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Moab Project

Annual Site Environmental Report for Calendar Year 2003

September 2004

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U.S. Department of Energy
Moab Site

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

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Acronyms

ACM	asbestos-containing-material
BA	Biological Assessment
BMPA	best management practice area
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
DCG	derived concentration guide
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
ft	feet
GJO	Grand Junction Office
IAD	Interim Action Determination
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
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
TDS	total dissolved solids
TLD	thermoluminscent dosimeter
TSCA	Toxic Substances Control Act
U.A.C.	Utah Administrative Code
UMTRCA	Uranium Mill Tailings Radiation Control Act
UPDES	Utah Pollutant Discharge Elimination System
U.S.C.	United States Code
USF&WS	U.S. Fish and Wildlife Service

Chemical Abbreviations

Ag	Silver
Al	Aluminum
As	Arsenic
B	Boron
Ba	Barium
Ca	Calcium
Cd	Cadmium
Cl^-	Chloride
Co	Cobalt
Cr	Chromium
Cu	Copper
F^-	Fluoride
Fe	Iron
Hg	Mercury
K	Potassium
Li	Lithium
Mg	Magnesium
Mn	Manganese
Mo	Molybdenum
N	Nitrogen
Na	Sodium
Ni	Nickel
NH_3	Ammonia
No	Nobelium
NO_3	Nitrate
PCB	Polychlorinated biphenyl
Pb	Lead
Po	Polonium
Ra	Radium
Rn	Radon
Sb	Antimony
Se	Selenium
SO_4	Sulfate
Sr	Strontium
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
Th	Thorium
Tl	Thallium
U	Uranium
V	Vanadium
VOC	Volatile Organic Compound
Zn	Zinc

Executive Summary

This annual Site Environmental Report presents information pertaining to environmental activities conducted during calendar year 2003 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 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 calendar year 2003.

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 2003 included site management and public affairs; site security, stabilization, and maintenance actions; site assessment and characterization; waste management and minimization; initiation 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 2003 were conducted in compliance with applicable federal, state, and local regulations and requirements, and with applicable DOE orders.

During calendar year 2003, 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 2003

Significant highlights, accomplishments, and activities conducted by DOE at the Moab site during 2003 are as follows:

Site Management and Public Affairs

- Continued to sponsor stakeholder/public involvement meetings.
- Maintained the Moab Project web page.
- In accordance with the National Environmental Policy Act (NEPA) process for evaluating various remedial action and disposal site alternatives and their associated environmental impacts, DOE continued its preparation of the draft Environmental Impact Statement (EIS) for remediation of contaminants associated with the former millsite, vicinity properties, and ground water.

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.

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.
- Made preparations to implement the "Initial Action" ground water remediation project. The purpose of this 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. However, due to sustained low river flows, the system was not deployed during 2003.
- 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 2003, the Interim Action ground water remediation system pumped and treated (through evaporation) approximately 4,000,000 gallons of contaminated ground water. Treatment of this volume of contaminated ground water resulted in the removal of approximately 12,000 Kg (26,455 pounds) of total ammonia and 45 Kg (99 pounds) of uranium during 2003.

Waste Management and Minimization

- DOE shipped for disposal approximately 561 containers totaling 2,674 kilograms (5,896 pounds) of non-RRM legacy chemicals (i.e., chemicals left on site that were associated with operation of the former on-site analytical chemistry and assay laboratories).
- Recycled 100 pounds of paper and 50 pounds of aluminum.
- Accumulated approximately 55 gallons of used oil for recycling or reuse.
- Accumulated 15 fluorescent light tubes for recycling.
- 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 safely stored miscellaneous liquid and solid wastes (e.g., used oils, lubricants, fire retardants, hydraulic fluids, equipment rinsates, soil, asbestos tiles, grease, etc.) in the BMPA. A total of 29 containers with volumes ranging from 5 to 55 gallons remained in protected storage inside the BMPA at the end of CY 2003.

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.
- Continued informal 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.
- 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.

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 2003, 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 which 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 Grand Junction office website.
- 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 various ground water monitoring and field investigations throughout 2003.
- Prepared technical reports associated with characterization of ground water conditions and contaminants (e.g., calculation sets, sensitivity analyses, data validation packages).
- Installed 17 ground water monitor wells during 2003.

Compliance Summary for Calendar Year 2003

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.

Limited ground water and surface water samples were collected in 2003. However, existing data were used to complete the Site Observational Work Plan (SOWP) (DOE 2003d) for the Moab Site, which included ground water modeling. An interim action ground water pump and treat system was also operated on a limited basis. Those results are presented in a performance report for the system (DOE 2004).

Surface water sampling confirmed elevated ammonia concentrations at one location adjacent to the site, as well as at the sewage treatment plant outfall across the river from the site.

Ground water sampling focused on the Matheson Wetlands Preserve across the river from the site. Sampling confirmed that the brine layer known to be at depth beneath the Moab Site occurs at shallower levels in the Matheson Preserve. Sulfate, chloride, and low levels of ammonia were detected in wells at the preserve.

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 2003, 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 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 2003. 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 2003 were below the 10 mrem/yr emissions limit.

In summary, environmental data collected for direct gamma radiation and radioparticulate air emissions during 2003 were below the public dose limits applicable to the Moab site at all off-site monitoring locations.

Waste Management/Minimization

During 2003, DOE continued to manage legacy wastes and began the process of removing these wastes from the site to better protect the public, site workers, and the environment.

Legacy wastes managed at the Moab site in 2003 included laboratory chemicals, industrial products, used petroleum products, fire retardants, and asbestos. Many of these legacy wastes were considered to be radiologically contaminated and remained stored within the boundaries of the Moab site's contaminated area at the end of 2003. The laboratory chemicals and industrial products were better isolated within the site's warehouse/shop building; the used petroleum products, fire retardants, and asbestos were placed in secured, containerized storage within the BMPA. A significant portion of the laboratory chemicals and industrial products (those that were determined to be free of any radiological contamination) were shipped for off-site disposal by a hazardous waste contractor in February 2003. Certain wastes such as used oil, fluorescent light tubes, paper products, aluminum cans, etc., were collected and recycled at a local recycling center.

Distribution of this Document

This document may be viewed in its entirety at the DOE Grand Junction office website at http://gj.em.doe.gov/Moab. Hard copies may be obtained by contacting Mr. Don Metzler, DOE 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 DOE Office of Environmental Management via their toll-free phone number (1-800-399-5618). 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 439-acre Moab Project site (Moab site) is located about 3 miles northwest of the city of Moab in Grand County, Utah, 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 southeastern boundary of the site. U.S. Highway 191 (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 (Figure 1−1).

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. 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. Surveys indicate that soils outside the pile also contain radioactive contaminants at concentrations above EPA standards. Figure 1−2 provides a map of the basic Moab site features (e.g., site boundary, buildings, tailings pile, roads, etc.).

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 the Colorado River adjacent to the site also 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 uranium.

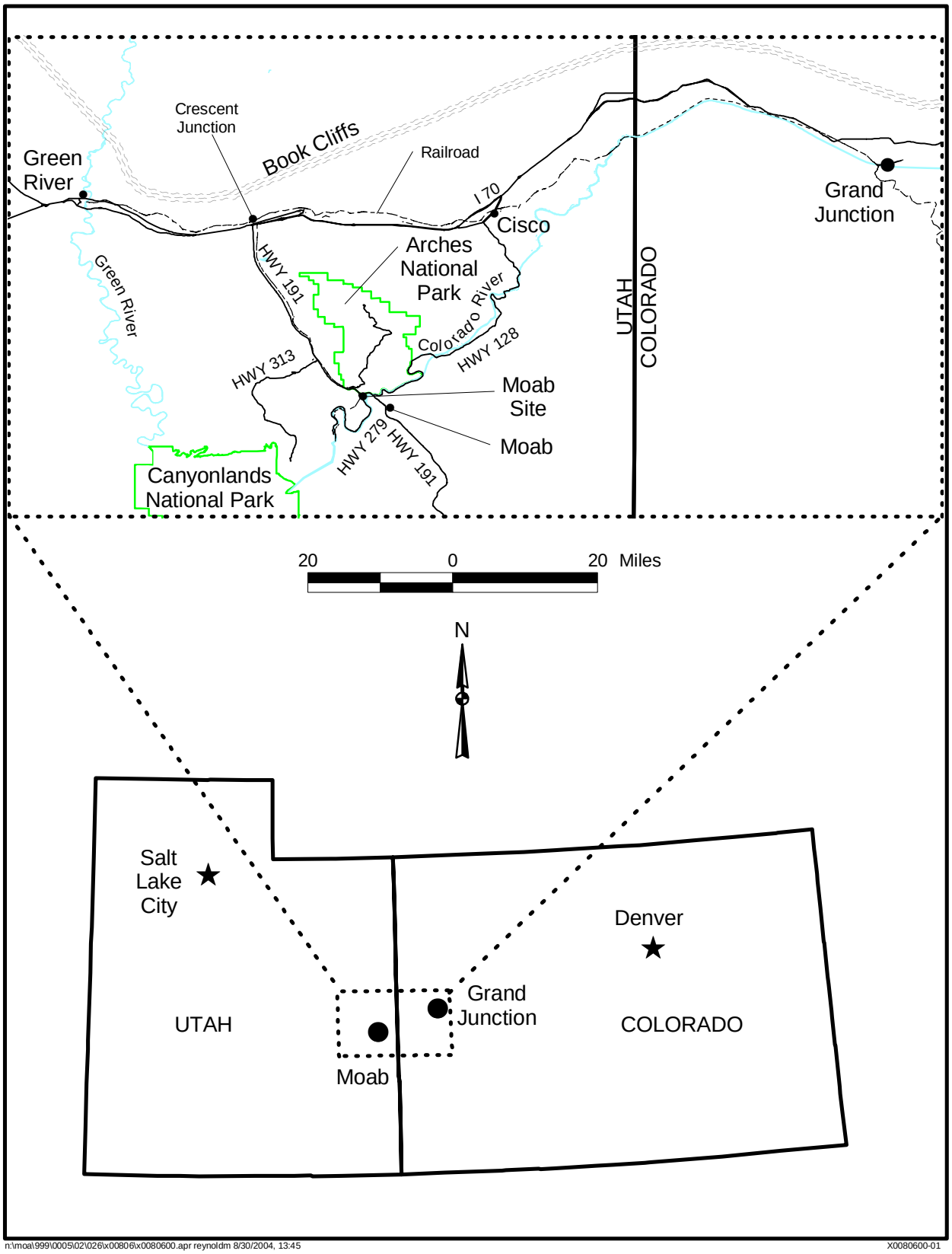

Figure 1–1. Location of the Moab Site

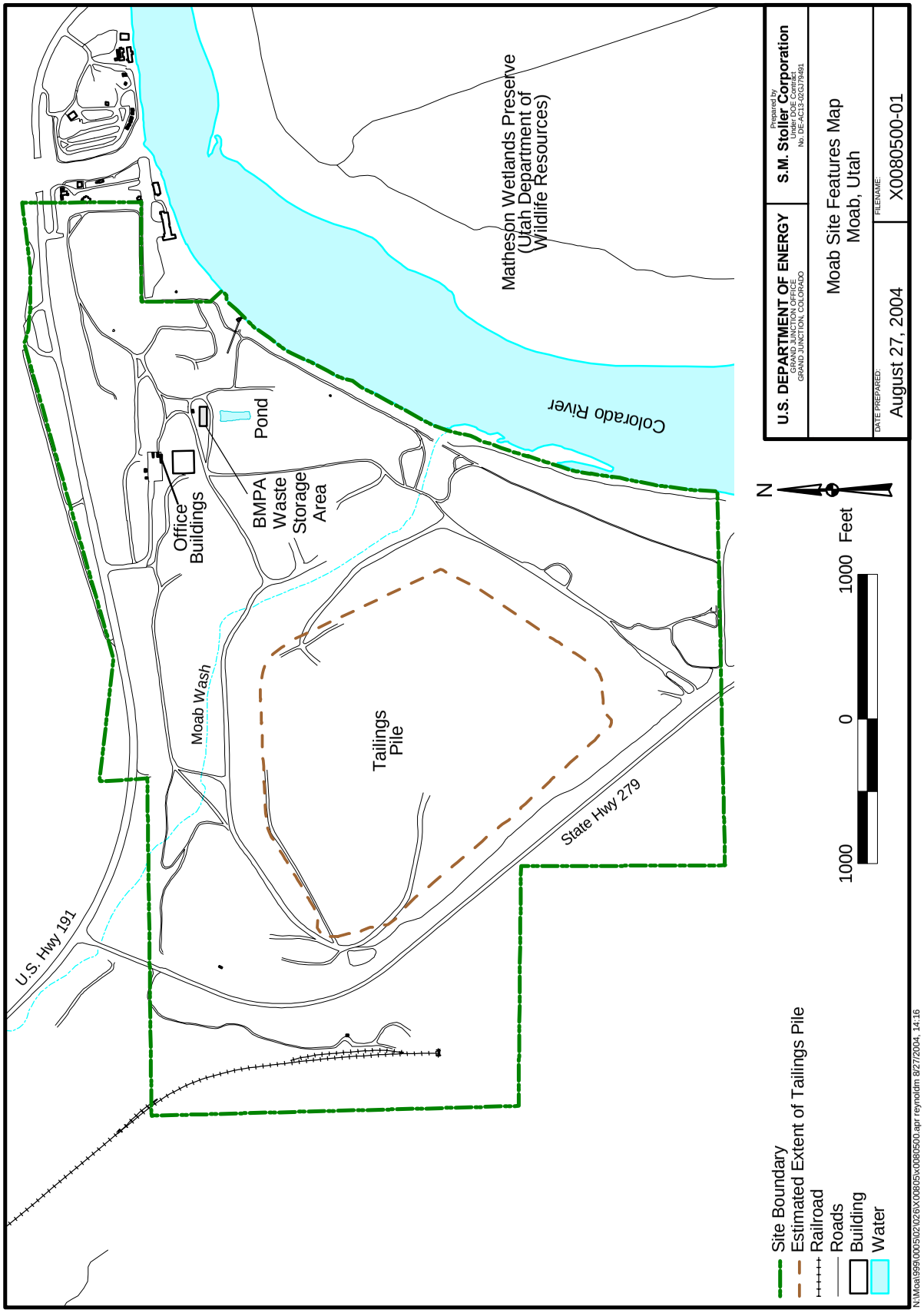

Figure 1–2. Moab Site Features Map

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. Small quantities of legacy chemicals used for laboratory operations also remain 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. NRC documented U.S. Fish and Wildlife Service (USF&WS) concerns regarding the effect of contaminants reaching the Colorado River; specifically, the effects on four endangered fish species and critical habitat (in 1998, the USF&WS had concluded in a Final Biological Opinion that continued leaching of existing concentrations of ammonia and other constituents into the Colorado River would jeopardize 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. DOE has addressed the NAS recommendations and has initiated preparation of the draft EIS. The final Plan for Remediation will be incorporated into DOE's final EIS. DOE is required by the National Environmental Policy Act (NEPA), 42 *United States Code* (U.S.C.) §§ 4321 *et seq*., to prepare an EIS to assess the potential environmental impacts of remediating the Moab site.

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.

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. DOE is committed to establishing and maintaining clear lines of communication with all stakeholders. To this end, DOE hosted several informational meetings that were open to the general public during 2003, and published and distributed an informational fact sheet (*Moab Project Information Update*, November 2003) to interested parties providing a status of site activities and the development of the EIS. DOE also sponsored several meetings with the various cooperating regulatory agencies during 2003.

Specific comments or questions regarding the Moab site and DOE's activities may be directed to Mr. Don Metzler, DOE 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 the DOE's Office of Environmental Management in Grand Junction, Colorado toll-free at 1-800-399-5618.

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 calendar year 2003, environmental monitoring data collected during 2003, 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.

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 calendar year 2003 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 is required to evaluate "the costs, benefits, and risks associated with various remediation alternatives, including removal or treatment of radioactive or other hazardous materials at the site, ground water restoration, and long-term management of residual contaminants." DOE completed the draft Plan for Remediation in October 2001. After having reviewed the Plan, 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 is scheduled for release for public comment in 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 issue licenses to 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 is ground water in the uppermost aquifer that is contaminated with RRM.

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 which 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. Also 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.

DOE also completed an *Interim Action Determination* (IAD) in 2003. The IAD was approved to conduct interim actions prior to completion of the EIS, and focused on the reduction of site-related ground water contamination (e.g., ammonia) that is currently discharging to the Colorado River. Interim actions were conducted in accordance with DOE and CEQ NEPA regulations.

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.

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 2003, 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 2003, DOE continued and expanded its environmental air monitoring program at the Moab site to monitor radon emissions and quantify 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 calendar year 2003 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 2003, 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 2003 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 2003 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 2003.

As with the radon data for calendar year 2003, 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 2003.

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 rains received at the Moab site in September 2002 resulted in damage to the mill tailings pile soil cover. 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. In several areas, these erosional features were deep enough to breach the thickness of the tailings cover and expose the underlying tailings. Immediate repairs to the berm on top of the tailings pile were performed to prevent future re-occurrences. In April 2003, DOE repaired the damage to the cover 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. Jurisdictional wetlands were identified at the Moab Site in 2002.

Activities accomplished in 2003 with the potential to affect jurisdictional wetlands include storm water controls, road improvements, and dredging operations to maintain the water intake structure supplying the on-site holding pond used for site activities such as dust control and

equipment washing. Nationwide permit applications were submitted to the U.S. Army Corps of Engineers and Streambank Alteration Permits were obtained from the State of Utah for these activities. Dredging operations included removal, maintenance, and replacement of the inlet structure and the construction of a hoisting mechanism to remove small quantities of silt from the intake.

DOE completed a technical paper on the Colorado River Migration, which included comments from the U.S. Army Corps of Engineers.

2.1.7 Resource Conservation and Recovery Act

Waste present at the Moab site is RRM in the form of uranium mill tailings. RRM is waste that is radioactive and is related to the milling process. UMTRCA and 40 CFR 192 regulate and define RRM. Wastes that are determined to be RRM are not subject to the Resource Conservation and Recovery Act (RCRA) regulations. Only hazardous, non-RRM wastes are subject to RCRA regulations.

2.1.8 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 2003, DOE accumulated 55 gallons of used oil generated from onsite vehicles and equipment. Used oil that is not radioactively contaminated, may be recycled offsite, or used in onsite oil burning shop heaters (during winter months). Any oil determined to be radioactively contaminated, will be burned in the onsite shop heaters during the winter months. Fluorescent light tubes, office paper, and aluminum cans were also accumulated for offsite recycling.

2.1.9 Waste/Legacy Chemical Management

Approximately 1,465 containers of chemicals were left behind by the former operator of the site. These legacy wastes were inventoried and segregated by DOE during 2002 for safe storage. As a best management practice, approximately 561 containers of non-radiologically contaminated chemical wastes were shipped off-site for disposal. DOE contracted for the shipment and disposal of these wastes with ONYX Environmental Services in February 2003.

Approximately 904 containers (ranging in quantities from 10 grams to 55-gallons) of various legacy chemicals and industrial products remained in storage at the Moab site in the warehouse/shop building or the BMPA at the end of 2003. These materials could not be disposed of off-site with other legacy chemicals and industrial products in February 2003 because these materials are considered to be potentially radiologically contaminated. These wastes continue to be stored on-site in a safe and compliant condition until a final disposal path is identified. Possible disposal paths could include treatment, disposing of them directly on the tailings pile, disposing of them at an off-site disposal facility licensed for radioactive waste, or some combination of these alternatives.

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. Vinyl asbestos floor tiles removed from abandoned rooms in the warehouse/shop building are safely sealed and stored in three 55-gallon drums in the BMPA. It is suspected that PCB wastes are present in fluorescent light ballasts in the warehouse/shop building. However, all of these materials were associated with past milling activities conducted at this site. If these materials are determined to be radiologically contaminated, they would be considered RRM, and are not subject to TSCA regulation.

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

During 2003, 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 the Superfund Amendments and Reauthorization Act (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. Therefore, the applicability of SARA Title III reporting requirements for calendar year 2003 is 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.

DOE reviews the Moab site chemical inventory on an annual basis to determine if SARA Title III reporting requirements are applicable. Based on the inventory of legacy chemicals that remain stored at the Moab site during 2003, DOE determined that none exceeded the threshold planning quantities that would necessitate chemical inventory reporting according to SARA Title III regulations. Although not required, on June 24, 2003, DOE notified the Utah State Emergency Response Commission, the Grand County Emergency Manager, and Moab City Fire Department that potentially hazardous chemicals were stored at the Moab site but none exceeded the inventory reporting thresholds of 40 CFR 370.

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 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 new biological assessment (BA) was initiated in conjunction with the draft EIS. The assessment, which will be attached as an appendix to the EIS, evaluates potential impacts to threatened and endangered species for all remediation alternatives being considered. The final BA is scheduled to be submitted to the USF&WS in March of 2004.

2.1.13 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. Portions of the Moab Site fall within the 100-year and 500-year floodplains (DOE 2003a).

Interim actions in the floodplain implemented in 2003 include removal of tamarisk in the well field area and along a pathway for the pipeline, and installation of the ground water wells. Prior to commencement of work, A Notice of Floodplain and Wetlands Involvement and a Floodplain and Wetlands Assessment were prepared for interim actions at the Moab Site, a Statement of Findings for Floodplain and Wetlands Involvement was submitted to the Federal Register, the U.S. Fish and Wildlife Service was consulted, and a Temporary Change Application and Streambank Alteration Permit were obtained from the State of Utah. The groundwater extraction and treatment system began operating in August 2003. With the exception of the intake, wells, and pipeline, the system is located outside the floodplains.

Storm events throughout the year resulted in some erosion within the floodplain. In June, the Colorado River rose and water temporarily backed up approximately 50 feet past the east culvert in Moab Wash. Damage to silt fences was inspected and repaired as necessary. A road in the southeast corner of the site was damaged and repaired as well as the culvert area of Moab Wash. Concrete was placed on the banks of Moab Wash to arrest future erosion.

Remediation in the right-of-way along Highway 191 was also completed in 2003. A small portion of this activity occurred within the 500-year floodplain, and all excavations were restored to grade.

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 calendar year 2003.

2.1.15 National Historic Preservation Act

During 2003, DOE subcontracted a Class I cultural resource inventory of the Moab site area (Berry 2003). A Class I inventory is a review of existing cultural resource information. Archaeologists study published and unpublished documents, records, files, and other sources to determine if previous cultural resource investigations have been conducted within a given area. Results of the Class I inventory indicated that the majority of the Moab Project site (approximately 95 percent) had not been surveyed for cultural resources. Within the 5 percent of the site that had been surveyed, three cultural sites eligible for the National Register of Historic Places had been recorded. One is a section of the historic U.S. Highway 160, which parallels and pre-dates the present-day U.S. Highway 191, one is a historic livestock driveway feature, and the other is a prehistoric feature.

DOE plans to conduct a Class III "on-the-ground" cultural resource survey of the unsurveyed portions of the site in 2004. The National Historic Preservation Act requires DOE to conduct this kind of survey before a site is disturbed.

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 2003, DOE initiated 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. 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 June 2003. Approvals for both the *Temporary Change Application* and authorization to construct the lined evaporation pond were received from the State of Utah, Department of Natural Resources, Division of Water Rights in July 2003. During 2003, the Interim Action ground water remediation system pumped and treated (through evaporation) approximately 4,000,000 gallons of contaminated ground water.

DOE anticipates that the Interim Action ground water treatment activities will be expanded in 2004. Further, DOE is expected to initiate the "Initial Action" ground water remediation project sometime in 2004. The Initial Action will be a non-consumptive activity wherein clean river water will be 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. DOE will continue to work with the State of Utah, Department of Natural Resources, Division of Water Rights personnel to conduct these activities in compliance with applicable state regulations.

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 2003.

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 2003 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 Department of Energy, 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 2003.

Table 2–1. Permits/Agreements Active in 2003 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	17[a]
Access agreements providing ingress/egress to wells and air monitoring equipment for data collection purposes	Bureau of Land Management, Private Landowners	9
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 03-01-04SA for a road crossing and storm water controls on Moab Wash. Permit withdrawn in late '03 and replaced with another application that was granted in 2004.	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

[a]This is the number of monitor wells exceeding 30 feet in depth that have been authorized and installed by DOE in 2003. Since taking over the site, DOE has installed 33 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.

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 2003, the monitoring network was increased from 23 total monitoring locations to 27 monitoring locations. These additional locations were added to better understand the spatial distribution of downwind radon concentrations and to better assess public exposures in areas immediately adjacent to the millsite that are often used for camping and other recreational purposes. 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
0114	Millsite, Tailings Pile	Rn, G
0115	Millsite, Tailings Pile	Rn, G
0116	Millsite, Tailings Pile	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: 16
Total off-site monitoring stations: 11[a]
Total radon monitoring stations: 27[a]
Total gamma monitoring stations: 27[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 2003, atmospheric radon was measured at 27 locations (16 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 Figures 3−1 and 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.

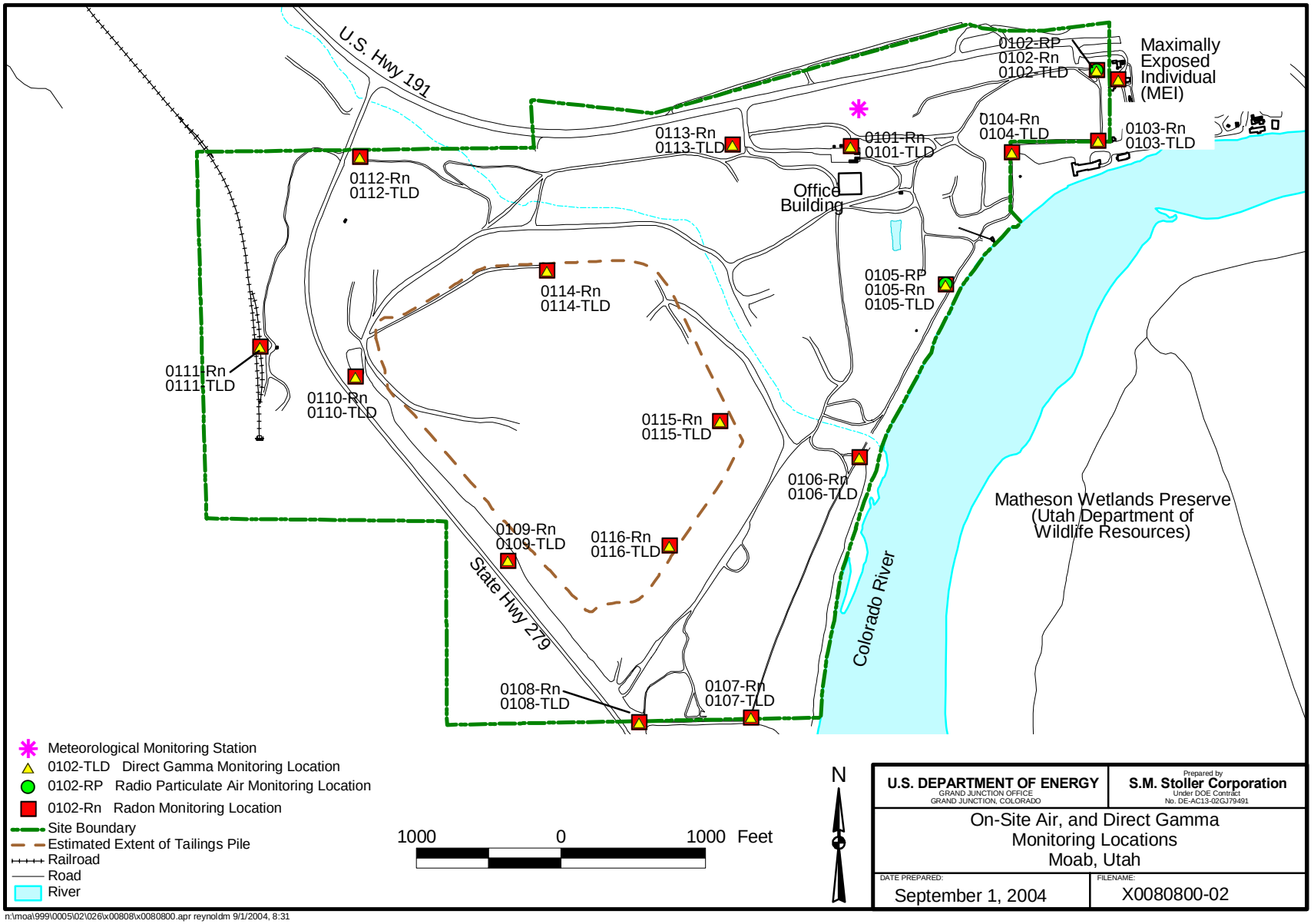

Figure 3–1. On-Site Air and Direct Gamma Monitoring Locations

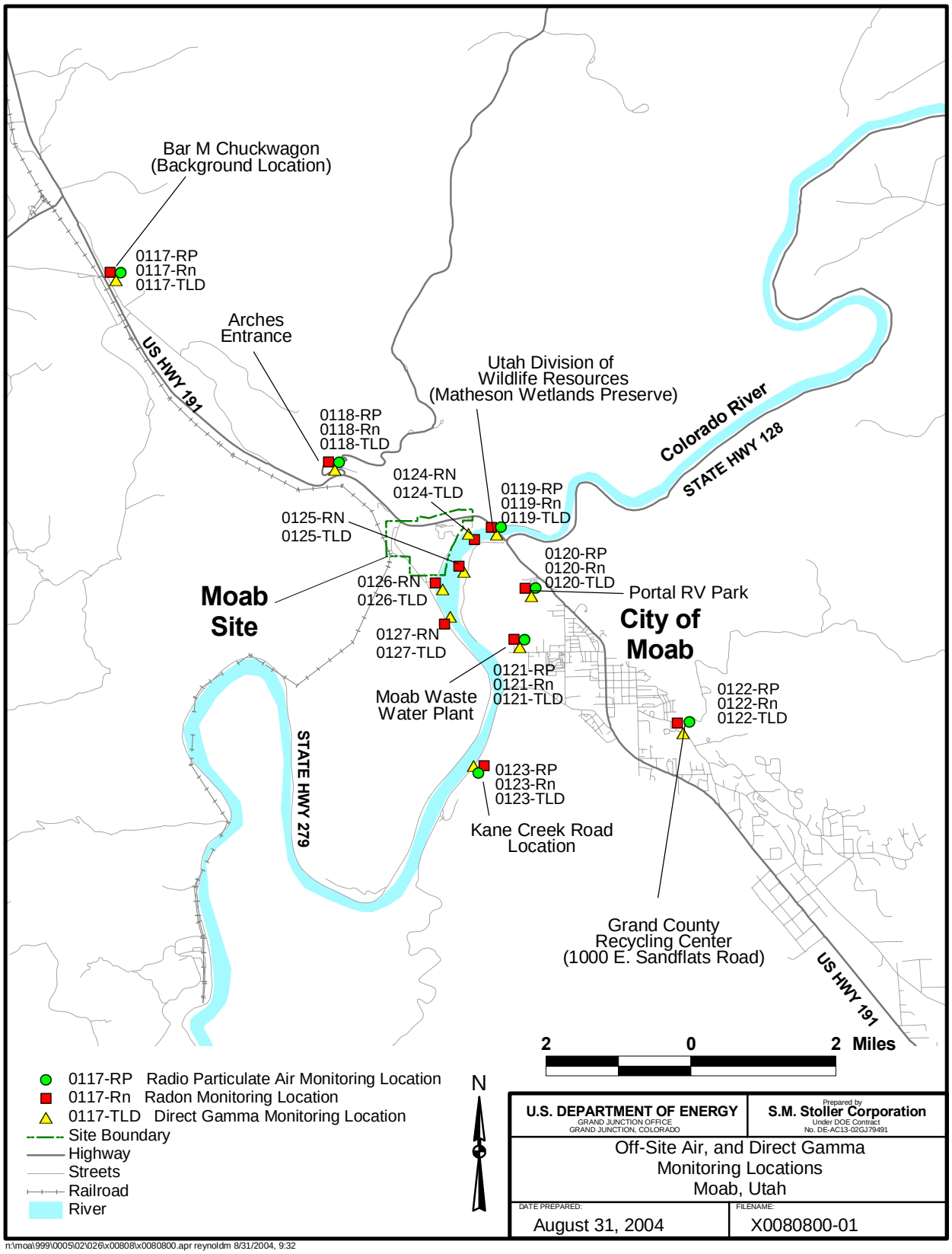

Figure 3–2. Off-Site Air and Direct Gamma Monitoring Locations

Direct gamma radiation monitoring is conducted to assess the potential gamma radiation dose to persons on and near the Moab site. During 2003, direct gamma radiation was measured at 27 locations (16 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 181mrem/yr. On-site, off-site, and background direct gamma radiation monitoring locations are shown in Figures 3−1 and 3−2.

3.1.3 Airborne Radioparticulates

In 2003, 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 Figures 3−1 and 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 will be 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 Water Monitoring

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 2003 was conducted at selected locations on the Colorado River and in the Matheson Wetlands Preserve (Figure 3−3). The goal of the surface water sampling in 2003 was to augment baseline sampling conducted previously. In particular, sampling was designed to improve the understanding of water quality in the Matheson Wetlands Preserve and to investigate a seep discharging from the site side of the river that displayed a purple and orange sheen.

A summary of the surface water sampling conducted in 2003 is displayed in Table 3−2. In addition to the analytes listed in Table 3−2, alkalinity, dissolved oxygen, oxidation-reduction potential, pH, specific conductance, temperature, and turbidity were measured in the field at most locations. Surface water locations sampled during 2003 are shown in Figure 3−3. During 2003, an evaluation of sampling results from 2003 and previous years was conducted. A site conceptual model was developed and included in the SOWP (DOE 2003d).

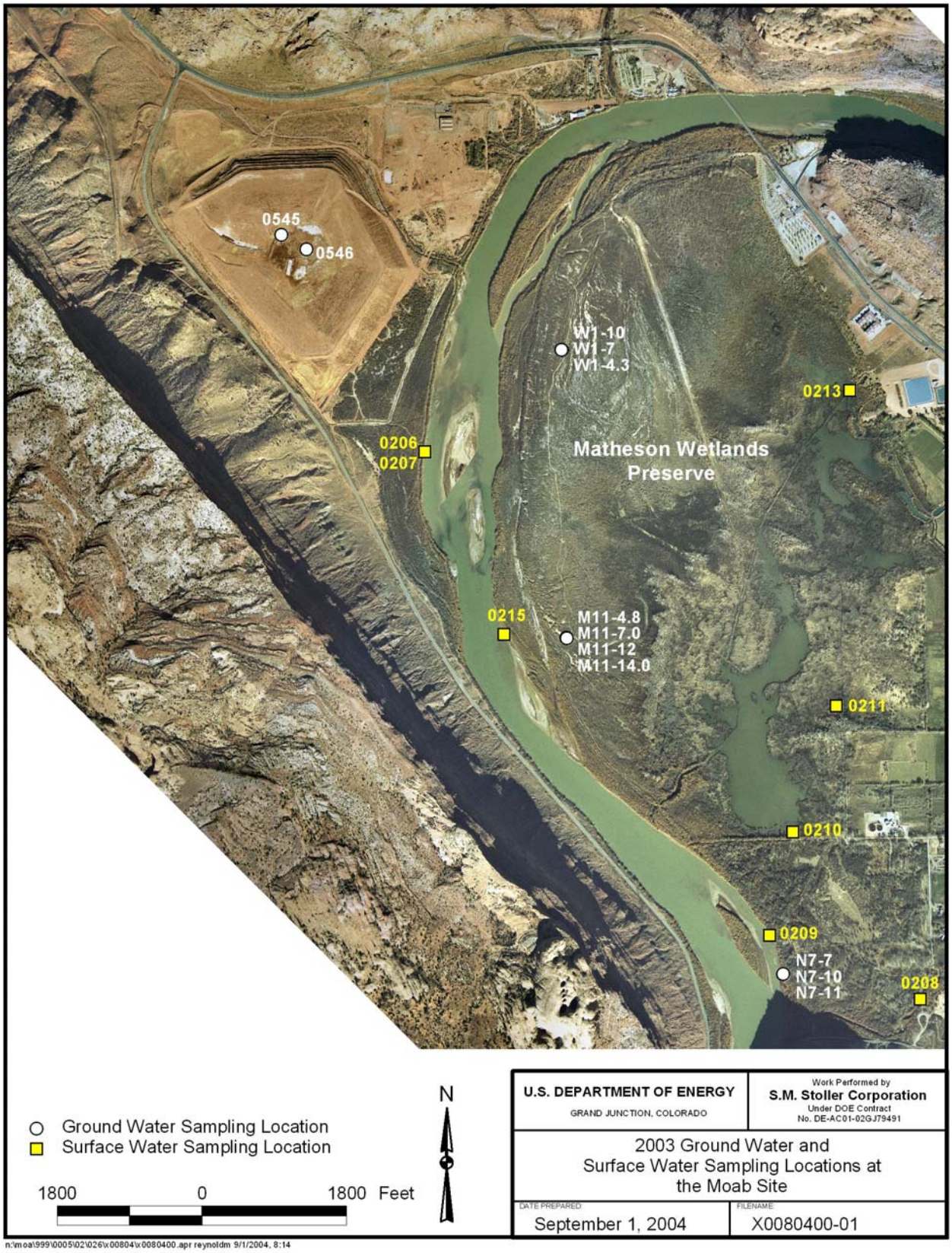

Figure 3–3. Surface Water and Ground Water Monitoring Locations at the Moab Site for 2003

Table 3–2. Summary of 2003 Surface Water Sampling Events

Date	Type	Area	Location ID	Analytes[a]
January	Colorado River	Seep and adjacent river	206 (seep), 207 (river)	Volatile organics, semi-volatile organics, NH_3 as N, Ba, B, Cd, Cl, Mn, NO_3, K, Se, Na, SO_4, TDS, U
March	Colorado River	Downstream and across river from site	215	NH_3 as N, Cl, NO_3, SO_4, TDS, U
	Colorado River	Outfall from sewage treatment plan	209	
	Matheson Wetlands Preserve	Various locations within the preserve	208, 210, 211, 213	

[a]Complete analyte list; field measurements are not included.

3.2.2 Ground Water

The ground water sampling conducted in 2003 was very limited compared to monitoring conducted in previous years. Sampling was focused on understanding the chemistry of the shallow tailings pile pore fluids by installing and sampling two new wells and better characterizing ground water quality in the Matheson Wetlands Preserve by sampling existing well nests.

A summary of the ground water sampling conducted in 2003 is displayed in Table 3−3. In addition to the analytes displayed in Table 3−3, alkalinity, dissolved oxygen, oxidation-reduction potential, pH, specific conductance, temperature, and turbidity were measured in the field at most wells. Monitor wells sampled during 2003 are shown in Figure 3–3. An evaluation of ground water data collected during 2003 and previous years was completed. A conceptual site model for the site was developed and included in the SOWP for the Moab site (DOE 2003d).

Ground water sampling and analysis was also conducted in 2003 in conjunction with operation of the interim remedial action system. However, the purpose of that monitoring was to evaluate system performance and not for environmental monitoring purposes. Results are therefore not reported in this document. They are presented in the performance monitoring report for the system (DOE 2004).

Table 3–3. Summary of 2003 Ground-Water Sampling Events

Date	Area	Formation	Well ID	Analytes[a]
March	Shallow Tailings Pile	Tailings	545, 546	NH_3 as N, Cl, NO_3, SO_4, TDS, U
April	Across from tailings pile	Alluvium	W1-10, W1-7, W1-4.3	NH_3 as N, Cl, NO_3, SO_4, TDS, U
	Across and downgradient of site		M11-4.8, M11-7.0, M11-12, M11-14.0	
	Downgradient of sewage treatment plant outfall across and downgradient of site		N7-7, N7-10, N7-11	

[a]Complete analyte list; does not include field measurements.

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. DOE anticipates that radiological surveys will be completed for the remainder of the site as funding becomes available.

3.4 Waste Management

During 2003, DOE conducted operations consistent with DOE's *Waste Management Policy for the Moab Project Site* (DOE 2002d) which was developed to provide guidance for the proper management of wastes generated at the Moab site.

3.4.1 Residual Radioactive Materials

RRM, defined at 40 CFR 192.01(a), is waste that is radioactive and related to the milling process. RRM generally refers to uranium mill tailings but may also consist of hazardous or toxic components related to the milling process.

DOE manages RRM that consists of hazardous or toxic components in a manner that is protective of human health and the environment as a best management practice. For example, the legacy chemicals and industrial products that remain stored at the Moab site are considered RRM, and are managed in a safe manner that protects site workers and the environment. DOE has ensured that all such materials are adequately labeled, are segregated for compatible storage, and are secured by secondary containment.

Legacy Chemicals and Industrial Products

The former operators of the mill left over 1,400 containers of excess laboratory chemicals and industrial products at the Moab site. An on-site analytical chemistry and assay laboratory maintained an extensive inventory of assorted chemicals. The bulk of these chemicals were stored in a dedicated chemical storage room located adjacent to the analytical laboratory in the warehouse/shop building. Additionally, containers of assorted industrial products were scattered throughout the warehouse/shop building and were also located around the exterior of the building. Hazardous components were present in many of the chemicals and industrial products.

During 2003, 561 containers of waste materials were determined to be non-RRM, and were shipped offsite for disposal by ONYX Environmental Services. The 904 containers of legacy chemicals and industrial products that remain in storage at the site are assumed to be RRM and continue to be segregated by chemical compatability for safe storage. These materials must be further evaluated to determine the best path(s) for disposition.

Polychlorinated Biphenyls and Asbestos

No PCB wastes were identified at the Moab site in 2003.

During 2003, DOE continued to manage three 55-gallon drums of vinyl asbestos floor tiles. These tiles were originally identified in 2002, and were double-bagged, labeled as ACM, placed in sealed containers, and safely stored in the BMPA (Section 3.4.3). The tiles are considered radiologically contaminated and are therefore RRM. It is suspected that ACM in the form of siding, roofing, transite piping, lagging, and insulation is present in the buildings and utilities that remain on site. 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 Management

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 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 containerized wastes that require further characterization and for which a waste disposal path has not yet been selected. Once adequate characterization data are obtained and a disposal path is selected, wastes will be removed from the BMPA.

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

Approximately 29 containers of waste with volumes ranging from 5 to 55 gallons were stored in the BMPA at the end of 2003. These wastes included fire retardant, used oil, grease, asbestos tiles, hydraulic fluid, petroleum-contaminated soils, and some unknown materials. Approximately 500 gallons of legacy fire retardant that was determined to be non-RRM was removed from the BMPA and included in the February 2003 offsite waste shipment. The materials that remain in the BMPA must be further characterized for radiological and chemical content, and a disposal path must be determined.

3.5 Pollution Prevention

Pollution prevention and waste minimization are part of the waste management strategy for the Moab site. All activities were evaluated to identify technically and economically feasible opportunities for source reduction, recycling, decontamination, or treatment. Disposal was the final option after all other avenues were 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" principle (i.e., as low as reasonably achievable) is emphasized to keep materials from becoming radioactively contaminated. Using administrative controls such as establishing radioactive materials areas, limiting the use of materials in the contaminated area (especially hazardous materials such as chemicals, batteries, or petroleum products), 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 radioactively contaminated. Decontamination is performed if warranted, feasible, and cost-effective.

3.5.2 Reuse and Recycling

DOE's activities at the Moab site during 2003 generated approximately 100 pounds of office paper, 50 pounds of aluminum, and 15 fluorescent light tubes. These items were recycled at a local recycling center in Moab. Prior to being transported offsite for recycling, all items are scanned to ensure that they are free from radioactive contamination. During 2003, DOE also accumulated approximately 55 gallons of used oil generated from maintenance of onsite vehicles and equipment. Used oil that is not radioactively contaminated, may be recycled offsite, or used during winter months as fuel for onsite, oil burning shop heaters. Any oil determined to be radioactively contaminated is not eligible for offsite recycling. During 2003, all used oil generated at the Moab site was collected and stored in the warehouse/shop building. Used oil generated by past site operations remained stored in the BMPA. There was no offsite recycling of used oil during 2003.

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.

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 2003. Ground water monitoring results for 2003 are described in Section 5.0.

4.1 Environmental Air Monitoring

DOE continued its environmental air monitoring activities at the Moab site during calendar year 2003 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 2003.

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 2003, the annual average atmospheric radon concentration exceeded the site-specific standard at six 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 2003

Station Number	First Quarter 2003 (01/07/03 – 03/31/03)		Second Quarter 2003 (3/31/03 – 07/09/03)		Third Quarter 2003 (07/09/03 − 10/01/03)		Fourth Quarter 2003 (10/01/03 − 01/07/04)		2003 Annual Average	
	Radon (pCi/L)	Gamma (mrem/ 91 d) (EAA)[5]	Radon (pCi/L)	Gamma (mrem/ 91 d) (EAA)	Radon (pCi/L)	Gamma (mrem/ 91 d) (EAA)	Radon (pCi/L)	Gamma (mrem/ 91 d) (EAA)	Rn (pCi/L)	Gamma (mR/yr)
On-Site Locations										
MPS- 0101[1]	3.2	77.3 (310)	1.8	62.9(252)	3.2	76.6(306)	3.7	80.2 (321)	3.0	297
MPS-0102[1]	2.3	26.4(106)	2.1	21.4(86)	1.8	24.5(98)	3.0	31.2 (125)	2.3	104
MPS-0103[1]	1.6	27.6(111)	1.2	21.5(86)	1.8	25.3(101)	2.8	31.4 (126)	1.9	106
MPS-0104[1]	2.9	34.4(138)	2.3	25.2(101)	3.1	31.5(126)	4.3	34.0 (136)	3.2	125
MPS-0105[1]	3.4	50.8(204)	2.8	43.0(173)	2.5	48.2(193)	4.2	55.8 (223)	3.2	198
MPS-0106[1]	8.3	43.0(172)	7.1	34.5(138)	8.2	39.2 (157)	10.9	45.8 (183)	8.6	163
MPS-0107[1]	6.8	55.0(221)	6.4	50.7(203)	5.5	52.6(210)	7.2	64.5 (258)	6.5	223
MPS-0108[1]	4.8	126.9(509)	6.2	120.6(484)	6.9	132.0(528)	7.1	137.7 (551)	6.3	518
MPS-0109[1]	1.6	56.7(227)	2.1	52.9(212)	2.6	57.3(229)	2.8	60.9 (244)	2.3	228
MPS-0110[1]	1.3	84.5(340)	2.9	77.7(312)	2.2	86.5(346)	2.3	85.6 (342)	2.2	335
MPS-0111[1]	1.0	65.8(264)	1.9	55.0(221)	1.5	64.8(259)	1.5	62.6 (250)	1.5	249
MPS-0112[1]	1.4	44.7(179)	2.5	34.7(139)	2.6	41.2(165)	3.0	40.6 (162)	2.4	161
MPS-0113[1]	2.7	99.0(397)	2.5	84.7(340)	2.7	98.9(396)	4.2	87.8 (351)	3.0	371
MPS-0114[1]	4.2	418.1(1,677)	5.3	354(1,420)	6.6	425.4 (1,702)	6.5	416.9 (1,668)	5.7	1617
MPS-0115[1]	5.2	247.5(993)	6.1	195.8(785)	7.8	317.1(1,268)	6.5	306.3 (1,225)	6.4	1068
MPS-0116[1]	4.8	145.2(583)	5.8	121.6(488)	6.5	143.3(573)	6.5	148.4 (594)	5.9	560
Off-Site Locations										
MPS-0117[2,3]	0.5	21.6(87)	0.8	19.9(80.0)	0.7	20.8(83)	1.3	24.7 (99)	0.8	87
MPS-0118[2]	0.7	23.4(94)	0.7	23.0(92)	1.2	23.1(92)	1.2	29.2 (117)	1.0	99
MPS-0119[2]	1.0	19.8(79)	1.0	21.0(84)	1.0	24.3(97)	1.9	27.0 (108)	1.2	92
MPS-0120[2]	0.6	16.1(65)	1.0	15.2(61)	1.1	17.0(68)	1.6	22.0 (88)	1.1	71
MPS-0121[2]	0.4	21.0(84)	0.7	18.2(73)	0.4	19.7(79)	1.3	22.5 (90)	0.7	82
MPS-0122[2]	0.6	18.6(75)	0.5	15.2(61)	0.5	17.2(69)	0.9	18.2 (73)	0.6	70
MPS-0123[2,3]	0.4	19.0(77)	0.4	14.8(59)	0.5	18.4(74)	1.3	17.9 (72)	0.7	71
MPS-0124[2]	1.9	NDA[6]	0.9	NDA[6]	1.6	20.6(82.4)	1.9	26.2 (105)	1.6	94
MPS-0125[2]	2.0	NDA[6]	1.9	NDA[6]	1.8	23.8(95)	3.0	27.0 (108)	2.2	102
MPS-0126[2]	1.7	NDA[6]	2.3	NDA[6]	1.7	23.1(92)	3.5	25.3 (101)	2.3	97
MPS-0127[2]	1.4	NDA[6]	1.0	NDA[6]	1.5	20.4(82)	1.6	27.6 (110)	1.4	96
MEI[4]	1.9	NA	1.2	NA	1.8	18.9 (76)	3.4	31.2 (125)	2.1 (2.5)	101

[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.
NA = Not Applicable.
NDA = No Data Available.
[6] Data rejected for these locations for 1st and 2nd quarter of 2003 due to technical errors associated with the gamma radiation detectors (i.e., TLDs).

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 a recreational area for camping and parties. 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. The newly added 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 is also when the 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 Figures 4−1 and 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 181mrem/yr (see Section 3.1.2). As can be seen from Table 4−1, during 2003 direct gamma radiation measurements exceeded this limit at eleven 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. As with the conclusions from radon monitoring, 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).

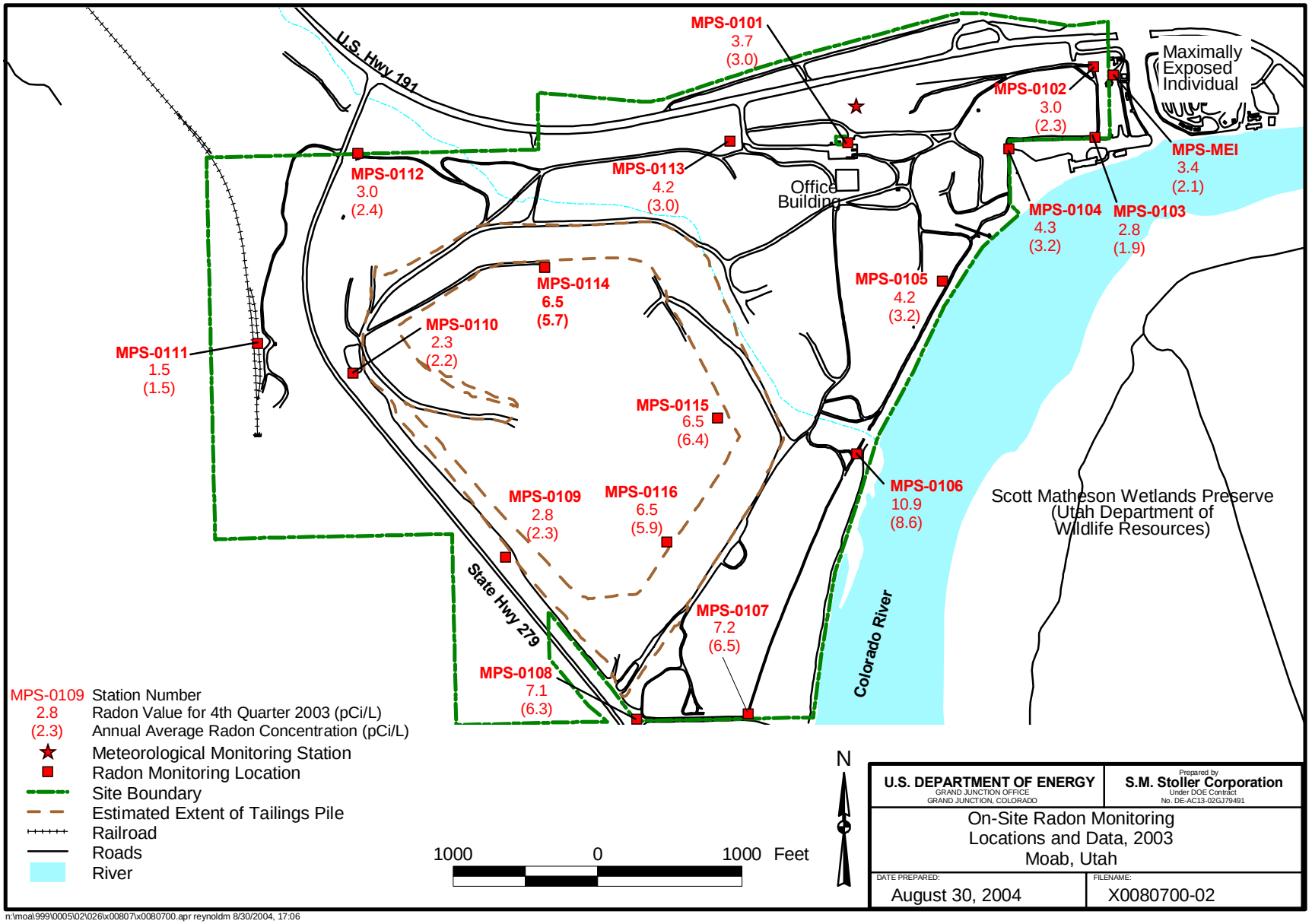

Figure 4–1. On-Site Radon Monitoring Locations and Data, 2003

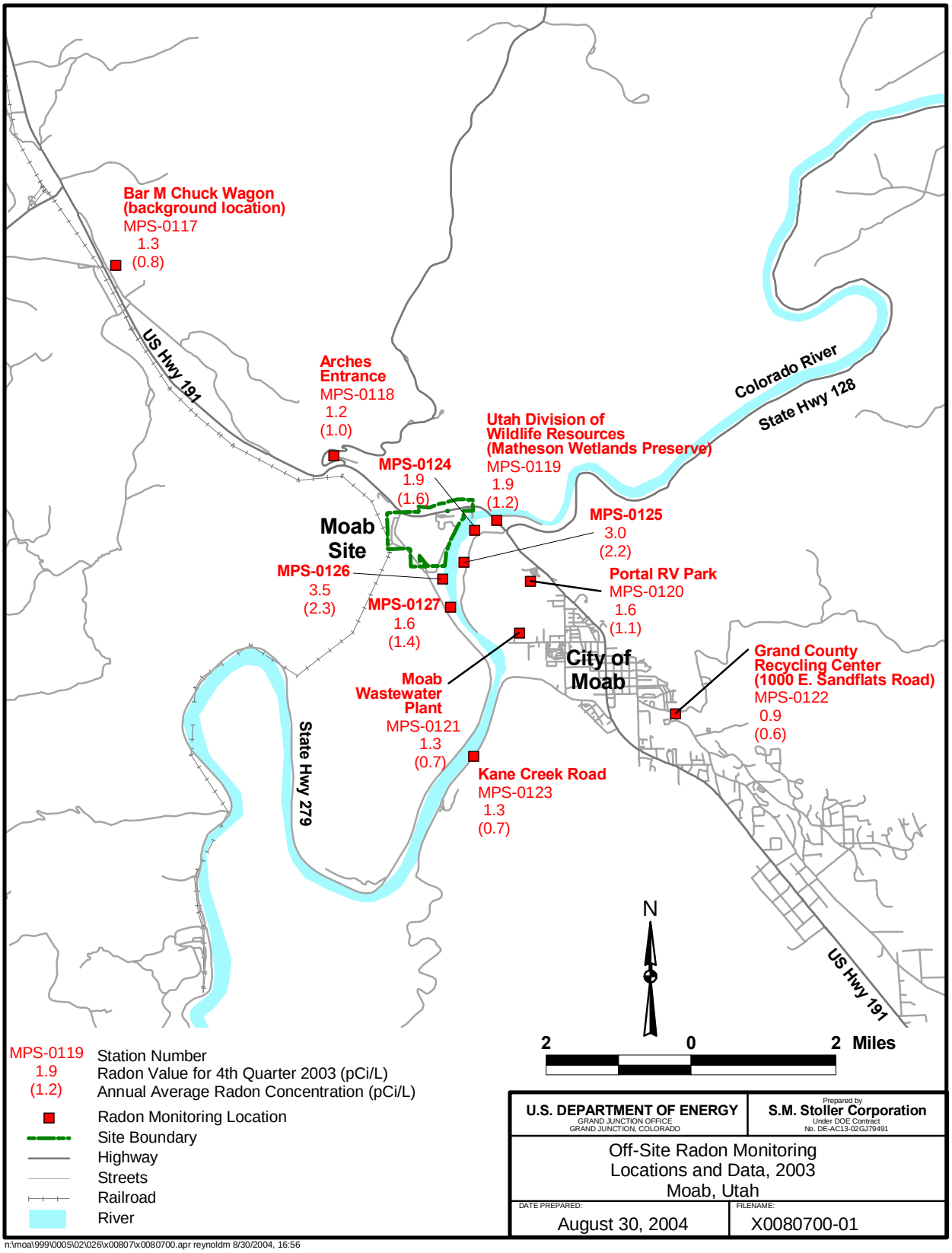

Figure 4–2. Off-Site Radon Monitoring Locations and Data, 2003

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 Figures 4−3 and 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 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 2003 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 Figures 4−5 and 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).

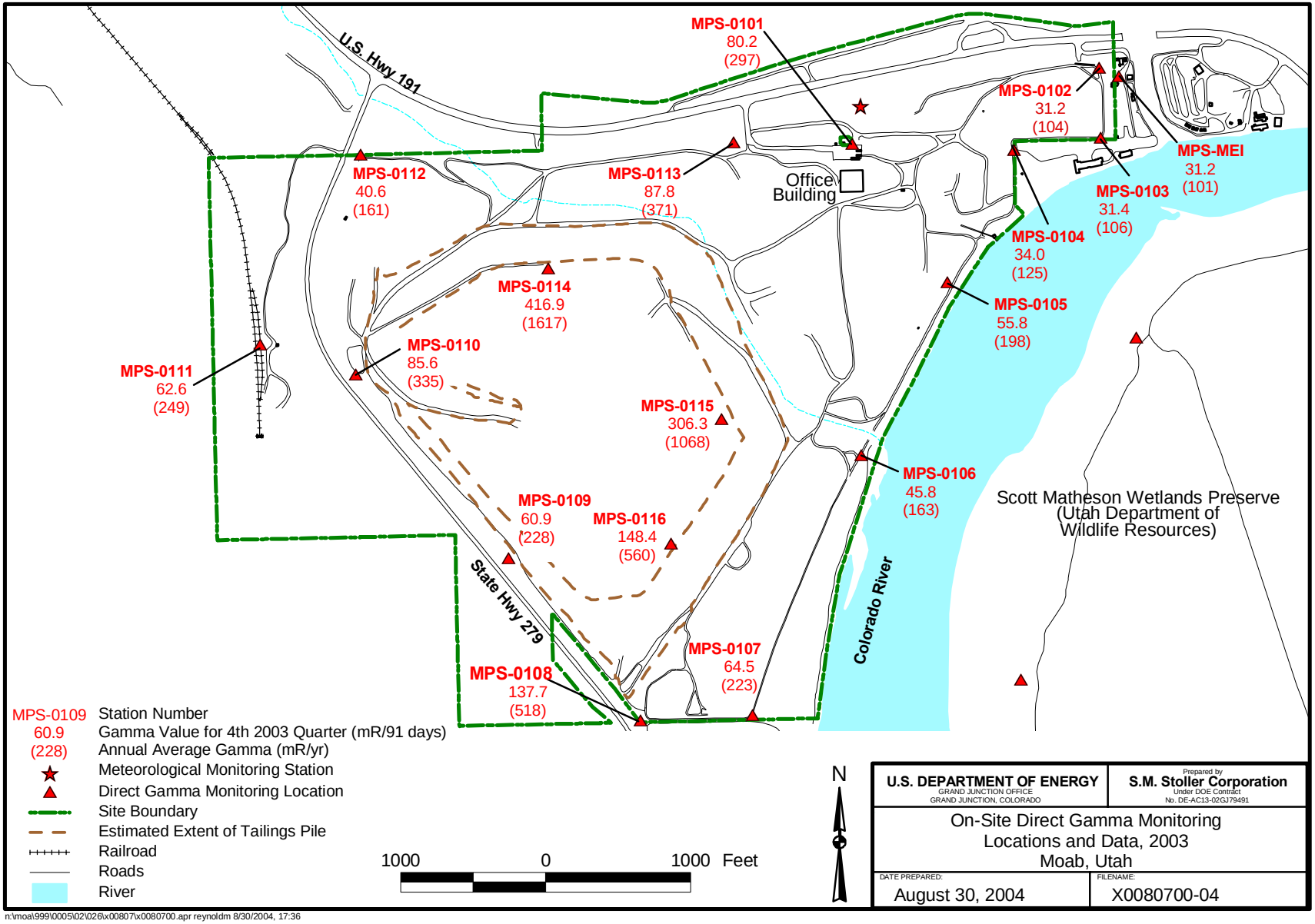

Figure 4–3. On-Site Direct Gamma Monitoring Locations and Data, 2003

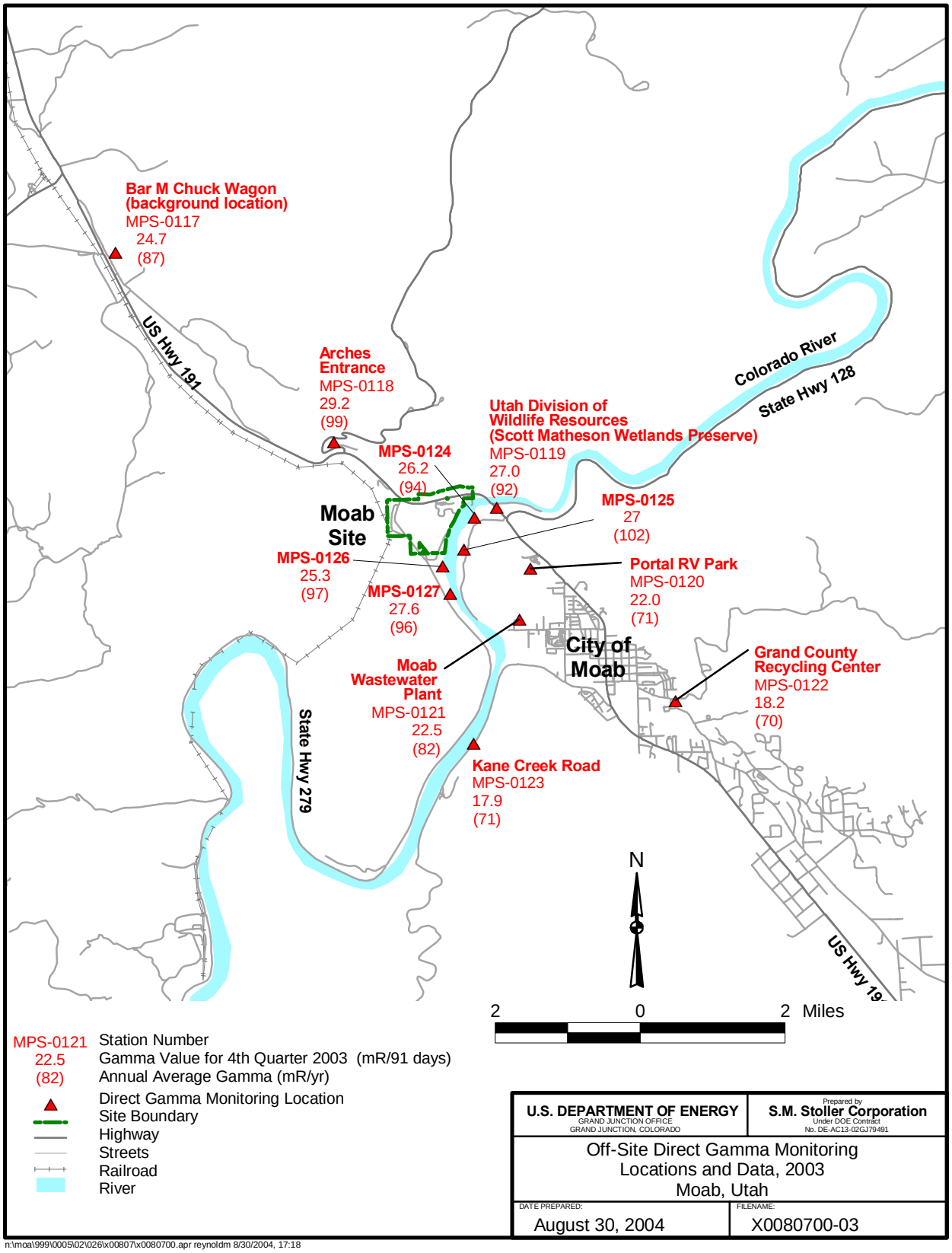

Figure 4–4. Off-Site Direct Gamma Monitoring Locations and Data, 2003

Table 4–3. Summary of Radioparticulate Air Monitoring Data for the Moab Site for Calendar Year 2003

Station Number	Isotope	First Quarter 2003 (µCi/mL)	Second Quarter 2003 (µCi/mL)	Third Quarter 2003 (µCi/mL)	Fourth Quarter 2003 (µCi/mL)	Annual Average (µCi/mL)
On-Site Locations						
MPS-0102 (East Property Line)	Uranium-Total	1.5E-16	2.0E-16	2.3E-16	1.8E-16	1.9E-16
	Thorium-230	2.1E-16	2.5E-16	2.3E-16	1.6E-16	2.2E-16
	Radium-226	3.2E-16	2.9E-16	3.0E-16	2.3E-16	2.9E-16
	Polonium-210	4.2E-15	2.5E-15	2.6E-15	3.2E-15	3.1E-15
MPS-0105 (River Berm)	Uranium-Total	3.2E-16	8.5E-16	1.1E-15	4.5E-16	7.0E-16
	Thorium-230	3.3E-16	6.5E-16	8.5E-16	3.3E-16	5.6E-16
	Radium-226	3.5E-16	4.2E-16	3.4E-16	2.5E-16	3.5E-16
	Polonium-210	6.1E-15	3.8E-15	4.0E-15	3.8E-15	4.5E-15
Off-Site Locations						
MPS-0117 (Bar M Chuck Wagon)	Uranium-Total	1.1E-16	1.3E-16	1.3E-16	1.7E-16	1.3E-16
	Thorium-230	2.2E-16	2.0E-16	2.2E-16	2.1E-16	2.1E-16
	Radium-226	3.1E-16	2.0E-16	3.1E-16	2.5E-16	3.0E-16
	Polonium-210	4.0E-15	3.2E-15	3.0E-15	2.9E-15	3.3E-15
MPS-0118 (Arches National Park Entrance)	Uranium-Total	1.0E-16	1.6E-16	2.0E-16	2.5E-16	1.7E-16
	Thorium-230	2.5E-16	2.2E-16	2.6E-16	2.9E-16	2.5E-16
	Radium-226	3.1E-16	2.0E-16	3.1E-16	2.4E-16	2.9E-16
	Polonium-210	4.4E-15	3.2E-15	3.4E-15	3.1E-15	3.6E-15
MPS-0119 (Scott Matheson Wetlands Preserve)	Uranium-Total	1.1E-16	1.5E-16	2.3E-16	1.3E-16	1.6E-16
	Thorium-230	2.4E-16	2.4E-16	3.4E-16	1.1E-16	2.4E-16
	Radium-226	3.2E-16	1.9E-16	3.1E-16	2.6E-16	3.0E-16
	Polonium-210	4.8E-15	3.2E-15	3.2E-15	3.5E-15	3.7E-15
MPS-0120 (Portal RV Park)	Uranium-Total	1.5E-16	2.0E-16	1.5E-16	1.4E-16	1.7E-16
	Thorium-230	3.4E-16	4.2E-16	1.9E-16	1.9E-16	2.9E-16
	Radium-226	3.1E-16	4.2E-16	3.1E-16	2.4E-16	3.6E-16
	Polonium-210	4.3E-15	2.8E-15	3.4E-15	3.3E-15	3.5E-15
MPS-0121 (Moab Wastewater Treatment Plant)	Uranium-Total	1.3E-16	1.3E-16	1.6E-16	1.3E-16	1.4E-16
	Thorium-230	2.3E-16	1.7E-16	1.7E-16	1.6E-16	1.9E-16
	Radium-226	3.4E-16	1.8E-16	2.7E-16	2.4E-16	2.9E-16
	Polonium-210	4.5E-15	3.2E-15	2.9E-15	3.0E-15	3.5E-15
MPS-0122 (Grand County Recycling Center)	Uranium-Total	1.2E-16	1.3E-16	1.4E-16	1.3E-16	1.3E-16
	Thorium-230	3.2E-16	2.8E-16	2.5E-16	2.5E-16	2.8E-16
	Radium-226	3.4E-16	2.0E-16	3.0E-16	2.4E-16	2.9E-16
	Polonium-210	4.2E-15	3.4E-15	3.1E-15	3.0E-15	3.5E-15
MPS-0123 (Kane Creek Road)	Uranium-Total	9.5E-17	1.3E-16	1.3E-16	1.4E-16	1.2E-16
	Thorium-230	2.1E-16	2.6E-16	1.7E-16	1.8E-16	2.1E-16
	Radium-226	3.3E-16	1.8E-16	3.1E-16	2.3E-16	2.9E-16
	Polonium-210	4.3E-15	2.6E-15	3.2E-15	3.2E-15	3.3E-15

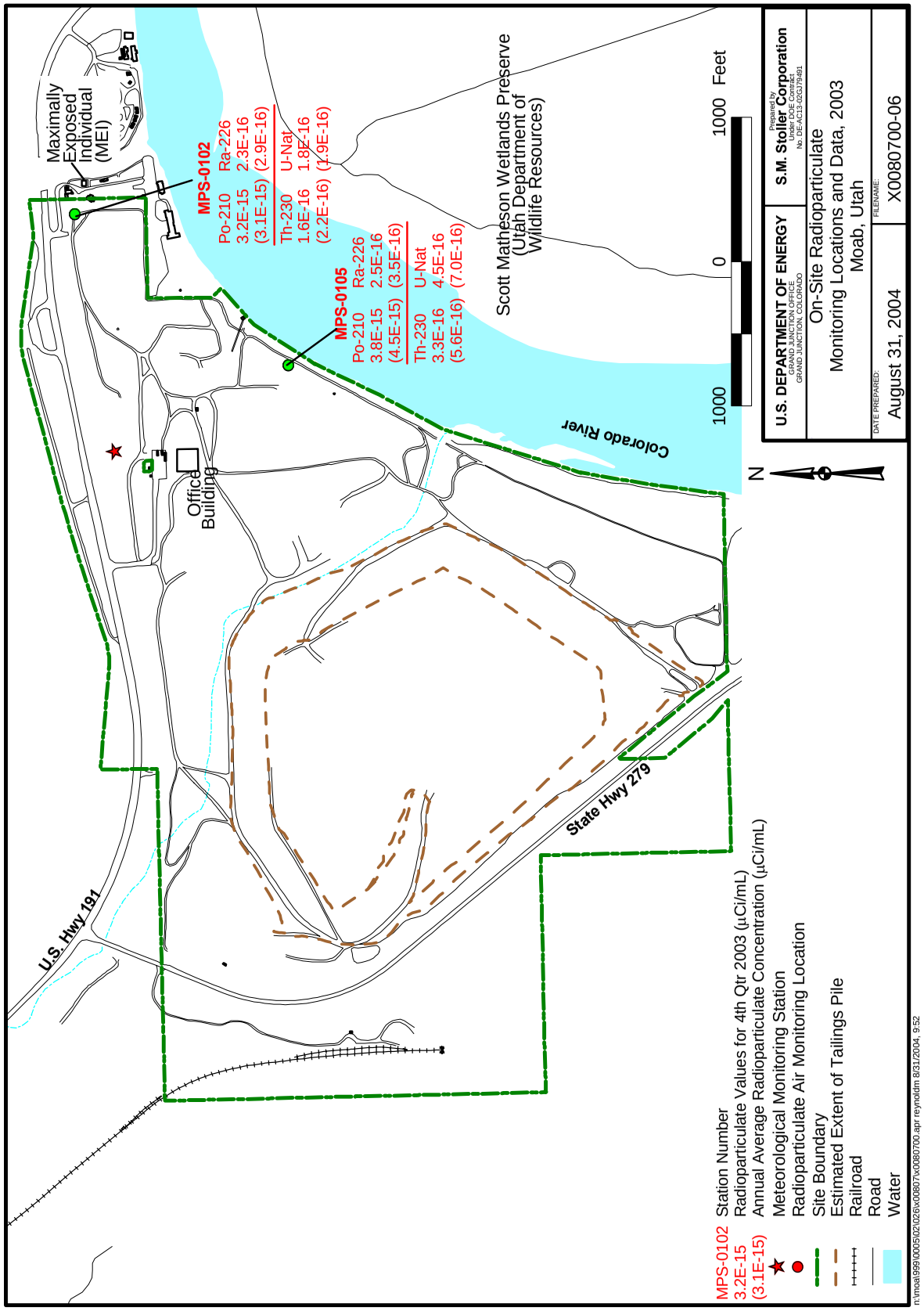

Figure 4–5. On-Site Radioparticulate Monitoring Locations and Data, 2003

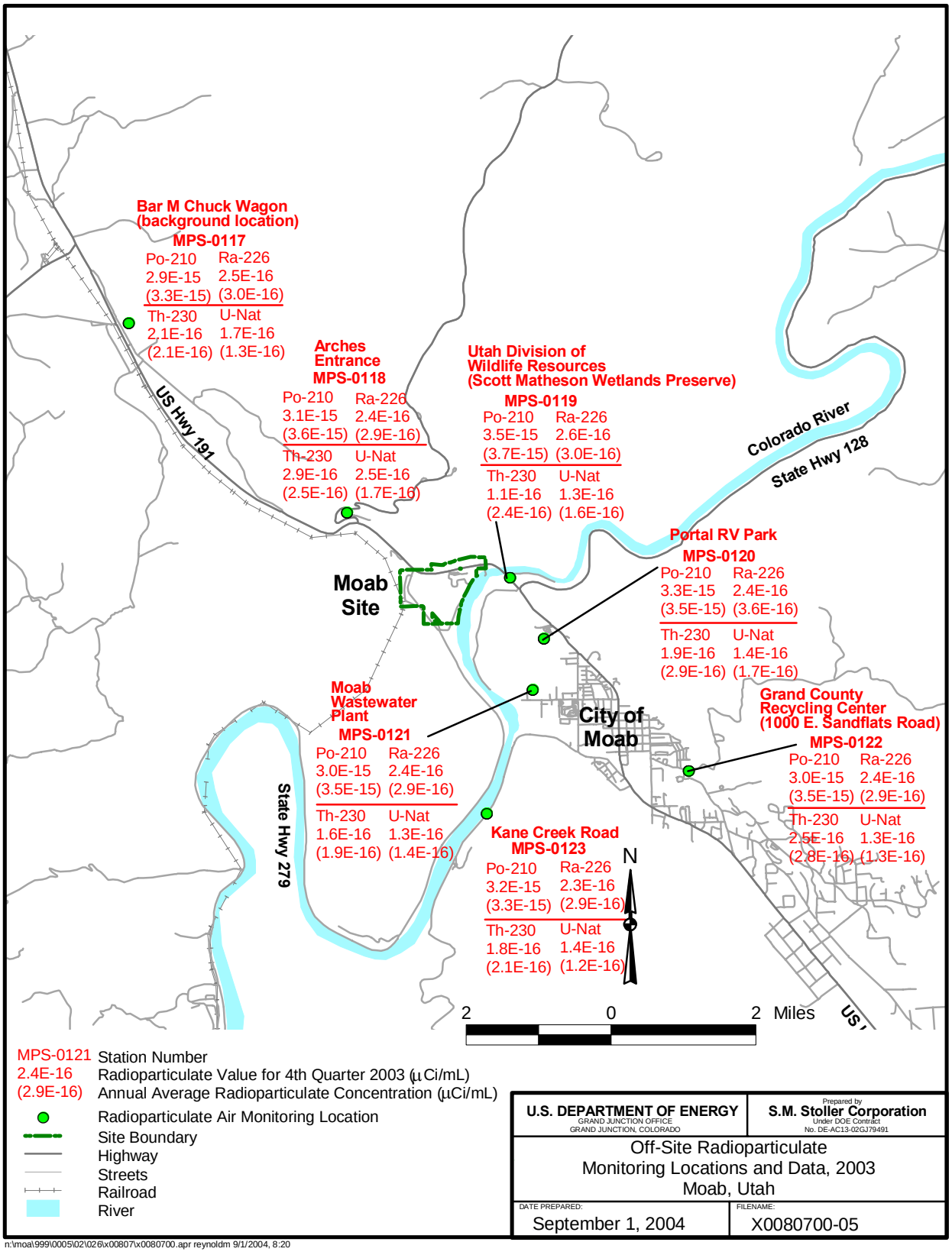

Figure 4–6. Off-Site Radioparticulate Monitoring Locations and Data, 2003

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 181mrem/yr. Direct gamma radiation measurements were also collected at the MEI location (MPS-MEI) during 2003. The monitoring data collected at MPS-MEI indicate that the annual average gamma radiation dose at this location was 101 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 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 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 3−2). 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 2003 meteorological data for temperature, wind speed, and precipitation.

Table 4–4. Meteorological Data Summary for the Moab Site for Calendar Year 2003

Month[a]	Temperature (F°)				Wind Speed (mph)		Precipitation Totals (inches/month)
	Avg High	Avg Low	Max Temp	Min Temp	Avg	Peak Gust	
January	51.1	24.8	58.5	19.6	2.3	19.6	0.12
February	51.0	30.1	63.5	15.1	3.6	46.4	0.88
March	60.4	38.2	76.2	25.6	4.5	35.3	0.7
April	70.9	44.9	80.9	28.6	5.5	48.2	0.06
May	82.6	53.4	102.8	40.0	4.7	46.4	0.76
June	92.0	62.6	100.9	52.8	5.2	36.4	0.04
July	104.5	70.3	109.2	59.2	4.2	34.6	0.03
August	97.3	68.7	105.3	60.4	4.3	38.5	0.34
September	87.1	52.8	96.4	39.5	3.8	37.5	0.55
October	79.8	45.4	94.4	32.9	3.5	55.0	0.19
November	53.8	33.4	70.3	13.2	3.7	39.2	0.36
December	46.6	25.1	63.0	16.7	2.9	40.7	0.76

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

Surface Water

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. A comparison of 2003 surface-water chemistry results to State of Utah water quality standards is summarized in Table 4−5. Surface-water chemistry data collected in 2003 are presented in Appendix Table A−1 and Table A−2. Note that due to the limited nature of the 2003 surface water sampling and the bias toward characterizing the seep and sewage treatment plant outfall areas, the water quality data presented in Appendix A−1 is not necessarily considered to be representative of overall river water quality.

Table 4–5. Comparison of State of Utah Water Quality Standards[a] with 2003 Maximum Concentrations in Colorado River[b]

Constituent	State Standard[a,b]	2003 Maximum[c,d]	
		Seep (206)	River
Ammonia Total as N[e]	2-4 mg/L	2.166	10
Boron	0.75 mg/L	1.74	0.105
Chloride	na[f]	17,300	455
Manganese	na	4.04	0.124
Molybdenum	na	0.153	0.0093
Nitrate as NO_3[g]	44 mg/L	<0.02	43.8
Potassium	na	381	10.3
Selenium	0.01 mg/L	0.0006	0.0053
Sodium	na	12,500	322
Sulfate	na	10,300	436
Total dissolved solids	1,200 mg/L	na	1028
Uranium	na	3.93	0.041

[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]A "<" indicates that the maximum concentration was below the detection limit (number shown is detection limit)
[d]The values are in units shown under the State Standard column.
[e]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.
[f]not available (standard) or not analyzed (concentration)
[g]Nitrate (as NO_3)" standard was derived from "Nitrate (as N)" standard (10) multiplied by 4.427.

Ground water discharge from the Moab site has caused localized degradation of surface water quality in the Colorado River as evidenced by the analysis of the discharging seep (location 206) and collocated river sample. Apparently the visible sheen at this sample location is not attributable to organic compounds; no volatile or semi-volatile organics were detected in samples from the seep. Discharge of effluent from the sewage treatment plant also has a localized effect on water quality; the highest ammonia and nitrate concentrations in the river were detected at the treatment plant outfall.

5.0 Ground Water Monitoring and Protection 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), which includes an upper fresh to moderately saline facies, an intermediate facies of very saline water, and a lower briny facies. 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.

5.2 Ground 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. While no true ground water samples were collected on the site side of the river in 2003, it is likely that standards for these constituents continue to be exceeded. 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 of ground water sampling in the Matheson Wetlands Preserve indicate high concentrations of chloride, total dissolved solids (TDS), and sulfate. These concentrations are most likely naturally occurring and attributable to brines from the Paradox Formation. Analytical results for 2003 ground water sampling are included in Appendix Table A−3.

While limited ground water sampling was completed in 2003, detailed evaluation and interpretation of new and existing data was performed in developing a site conceptual model for the site. Ground water fate and transport modeling was completed and the potential effects of ground water discharge on surface water quality was evaluated. Results of the data analysis and resulting conceptual site model are presented in the SOWP for the Moab site (DOE 2003d).

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 414.1A, *Quality Assurance,* requirements and refers to documents that implement the QA Program. The *Moab Project Quality Assurance Program Plan* (QAPP) (DOE 2003e) 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 Grand 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.

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.

7.0 References

10 CFR 1021. U.S. Department of Energy, "National Environmental Policy Act Implementing Procedures," *Code of Federal Regulations,* January 1, 2003.

36 CFR 1220. National Archives and Records Administration, "Federal Records; General," *Code of Federal Regulations,* July 1, 2002.
1222. "Creation and maintenance of Federal records."
1228. "Disposition of Federal Records."
1230. "Micrographic Records Management."
1232. "Audiovisual Records Management."
1234. "Electronic Records Management."

40 CFR 61. U.S. Environmental Protection Agency, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations,* July 1, 2003.

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations,* July 1, 2003.
261.2. "Definition of Solid Waste," July 1, 2002.
261.5. "Special Requirements for Hazardous Waste Generated by Conditionally Exempt Small Quantity Generators," July 1, 2002.
370. "Hazardous Chemical Reporting: Community Right-To-Know," July 1, 2003.
761. "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," July 1, 2003.

40 CFR 1500. Council on Environmental Quality, "Purpose, Policy, and Mandate," *Code of Federal Regulations,* July 1, 2003.
1507.3. "Agency Procedures," July 1, 2003.

50 CFR 402. Joint Regulations (U.S. Fish And Wildlife Service, Department of the Interior, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce), "Interagency Cooperation—Endangered Species Act of 1973," *Code of Federal Regulations,* October 1, 2002.

42 U.S.C. 4321, *et seq*., National Environmental Policy Act.

42 U.S.C. 7901 *et seq*., Uranium Mill Tailings Radiation Control Act.

Utah Administrative Code (U.A.C.), Section R307-205, *Emissions Standards: Fugitive Emissions and Fugitive Dust*, Salt Lake City, Utah, September 2001.

———, Section R307-309-4, *Fugitive Dust Control Plan*.

———, Section R313-15-301, *Standards for Protection Against Radiation, Dose Limits for Individual Members of the Public*, Salt Lake City, Utah, September 2001.

Utah Administrative Code (U.A.C.), Section R317-8-3.8, *Utah Pollutant Discharge Elimination System* (UPDES), *Storm Water Discharges*.

———, Section R655, *Natural Resources, Water Rights*.

DOE Order 231.1, *Environment, Safety, and Health Reporting*, 30 September 1995, U.S. Department of Energy, Washington, D.C.

———, 414.1A, *Quality Assurance*, with change 1, 12 July 2001, U.S. Department of Energy, Washington, D.C.

———, 435.1 *Radioactive Waste Management*, 9 July 1999, U.S. Department of Energy, Washington, D.C.

———, 5400.5, *Radiation Protection of the Public and the Environment*, 8 February 1990, U.S. Department of Energy, Washington, D.C.

Atlas, 1996. *Final Reclamation Plan, Atlas Corporation Uranium Mill Tailings Disposal Area,* Atlas Minerals Corporation.

Berry, Claudia, 2003. *Class I Cultural Resource Inventory of Three Alternative Sites for the Department of Energy Moab Project, Grand County, Utah*, Alpine Archaeological Consultants, Inc., Montrose, Colorado; prepared for S.M. Stoller Corp., Grand Junction, Colorado, June.

STO 1. *Quality Assurance Manual*, U.S. Department of Energy, Grand Junction, Colorado, continuously updated.

STO 3. *Site Radiological Control Manual*, U.S. Department of Energy, Grand Junction, Colorado, continuously updated.

STO 9. *Records Management Manual,* U.S. Department of Energy, Grand Junction, Colorado, continuously updated.

STO 10. *Integrated Safety Management System Description*, U.S. Department of Energy, Grand Junction, Colorado, continuously updated.

Lab 5. *Analytical Chemistry Laboratory Administrative Plan and Quality Control Procedures,* continuously updated, U.S. Department of Energy Analytical Chemistry Laboratory, Grand Junction, Colorado.

U.S. Department of Energy (DOE), 1996. *Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project,* DOE/EIS-0198, U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado, October.

———, 2002a. *Moab Project, Moab Mill Site Radiological Assessment Plan*, U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, March.

———, 2002b. *Moab Project Site Fugitive Dust Control Plan,* U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, March.

U.S. Department of Energy (DOE), 2002c. *Moab Project Site Storm Water Pollution Prevention Plan,* U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, May.

———, 2002d. *Waste Management Policy for the Moab Project Site,* U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, August.

———, 2003a. *Floodplain and Wetlands Assessment for Interim Actions at the Moab Project Site*, prepared for the U.S. Department of Energy, Grand Junction Office, May.

———, 2003b. *Moab Project Environmental Air Monitoring Sampling and Analysis Plan*, GJO-2001-274-TAC, U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, March.

———, 2003c. *Moab Project Site Health and Safety Plan,* Rev. 3, GJO-2002-389-TAC, U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, February.

———, 2003d. *Site Observational Work Plan for the Moab, Utah, Site,* GJO-2003-424TAC, prepared by S.M. Stoller Corporation under DOE Contract No. DE−AC13−02GJ79491, for the U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, December.

———, 2003e. *Moab Project Quality Assurance Program Plan,* MOA-1.2-1, U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, March.

———, 2004. *Evaluation of September 2003 Preliminary Performance Data for the Interim Action,* Calc. No. Moab-02-2004-01-07-00, February.

U.S. Environmental Protection Agency (EPA), Executive Order 11988, *Floodplain Management* Superfund Amendments and Reauthorization Act, Title III; Executive Order 12856 *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*.

U.S. Nuclear Regulatory Commission (NRC), 1999. *Final Environmental Impact Statement Related to Reclamation of the Uranium Mill Tailings at the Atlas Site, Moab, Utah*, NUREG-1531, Office of Nuclear Materials Safety and Safeguards, Washington, D.C., March.

Appendix A

Water Monitoring Data

Table A-1. Surface Water Chemical Data Crosstab

Sample Location	Sample Date	ALK (mg/L)	B (mg/L)	Ba (mg/L)	Cd (mg/L)	Chloride (mg/L)	Density (g/cm3)	DO (mg/L)	EC (umhos/cm)	K (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	NH3+NH4 As N (mg/L)	NO3 (mg/L)	Organics (ug/L)	ORP (mV)	pH (s.u.)	Se (mg/L)	SO4 (mg/L)	TDS (mg/L)	Temp (C°)	Turbidity (NTU)	U (mg/L)
0206	01/30/2003	678	1.74	0.0617	0.00039	17300	--	--	52460	381	4.04	0.153	12500	2.166	<0.020	See Table	-107	7.87	0.00064	10300	--	11.71	467	3.93
0207	01/30/2003	156	0.105	0.0571	<0.0001	455	--	--	2480	10.3	0.124	0.0093	322	5.846	4.85	See Table	-46	8.63	0.0053	436	--	5.28	12.8	0.041
0208	03/13/2003	187	--	--	--	55	0.9983	10.7	860	--	--	--	--	0.03	5.3	--	159	6.74	--	276	633	7.1	11.7	0.0039
0209	03/13/2003	197	--	--	--	62	0.9982	3.1	704	--	--	--	--	10	43.8	--	-112	6.84	--	107	461	14.2	55.2	0.0013
0210	03/13/2003	129	--	--	--	27	0.9982	9.38	667	--	--	--	--	0.01	<0.5	--	120	6.52	--	165	404	18	5.71	0.0028
0211	03/13/2003	192	--	--	--	11	0.9983	3.45	532	--	--	--	--	0.11	<0.5	--	122	7.95	--	80	293	7.6	13.8	0.0015
0213	03/14/2003	160	--	--	--	145	0.9986	8.18	968	--	--	--	--	0.08	<0.5	--	196	7.34	--	75	532	13.4	19.1	0.011
0215	03/14/2003	158	--	--	--	256	0.9981	4.05	1515	--	--	--	--	0.11	5.5	--	132	7.98	--	304	1028	15.3	137	0.0061

"<" indicates that the maximum concentration was below the detection limit (number shown is detection limit).

"--" indicates no data.

Analyte abbreviations ALK, DO, EC, ORP are Total Alkalinity (as CaCO3), Dissolved Oxygen, Specific Conductance, Oxidation Reduction Potential, respectively.

"See Table" indicates that the reader should refer to Table A-2 for a list of detected constituents.

Table A-2. Surface Water Organics Detected

Sample Location	Sample Date	Analyte Name	Concentration (µg/L)	Category
0206	1/30/2003	(Carbethoxyethylidine)triphenylphosphora	6.4NJ	Semivolatile
	1/30/2003	4-Hydroxy-4-methyl-2-pentanone	4.8BNJ	Semivolatile
	1/30/2003	Unknown	5.7J	Semivolatile
	1/30/2003	Unknown	9.4J	Semivolatile
	1/30/2003	Unknown	10.1J	Semivolatile
0207	1/30/2003	4-Hydroxy-4-methyl-2-pentanone	11.6BNJ	Semivolatile
	1/30/2003	Ethyl Acetate	36.3BNJ	Semivolatile
Laboratory result qualifiers:				
"B" Analyte also found in method blank.				
"J" Indicates an estimated value.				
"N" Tentatively identified compound (TIC).				

Table A-3. Ground Water Chemical Data Crosstab

Sample Location	Sample Elevation	Sample Date	ALK (mg/L)	Chloride (mg/L)	Density (g/cm3)	DO (mg/L)	EC (umhos/cm)	NH3+NH4 As N (mg/L)	NO3 (mg/L)	ORP (mV)	pH (s.u.)	SO4 (mg/L)	TDS (mg/L)	Temp (C°)	Turbidity (NTU)	U (mg/L)
0545	4007.43	04/02/2003	--	1200	1.0073	1.14	11650	200	58	-121	6.73	5240	10307	14.1	--	1.866
0546	4005.67	04/02/2003	--	206	1.0475	1.63	50350	3700	1621	171	4.69	40100	54299	14.8	--	3.976
M11-12	3923.64	03/12/2003	448	2550	1.0008	0.08	8548	0.35	<50	-140	7.44	614	5508	14	17.7	0.001
M11-14.0	3920.03	03/12/2003	233	17200	1.0195	0.26	43695	1.19	<50	-138	7.06	2000	31214	15.2	8.1	0.0009
M11-4.8	3950.12	03/12/2003	650	1620	1.0013	0.22	7792	0.46	<50	-136	6.98	1440	5493	17.08	9.28	0.0037
M11-7.0	3945.38	03/12/2003	610	1320	0.9999	1.48	6143	0.48	<50	-101	7.03	995	4234	15.2	2.19	0.0044
N7-10	3929.64	03/13/2003	179	24300	1.0282	0.13	59705	1.28	<50	-184	7.03	2340	43761	11.35	9.32	0.0028
N7-11	3927.51	03/13/2003	--	52400	1.0645	0.24	111287	3	<5000	-45	5.7	5270	97014	8.73	95.6	0.0007
N7-7	3941.6	03/13/2003	329	905	0.9988	6.64	3381	1.27	<50	-112	6.88	336	2246	8.78	105	0.001
W1-10	3931.56	03/18/2003	--	23000	1.0277	1.51	59190	3	<1250	-55	6.27	2360	40906	11.7	373	0.0159
W1-4.3	3955.06	03/12/2003	140	30200	1.036	1.84	68050	0.32	<50	206	6.37	2920	53281	15.6	48.3	0.0016
W1-7	3941.36	03/12/2003	235	27100	1.0357	0.34	66470	0.27	<50	-45	6.41	2900	52380	16.8	3.23	0.0192
"<" indicates that the maximum concentration was below the detection limit (number shown is detection limit).																
"--" indicates no data.																
Analyte abbreviations ALK, DO, EC, ORP are Total Alkalinity (as CaCO3), Dissolved Oxygen, Specific Conductance, Oxidation Reduction Potential, respectively.																