.71	0.1	3.8	1.2	0.03	0.08	3810
0225-003	11/2/2004	8.51	8.84	0.72	3.1	1.0	0.23	0.74	3700
0226-003	10/27/2004	8.56	10.8	0.1	2.9	0.9	0.03	0.11	3620
0227-003	10/27/2004	8.54	10.69	0.1	3.0	0.9	0.03	0.11	3620
0228-003	10/27/2004	8.45	10.66	0.1	3.5	1.1	0.03	0.09	3620
0232-003	10/27/2004	8.51	11.04	0.1	3.1	1.0	0.03	0.10	3620
0233-003	10/28/2004	8.35	9.71	0.1	4.3	1.3	0.02	0.08	3540
0234-003	11/2/2004	8.5	7.62	0.1	3.2	1.0	0.03	0.10	3700
0235-003	11/2/2004	8.49	8.15	0.1	3.3	1.0	0.03	0.10	3700
0236	11/1/2004	8.05	14.74	170	7.6	2.2	22.23	78.82	3810
0236	11/3/2004	7.87	12.63	310	10.7	2.8	28.96	108.89	3600
0240	11/3/2004	7.73	9.99	320	13.7	3.4	23.32	94.04	3600
CR1	10/26/2004	8.44	9.79	0.1	3.6	1.1	0.03	0.09	3530
CR3-003	10/28/2004	8.38	9.8	0.1	4.0	1.2	0.02	0.08	3540
CR5	10/27/2004	8.57	10.57	0.1	2.8	0.9	0.04	0.11	3620

[1]Criteria for salmonids absent; early life stages present
[2]USGS data for Cisco gauging station—http://waterdata.usgs.gov/nwis