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Moab Project

Annual Site Environmental Report for Calendar Year 2002

September 2003

Prepared for U.S. Department of Energy Grand Junction Office
under DOE Contract Number DE–AC13–02GJ79491.
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U.S. Department of Energy
Moab Site

Annual Site Environmental Report for Calendar Year 2002

September 2003

Prepared by
U.S. Department of Energy
Grand Junction Office
Grand Junction, Colorado

Work Performed Under DOE Contract No. DE−AC13−02GJ79491

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Acronyms

ACM	asbestos-containing-material
BMPA	best management practice area
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
MEI	maximally exposed individual
mrem	millirem
mrem/yr	millirem per year
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act
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
RRM	residual radioactive materials
SARA	Superfund Amendments and Reauthorization Act
SWP^3	Storm Water Pollution Prevention Plan
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 2002 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 Grand Junction Office (GJO). S.M. Stoller Corporation, the Technical Assistance Contractor for DOE−GJO, 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 2002. This report applies specifically to the Moab site and is DOE's first annual Site Environmental Report for the Moab site since DOE took possession of the property in October 2001.

As of January 2002, DOE had been in possession of the Moab site for a little over two months. As the new custodian of this property, one of DOE's first actions at this site 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 2002 included site management and public affairs; site security, stabilization, and maintenance actions; site assessment and characterization; waste management and minimization; and environmental compliance and monitoring (air, surface, and ground water). All activities performed at the Moab site during 2002 were conducted in compliance with applicable federal, state, and local regulations and requirements, and with applicable DOE orders.

During calendar year 2002, 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 2002

Significant highlights, accomplishments, and activities conducted by DOE at the Moab site during 2002 are as follows:

Site Management and Public Affairs

- Initiated stakeholder/public involvement meetings.
- Established the Moab Project web page.
- Participated in meetings with the National Academy of Sciences to evaluate the long-term disposition of the millsite and the associated tailings.
- Initiated the National Environmental Policy Act (NEPA) process for evaluating various remedial action and disposal site alternatives and their associated environmental

impacts. Began preparation of the draft Environmental Impact Statement for remediation of contaminants associated with the former millsite, vicinity properties, and ground water.

Site Security, Stabilization, and Maintenance

- Established 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 Atlas property in October 2001, the entire site was in an overall state of disrepair. DOE immediately initiated general "housekeeping" activities 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.).
- Established 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 a second pump in the river diversion structure to supply water for on-site dust suppression activities.

Site Assessment and Characterization

- Conducted extensive field assessment, characterization, survey, and mapping of on-site soil contamination areas.

Waste Management and Minimization

- Initiated the inventory process to catalogue on-site legacy chemicals (i.e., chemicals left on site that were associated with operation of the Atlas analytical chemistry and assay laboratories).
- Recycled 10 used batteries in August 2002.
- Disposed of 13 compressed gas cylinders in October 2002.
- Constructed 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.
- Re-packaged asbestos wastes (three 55-gallon drums of old floor tiles) and placed into the BMPA.
- Consolidated miscellaneous liquid wastes (e.g., used oils, lubricants, fire retardants, hydraulic fluids, equipment rinsates) into the BMPA. A total of 40 containers with volumes ranging from 5 to 55 gallons were placed on pallets inside the BMPA.

Environmental Compliance

- Prepared a *Fugitive Dust Control Plan* and submitted to State of Utah.
- Prepared a Notice of Intent for storm water discharges and a *Storm Water Pollution Prevention Plan* specific to the Moab site.
- Transferred various water rights from Moab Mill Reclamation Trust to DOE.
- Initiated 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.
- Prepared a *Floodplain and Wetlands Assessment* report (March 2002).
- Prepared three NEPA Environmental Checklists which resulted in separate categorical exclusions 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

- Prepared the *Environmental Air Monitoring Sampling and Analysis Plan* (March 2002).
- Established the environmental air monitoring network and began collecting radon, direct gamma radiation, and radioparticulate data from the Moab site, the surrounding community, and background locations.
- Installed a meteorological monitoring station at the Moab site to assist in determining public and environmental exposures.
- Developed a quarterly environmental air monitoring report and began posting the environmental air monitoring data on the GJO website.

Ground Water and Surface Water Monitoring

- Conducted ground water monitoring and field investigations throughout 2002.
- Prepared various technical reports associated with characterization of ground water conditions and contaminants (e.g., calculation sets, sensitivity analyses, data validation packages).
- Installed 25 ground water monitor wells during 2002.

Compliance Summary for Calendar Year 2002

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 constituents with concentrations that are most consistently elevated in the Colorado River are ammonia and uranium.

The alluvial aquifer beneath the Moab site has been contaminated from former uranium milling operations. Ground water standards for arsenic, cadmium, molybdenum, net alpha, nitrate, radium-226 + radium-228, selenium, and uranium were exceeded in samples collected from one or more wells in 2002. Ground water samples were collected and analyzed for volatile organic compounds, semivolatile organic compounds, herbicides, pesticides, and polychlorinated biphenyls. With the exception of a low concentration of one herbicide, all target organic results were below their respective detection limits.

Environmental Air Monitoring

During 2002, DOE implemented an environmental air monitoring strategy that 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 2002, DOE's monitoring data indicated 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 suggest 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 maximally exposed individual location, 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 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.

On-site fugitive dust emissions were maintained below the State standard for opacity (i.e., fugitive dust emissions cannot exceed 20-percent opacity), and are controlled through 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 2002. DOE's radioparticulate monitoring targeted specific radionuclides that are common constituents of uranium mill tailings. Radioparticulate monitoring data collected at all sampling locations during 2002 were below the 10 mrem/yr emissions limit.

In summary, environmental data collected for direct gamma radiation and radioparticulate air emissions during 2002 were below the public dose limits applicable to the Moab site at all off-site monitoring locations.

Waste Management/Minimization

During 2002, DOE evaluated the nature and extent of legacy wastes (waste left behind by previous site operators) and began the process of managing these wastes to better protect the public, site workers, and the environment.

Legacy wastes evaluated and managed at the Moab site in 2002 included laboratory chemicals, industrial products, used petroleum products, fire retardants, asbestos, vehicle batteries, and compressed gas cylinders. Many of these legacy wastes were considered potentially radioactively contaminated and remained stored within the boundaries of the Moab site's contaminated area at the end of 2002. The laboratory chemicals and industrial products were better isolated within the site's warehouse/shop building; plans were made to procure a hazardous waste disposal contractor in 2003 to facilitate the off-site disposal of as many of these materials as possible. The used petroleum products, fire retardants, and asbestos were placed in more secure containerized storage within the BMPA. Nonradioactive wastes, such as vehicle batteries and compressed gas cylinders, were either recycled or properly disposed of at off-site facilities.

Distribution of this Document

This document may be viewed in its entirety at the DOE–GJO website at http://www.gjo.doe.gov. Hard copies may be obtained by contacting Mr. Joel Berwick, DOE Project Manager (970-248-6020), 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−GJO 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.

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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 soils taken from the site outside the pile area. Debris from dismantling the mill buildings and associated structures was placed in an area at the southern toe of the pile and 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. Tailings contaminants 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.

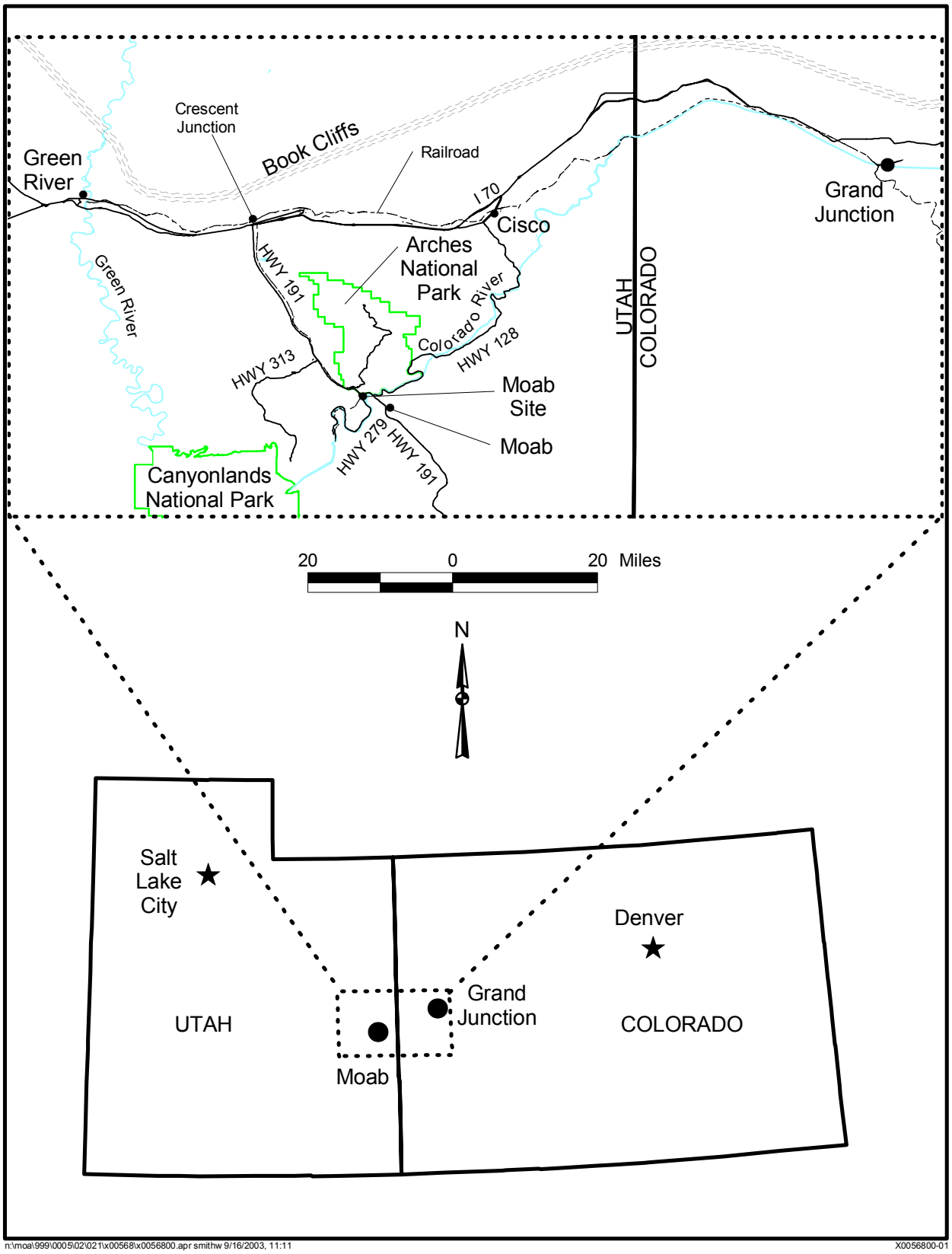

Figure 1–1. Location of the Moab Site

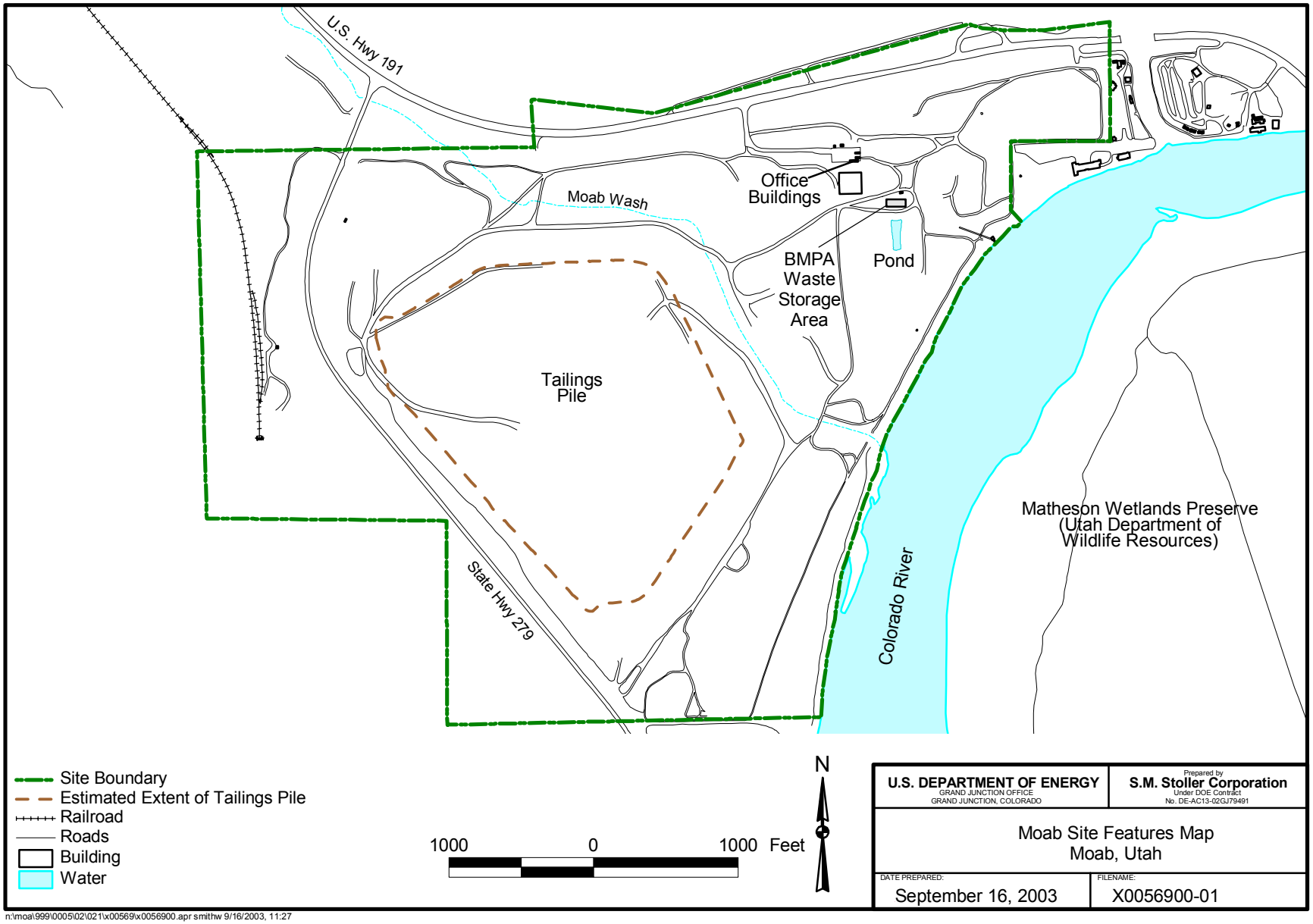

Figure 1–2. Moab Site Features Map

Besides tailings and contaminated soils, 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 are also present on 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 the Atlas Minerals Corporation under a license issued by the U.S. Nuclear Regulatory Commission (NRC). The processing facility, which was used to process 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 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 initiated internal scoping activities associated with preparation of a draft EIS during 2002. 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. During 2002, DOE designed a ground water extraction system, implemented in the summer of 2003, to intercept ground water contaminants discharging to the Colorado River and thereby reduce 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. In an effort to establish clear lines of communication with these stakeholders, DOE sponsored several public information meetings during 2002 and will continue these efforts into the future.

Specific comments or questions regarding the Moab site and DOE's activities may be directed to Mr. Joel Berwick, DOE Project Manager, at (970) 248-6020. Interested individuals may also submit comments via e-mail to the following address: moabcomments@gjo.doe.gov, or they may call the DOE Grand Junction Office (GJO) 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−GJO's activities at the Moab site. This report will summarize environmental activities conducted at the Moab site during calendar year 2002, environmental monitoring data collected during 2002, and noteworthy milestones and accomplishments. This report is structured as follows:

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

End of current text

2.0 Compliance Summary

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

2.1 Compliance Status

The Moab site operated during calendar year 2002 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). 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 has addressed the NAS recommendations and initiated internal scoping activities associated with preparation of a draft EIS. DOE is required by NEPA to prepare an EIS to assess the potential environmental impacts of remediating the Moab site. The final Plan for Remediation will be incorporated into DOE's final EIS.

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 hazard associated with this material was known). UMTRCA also directed EPA to promulgate cleanup standards (now codified at 40 CFR 192) and assigned NRC to oversee the cleanup and license the completed disposal cells.

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 (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 guidance is provided in *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements* (DOE 1993). Generally, for each Title I uranium-ore processing site, DOE prepared site-specific NEPA documentation (either an environmental assessment or an EIS) to address surface remediation at the site (i.e., cleanup of tailings, residual processing materials, soil, and buildings). Ground water cleanup was not a consideration in these planning documents.

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 in 1997.

The PEIS used a framework to determine the appropriate compliance strategies for ground water cleanup 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. The preferred alternative provides three basic options for achieving compliance with ground water standards: no remediation, natural flushing, or active remediation. The standards that may be met include background, maximum concentration limits (as stipulated in 40 CFR 192, subpart A), alternate concentration limits, or supplemental standards. The applicable standards are determined on a site-specific basis.

Because remediation of the Moab site is a major federal action that is subject to the requirements of NEPA, DOE is preparing an EIS to evaluate the remedial alternatives for the Moab site that will achieve the RRM cleanup and control standards as outlined by UMTRCA. DOE began preparation of the EIS in 2002 and is expected to select a remedial alternative and issue a Record of Decision by December 2004.

In compliance with NEPA, DOE also prepared three environmental checklists which resulted in separate categorical exclusions during 2002 for current, 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 2002, all activities and operations at the Moab site were conducted in compliance with applicable NEPA requirements.

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 2002c). This plan outlines specific areas of the Moab site that are particularly vulnerable to wind erosion, and describes the engineering controls DOE has implemented at the site to control fugitive dust emissions.

As required by state regulations, DOE provided a copy of the Moab *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.

Radon

During 2002, DOE initiated an 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 regulations in 40 CFR 61. DOE has reviewed the applicability of the various subparts (Subparts Q, and T) of the National Emission Standards for Hazardous Air Pollutants regulations and has determined that none of them are directly applicable to the Moab site. 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 2002 indicate that radon concentrations are elevated above this guideline at several 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 2002, 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 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 2002 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 2002.

As with the radon data for calendar year 2002, the direct gamma radiation monitoring data also indicate that direct gamma radiation levels are elevated at several 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 2002.

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 in 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 sources 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 2002d). 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. A copy of the SWP^3 is 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.

Heavy rains received in September 2002 resulted in some storm water damage at the site, including the washing out of a road crossing in Moab Wash. To keep the road accessible, it was repaired with culverts so it would not be susceptible to subsequent storm water flows in the wash. A check dam was also installed downstream of the road crossing to slow the water and trap additional sediment before the water reaches the river. As a result, these actions serve to minimize the discharge of sediment and on-site contaminants to Moab Wash and the Colorado River.

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*

In February 2002 potential wetlands at the Moab site were investigated by DOE contractors. Several areas of jurisdictional wetlands were delineated along the Colorado River that contain wetland plants and soils. Seedling tamarisk is the predominant plant in these wetland areas; other wetland plants include saltgrass *(Distichlis spicata)*, cattail *(Typha sp.)*, rush (*Juncus sp.*), bulrush *(Scirpus sp.)*, spikerush (*Eleocharis sp.*), redroot flat sedge (*Cyperus erythrorhizos*), and sandbar willow (*Salix exigua*). These wetland delineations were completed to ensure DOE compliance with state and federal wetland regulations during site activities.

DOE acquired a Clean Water Act Section 404 permit and a Utah streambank alteration permit in February 2002 to install a stilling well along the Colorado River. In April 2002, plans were made to install an intake structure in the river to pump water from the river to an area of critical fish habitat to dilute the concentration of contaminants in ground water discharging into the river. Section 404 and streambank alteration permits were obtained for this action, and the intake structure was installed. However, due to low flows in the river in 2002, this action was never performed (flows need to be at least 5,000 cubic feet per second to reach the critical fish habitat area).

Another action in 2002 was the maintenance of the water intake for the on-site holding pond. Water in this pond is used for site activities such as dust control and equipment washing and is pumped periodically from the Colorado River. The intake was silted and excess sediment was removed from the intake and placed on the riverbank in the same area where silt removed during previous intake maintenance events had been placed.

At the request of the USF&WS, DOE installed a 1/4-inch mesh screen over the river intake to minimize harm to "young-of-year" fish.

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*

All waste storage, management, and disposal activities at the Moab site during 2002 were conducted safely, without incident. DOE recycled 10 spent lead-acid batteries that were left behind by the former operators of the millsite. The batteries were free of radioactive contamination and were recycled at a local outlet for used batteries. DOE also disposed of 13 compressed gas cylinders that were left behind by the former operators of the millsite. The cylinders were free of radioactive contamination and were disposed of through an approved waste gas cylinder disposal contractor.

2.1.9 Waste/Legacy Chemical Management

Approximately 1,400 containers of chemicals were left behind by the former operator of the site. DOE inventoried these wastes and segregated them for safe storage. As a best management practice, all non-radiologically contaminated chemical wastes were shipped off-site for disposal. If it is determined that any item is radiologically contaminated, it is treated as RRM.

Approximately 900 containers (ranging in quantities from 10 grams to 55-gallons) of various legacy chemicals and industrial products remain stored at the Moab site in the warehouse/shop building or the BMPA. These materials could not be disposed of off-site with other legacy chemicals and industrial products in February 2003 because these materials may be radiologically contaminated. These wastes will 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. During 2002, vinyl asbestos floor tiles located in barrels adjacent to the warehouse/shop building were placed in sealed containment and safely stored in the BMPA. It is suspected that PCB wastes are currently 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 2002, 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 2002 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.

Based on the inventory of legacy chemicals that remain stored at the Moab site, DOE determined that and none exceeded the threshold planning quantities that would necessitate chemical inventory reporting according to SARA Title III regulations. Although not required, 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 USF&WS, ensures that any action it authorizes is not likely to jeopardize the continued existence of any listed species or its habitat. 50 CFR 402 sets forth the regulations that implement the Endangered Species Act.

NRC, in consultation with the USF&WS, identified four aquatic and two avian threatened or endangered wildlife species 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. Other species were identified for consideration;

however, they do not occur within the vicinity of the site or are they not currently listed species. The species list will be re-evaluated and updated in subsequent documents and may vary depending upon the location of proposed interim actions and remediation alternatives.

A Biological Assessment was completed in 1995 and a Final Biological Opinion was issued by the USF&WS in 1998. 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. Informal consultation has also been ongoing with the USF&WS for various interim actions to ensure protection of threatened and endangered species and critical habitat since the site was placed under DOE control.

2.1.13 Executive Order 11988, *Floodplain Management*

DOE regulation 10 CFR 1022 implements the requirements of Executive Orders 11988, *Floodplain Management,* and 11990, *Protection of Wetlands,* for actions that may affect these areas. The NRC's EIS (NRC 1999) states that a portion of the Moab site falls within the 100-year floodplain. DOE's draft EIS will address potential wetlands that may exist within and adjacent to the site. A Floodplain/Wetland Assessment will be required prior to the implementation of interim or remedial actions.

Tamarisk on the floodplain was characterized in spring 2002 by DOE contractors to define the role of the plants in removing contaminated ground water in the floodplain. Vegetation transects were established, and data on percent cover, plant vigor, and production were gathered to estimate existing and potential transpiration rates, and how much water the tamarisk were using.

As discussed in Section 2.1.5, a significant storm event occurred at the Moab site in September of 2002. Maintenance actions were conducted to repair damage to site roads, culverts, and crossings along Moab Wash. The repairs were conducted in the floodplain and included the construction of berms, drainage ditches, check dams, and sediment traps. These actions were necessary to prevent the loss of sediment and to minimize erosion and discharges of storm water runoff from the site.

2.1.14 Safe Drinking Water Act

The provisions of the Safe Drinking Water Act (40 CFR 141−143) are not directly relevant to the Moab site because neither ground water nor surface water at or near the site is used as a public drinking water supply. DOE did not engage in any activities that affected drinking water supply sources; therefore, the requirements of this statute are not applicable to the activities occurring at the Moab site during calendar year 2002.

2.1.15 National Historic Preservation Act

Most of the Moab site has not yet been inventoried for cultural resources. It is unlikely that cultural resources of significant value are present on the site because of its highly disturbed condition. However, several of the less-disturbed areas of the site, particularly along U.S. Highway 191 in the northern portion of the site and on the steep cliff areas in the western and southwestern portions, may contain cultural resources. The on-site mill building, although less than 50 years old, may qualify as a historical structure for its representation of a "major historical theme or era." Remains of an old log structure were discovered in the northeast portion of the

site during 2002. A professional archaeologist has not yet assessed this structure to determine its historical significance. DOE will continue protect this structure until such an evaluation and subsequent recommendations can be made.

In 2002, a cultural resource inventory for areas surrounding four well locations along the U.S. Highway 191 corridor and Colorado River was completed (Patterson 2002) prior to installing the monitor wells. One cultural site eligible for inclusion in the National Register of Historic Places was found within the boundaries of the site.

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. During 2002, all water rights associated with the former Atlas millsite were transferred to DOE. 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. 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 2002.

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 2002 related to environmental compliance include emergency management, the "as low as reasonably achievable" (ALARA) program, hazard communication, confined-space entry, and all elements of the analytical laboratory quality systems.

2.2.1 Summary of Moab Site Permits

Table 2−1 shows the types of permits that were active at the Moab site during 2002.

Table 2–1. Types of Permits Active in 2002 at the Moab Site

Type of 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 Permits	State of Utah, Department of Natural Resources, Division of Water Rights	25[a]
EPA Hazardous Waste Generator Identification Number (UTP 000001244)	EPA	1
Section 404 Nationwide Permit (permit number 200275165, dated 7/1/02; issued for construction of the ground water initial action intake structure)	U.S. Army Corps of Engineers	1

[a]These are monitor wells installed by DOE during 2002 that exceeded 30 ft in depth. This 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−GJO 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 2003b), the *GJO Site Radiological Control Manual* (GJO 3), and the *GJO Integrated Safety Management System Description* (GJO 10).

3.1 Environmental Air Monitoring

During 2002, DOE initiated environmental air-emissions monitoring at the Moab site to assess the potential for radiation dose to members of the public that could result from site operations, and to demonstrate compliance with applicable radon concentration guidelines established by DOE 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. Table 3−1 summarizes the types of data collected at the various monitoring locations.

Table 3–1. Summary of On-site and Off-site 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
MEI	Maximally Exposed Individual-Caretaker Housing at Tex's River Tours	Rn

Summary:

Total on-site monitoring stations:	16
Total off-site monitoring stations:	7[a]
Total radon monitoring stations:	23[a]
Total gamma monitoring stations:	23[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 on 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 2002, atmospheric radon was measured at 23 locations (16 on-site locations and seven 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−GJO'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 closest to the Moab site (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.

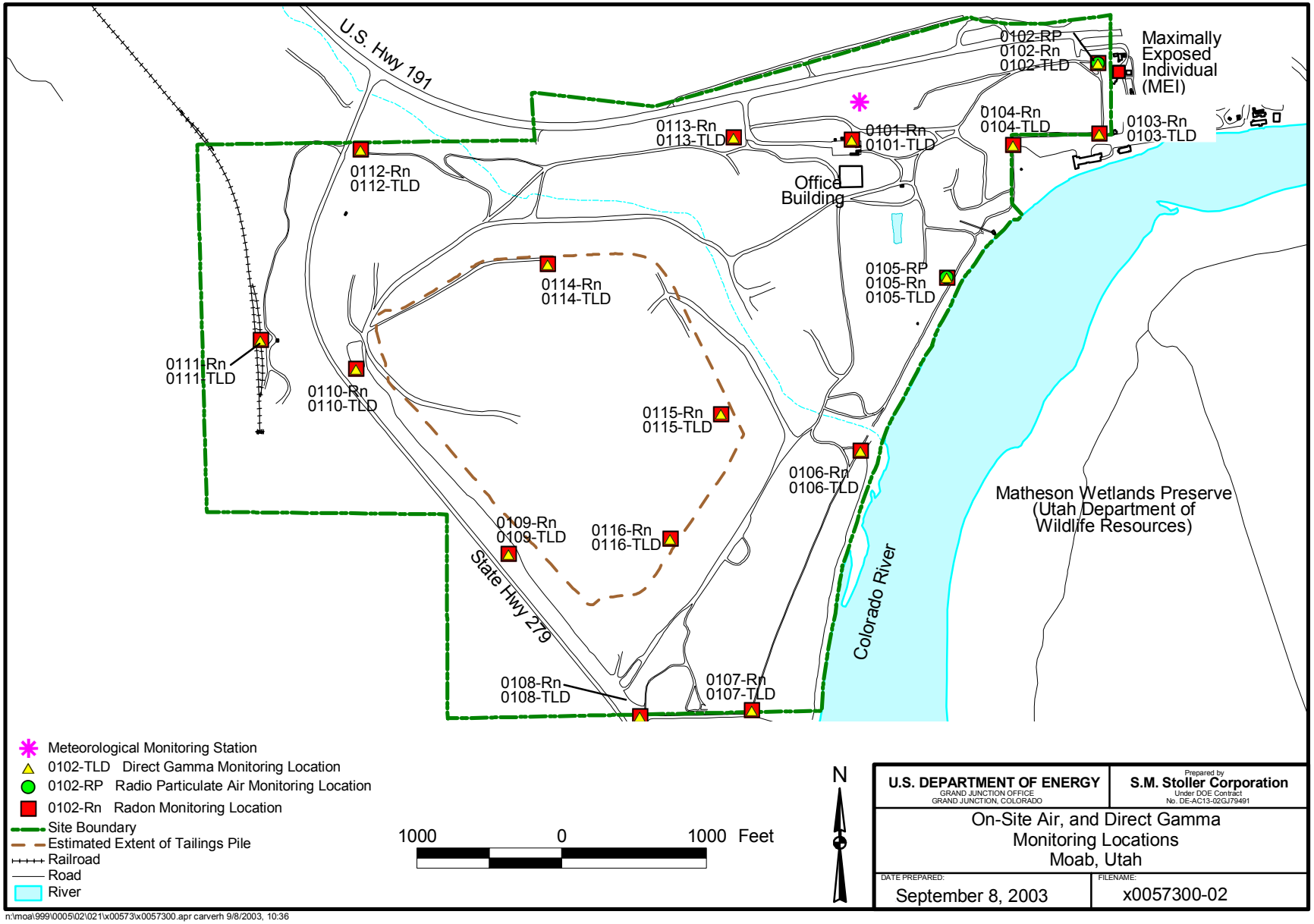

Figure 3–1. On-Site Air and Direct Gamma Monitoring Locations

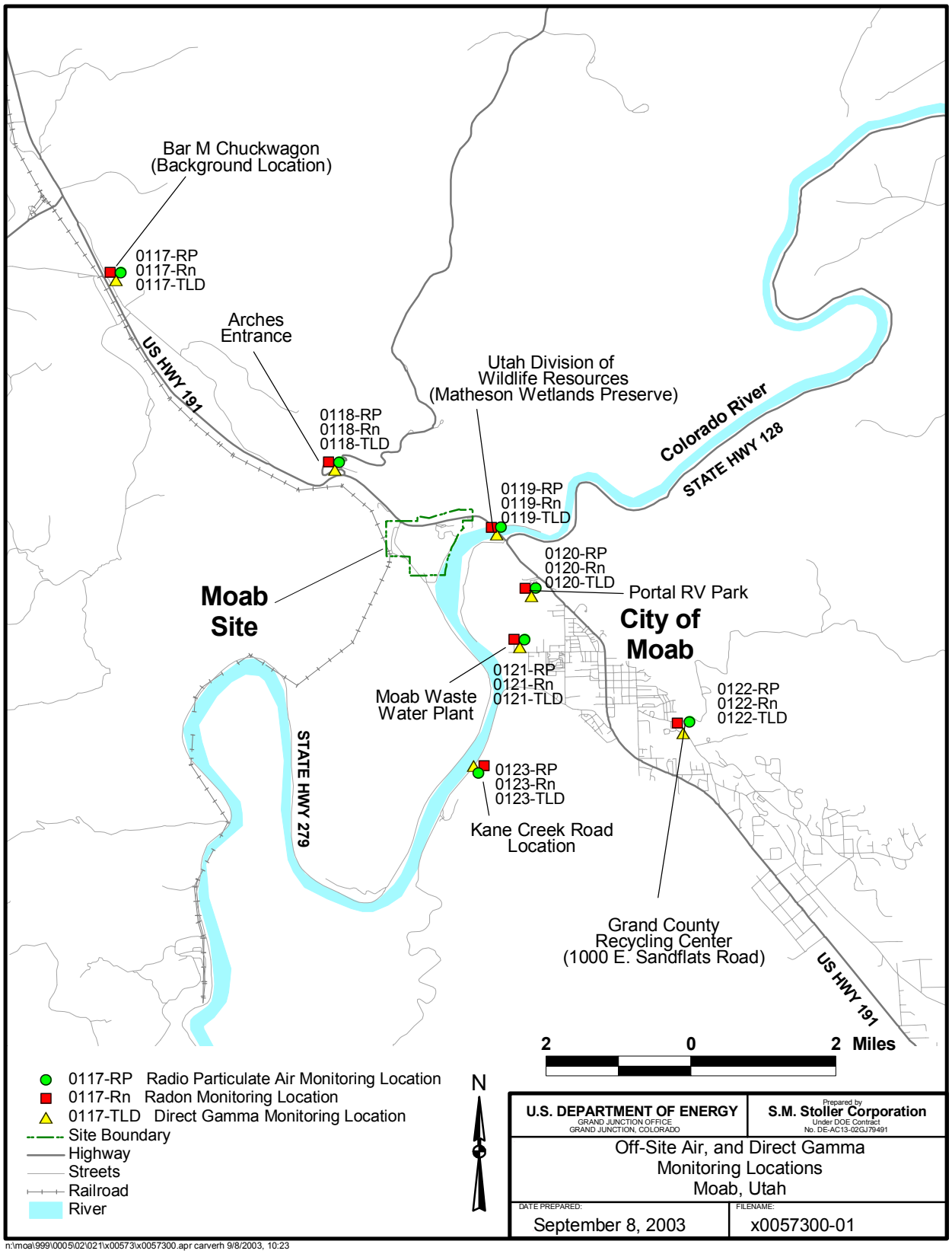

Figure 3–2. Off-Site Air and Direct Gamma Monitoring Locations

Direct gamma radiation monitoring is conducted to assess the potential gamma radiation dose to persons on and near the Moab site. During 2002, direct gamma radiation was measured at 23 locations (16 on-site locations and seven 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−GJO'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 2002, 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 monthly 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−GJO's website on a quarterly basis. The analytical data (the annual average values) are then compared with DOE's DCGs (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. To ensure compliance with this standard, a current, certified opacity reader (certified according to EPA Method 9 requirements) shall be present during all construction activities. 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 R307-309-4, *Fugitive Dust Control Plan*, of the U.A.C.), DOE prepared the *Moab Project Site Fugitive Dust Control Plan* (DOE 2002c). 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 and "fine-tuning" 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. Surface water monitoring in 2002 was conducted at various locations on the Colorado River upstream, adjacent to, and downstream of the site (Figure 3−3). The goals of the surface water monitoring program in 2002 were to establish baseline water quality conditions in the Colorado River and to characterize the impacts to river water quality from the discharge of contaminated alluvial ground water. Characterization of the types and distribution of contaminants discharging to the Colorado River is necessary to develop a conceptual site model, which will be used to make decisions regarding remedial action for the ground water. The results of this characterization effort will be detailed in forthcoming project documents (e.g., Site Observational Work Plan and EIS).

A summary of the surface water sampling conducted in 2002 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 2002 are shown in Figure 3−3.

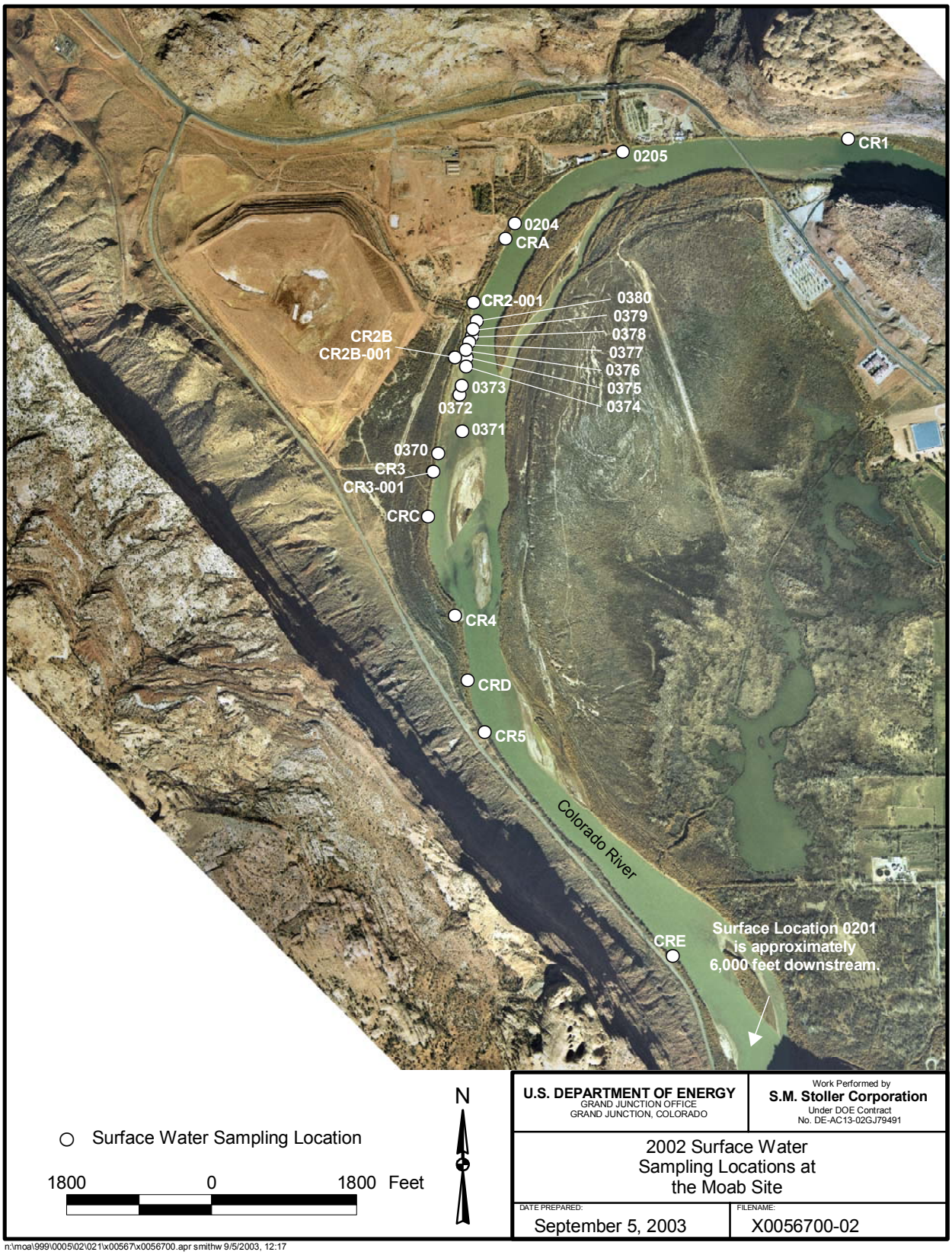

Figure 3–3. Surface Water Monitoring Locations Upstream, Adjacent to, and Downstream of the Moab Site for 2002

Table 3–2. Summary of 2002 Surface Water Sampling Events

Date	Type	Area	Location ID	Analytes[a]
March	Colorado River	Upstream from site	CR1	Ag, As, B, NH_3 as N, Ca, Cd, Cl, Cr, Cu, Fe, Gross alpha, Gross Beta, Hg, Mg, Mn, Mo, Ni, NO_3, K, Na, Pb, Pb-210, Po-210, Ra-226, Ra-228, Th-230, Sb, Se, SO_4, Sr, TDS, Tl, U, V, Zn
	Colorado River	Adjacent to site	CR2, CR2-001, CR2B, CR2B-001, CR3, CR3-001, CRA, CRC	
	Colorado River	Downstream from site	CR4, CR5, CRD, CRE, 0201	
May	Colorado River	Upstream from site	CR1	Ag, As, NH_3 as N, Ca, Cd, Cl, Cr, Cu, Fe, Gross alpha, Gross Beta, Hg, Mg, Mn, Mo, Ni, NO_3, K, Na, Pb, Pb-210, Po-210, Ra-226, Ra-228, Th-230, Sb, Se, SO_4, Sr, TDS, Tl, U, V, Zn
	Colorado River	Adjacent to site	CR2, CR2-001, CR2B, CR2B-001, CR3, CR3-001, CRA, CRC	
	Colorado River	Downstream from site	CR4, CR5, CRD, CRE, 0201	
August	Colorado River	Upstream from site	CR1	Ag, Al, As, B, Ba, NH_3 as N, Ca, Cd, Cl, Co, Cr, Cu, F, Fe, Gross alpha, Gross Beta, Li, Mg, Mn, Mo, Ni, NO_3, K, Na, Pb, Pb-210, Po-210, PO_4, Ra-226, Ra-228, Rn-222, Th-230, Sb, Se, SO_4, Sr, TDS, Tl, TOC, U, U-234, U-238, V, Zn
	Colorado River	Adjacent to site	CR2, CR2-001, CR2B, CR2B-001, CR3, CR3-001, CRA, CRC	
	Colorado River	Downstream from site	CR4, CR5, CRD, CRE, 0201	
December	Colorado River	Upstream from site	CR1, 0205	Ba, B, Cl, Gross alpha, Gross Beta, Mn, Mo, NH_3 as N, Se, Sr, SO_4, TDS, U
	Colorado River	Adjacent to site	CR2, CR2-001, CR2B, CR2B-001, CR3, CR3-001, CRA, CRC, 0204	
	Colorado River	Downstream from site	CR4, CR5, CRD, CRE, 0201	

[a]Complete analyte list; not all locations were sampled for all analytes. Field measurements are not included.

3.2.2 Ground Water

The ground water monitoring program in 2002 consisted of collecting a variety of characterization data to support development of a conceptual site model that will be used to make decisions related to remedial action of the contaminated ground water beneath the site. Activities related to the development of the conceptual site model included ground water sampling and analysis, water level measurements, aquifer pumping tests, well installation, depth discrete salinity monitoring, and ground water modeling. Investigations were conducted to characterize the spatial distribution of the brine interface in the alluvial aquifer and to determine the response of the brine interface to pumping of the aquifer. The results of this characterization effort will be detailed in forthcoming project documents (e.g., Site Observational Work Plan and EIS).

A summary of the ground water sampling conducted in 2002 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 2002 are shown in Figure 3−4.

Table 3–3. Summary of 2002 Ground-Water Sampling Events

Date	Area	Formation	Well ID	Analytes[a]
March	Upgradient	Alluvium	AMM-1	Ag, As, B, NH_3 as N, Ca, Cd, Cl, Cr, Cu, Fe, Gross alpha, Gross Beta, Hg, Mg, Mn, Mo, Ni, NO_3, K, Na, Pb, Pb-210, Po-210, Ra-226, Ra-228, Th-230, Sb, Se, SO_4, Sr, TDS, Tl, U, V, VOCs, Zn
	On site	Alluvium	AMM-2, AMM-3, ATP-2-S, MW-3, TP-01, TP-02, TP-07, TP-08, TP-09	
	Crossgradient	Alluvium	N2-12.8, W1-4.3	
May	Upgradient	Alluvium	AMM-1, RW-01	Ag, As, NH_3 as N, Ca, Cd, Cl, Cr, Cu, Fe, Gross alpha, Gross Beta, Hg, Mg, Mn, Mo, Ni, NO_3, K, Na, Pb, Pb-210, PCBs, Herbicides, Pesticides, Po-210, Ra-226, Ra-228, Th-230, Sb, Se, Semi VOCs, SO_4, Sr, TDS, Tl, U, V, VOCs, Zn
	On site	Tailings	PW-11, PW-4-OB-A	
		Alluvium	AMM-2, AMM-3, MW-3, TP-01, TP-02, 0410, 0412, 0413, 0414, ATP-2-S, TP-07, TP-08, TP-09, EE-3, SMI-PZ3M, SMI-PZ3S, SMI-PZ3D2	
August	Upgradient	Alluvium	AMM-1, RW-01	Ag, Al, As, B, Ba, NH_3 as N, Ca, Cd, Cl, Co, Cr, Cu, F, Fe, Gross alpha, Gross Beta, Mg, Mn, Mo, NO_3, K, Li, Na, Pb, Pb-210, Po-210, PO_4, Ra-226, Ra-228, Rn-222, TOC, Th-230, Sb, Se, SO_4, Sr, TDS, Tl, U, U-234, U-238, V, Zn
		Bedrock	0430, 0432, 0434	
	On site	Alluvium	AMM-2, AMM-3, MW-1-R, ATP-2-S, ATP-2-D, MW-3, SMI-PZ3D2, SMI-PZ3M, SMI-PZ3S, TP-01, TP-02, TP-07, TP-08, TP-09, 0437, 0438	
		Bedrock	0433	
September	On site	Alluvium	ATP-1-S, ATP-3, 0410, 0413, 0414, 0412, 0431, 0435, 0436, 0438, 0439, 0440, 0442, 0443, 0444, 0458, 0459	Al, Ag, As, Ba, B, Cd, Cl, Co, Cr, Cu, F, Fe, Gross alpha, Gross Beta, K, Li, Mg, Mn, Mo, Na, NH_3 as N, NO_3, Pb, Pb-210, Po-210, PO_4, Ra-226, Ra-228, Rn-222, Se, Sb, SO_4, Sr, TDS, Th-230, Tl, TOC, U, U-234, U-238, V, Zn
December	Upgradient	Alluvium	AMM-1, RW-01, 0456	As, B, Cd, Cl, F, Fe, Gross alpha, Gross Beta, Li, Mn, No, Na, NH_3 as N, NO_3, Ra-226, Ra-228, Se, SO_4, specific gravity, Sr, TDS, U, V
		Bedrock	0430, 0432, 0434	
	On site	Alluvium	AMM-2, AMM-3, ATP-1-D, ATP-1-ID, ATP-1-S, ATP-2-S, ATP-2-D, ATP-3, MW-1-R, MW-3, OW-2, SMI-PZ3D2, SMI-PZ3M, SMI-PZ3S, TP-01, TP-02, TP-07, TP-11, 0412, 0414, 0433, 0436, 0437, 0438, 0439, 0440, 0442, 0443, 0444, 0455, 0457	
		Bedrock	0431, 0435	
	Crossgradient	Alluvial	M11-14.0, N7-10, W1-7	
	Downgradient	Alluvium	TP-17, TP-18, TP-19, TP-20	

[a]Complete analyte list; not all locations were sampled for all analytes. Does not include field measurements.

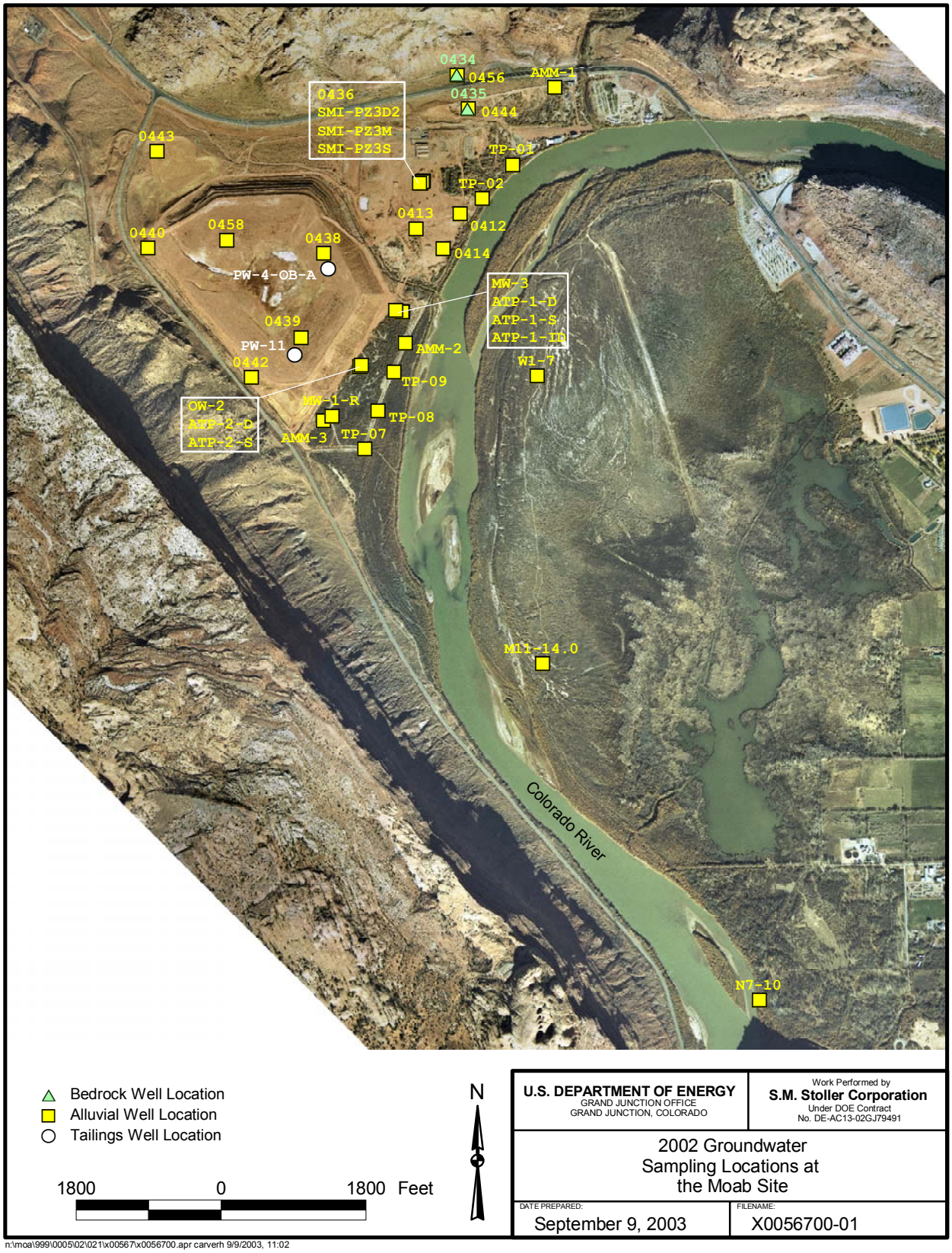

Figure 3–4. Moab Site Ground Water Monitoring Locations for 2002

3.3 Sediment and Soil Characterization

In accordance with the *Moab Project, Moab Millsite Radiological Assessment Plan* (DOE 2002a) DOE initiated a radiological assessment of the surface soils at the Moab site. 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. DOE anticipates that radiological surveys will be completed for the remainder of the site as funding becomes available.

3.4 Waste Management

During 2002, DOE developed the draft *Waste Management Plan for the Moab Project Site* (DOE 2002e) to provide guidance for the proper management of wastes generated at the Moab site. The draft waste management plan includes DOE's *Waste Management Policy for the Moab Project Site* (DOE 2002f), management requirements for several different types of special waste streams (e.g., asbestos materials and legacy laboratory chemicals and industrial products), and a description of different types of waste management areas. DOE has not yet finalized the draft waste management plan; however, the *Waste Management Policy for the Moab Project Site* was finalized in August 2002.

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.

These materials are considered to be RRM since they were explicitly used in the operations and activites assoiciated with the former mill.

During 2002, DOE developed plans to inventory these materials, surveyed them for radioactive contamination, segregated them by chemical compatibility, and safely stored them. The draft *Waste Management Plan for the Moab Project Site,* developed in 2002, included provisions to assist with this task.

Polychlorinated Biphenyls and Asbestos

No PCB wastes were identified at the Moab site in 2002.

During 2002, DOE managed three 55-gallon drums of vinyl asbestos floor tiles. These floor tiles, found in open drums located adjacent to the warehouse/shop building, were double-bagged, labeled as ACM, placed in sealed containers, and safely stored in the BMPA (Section 3.4.6). 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 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*

In July 2002, DOE recycled 10 spent lead-acid batteries that were left behind by the former operators of the mill. The batteries, which came from heavy equipment and vehicles that were used at the site, were collected from various locations around the millsite and consolidated into a single storage area pending their recycling. Surveys determined that the batteries were not radioactively contaminated. The batteries were recycled at a local outlet for used batteries.

In October 2002, DOE disposed of 13 compressed gas cylinders that were left behind by the former operators of the mill. The compressed gases were used for various purposes at the mill, including metal cutting/brazing, heating, water treatment, and analytical laboratory support. Most of the cylinders were either empty or only partially full. All of the cylinders and their valves were in good condition. Surveys determined that the compressed gas cylinders were not radioactively contaminated. The gas cylinders were disposed of through an approved waste gas cylinder disposal contractor.

3.4.3 Low-Level Waste Management

No low-level waste exists at the Moab site. All radioactive waste at the site is classified as RRM that is regulated by UMTRCA and 40 CFR 192. The management of RRM is discussed in Sections 2.1.2 and 3.4.1.

3.4.4 Best Management Practice Area

When DOE assumed ownership of the Moab site in 2001, a variety of legacy wastes were found haphazardly stored in approximately 42 open and closed containers (primarily 55-gallon drums) located on the concrete dock and on the ground adjacent to the east side of the warehouse/shop

building. These wastes included used motor oil, grease, hydraulic oil, antifreeze, fire retardant, asbestos tiles, and some unknown materials. In 2002, these materials were placed in appropriate closed containers, inventoried, and moved to the BMPA for safe storage.

The BMPA is a special 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; 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 BMPAs may be constructed at the Moab site to store additional wastes generated during remediation activities.

Approximately 40 containers of waste with volumes ranging from 5 to 55 gallons were stored in the BMPA at the end of 2002. These wastes included fire retardant, used oil, grease, asbestos tiles, hydraulic fluid, petroleum-contaminated soils, and some unknown materials. Plans were made in 2002 for the off-site disposal in 2003 of a portion of the fire retardant that was identified as non-RRM waste. 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 principle of 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

In addition to the recycled batteries (Section 3.4.2), DOE generates used oil at the Moab site from equipment operation. The used oil is accumulated inside or outside the radiologically contaminated area, depending on where it is generated. The used oil is accumulated for recycling

at an appropriate processing, re-refining, or fuel burning facility. Used oil accumulated in the radiologically contaminated area must first be analyzed to ensure it is free of radioactive contamination before it is recycled. During 2002, all used oil generated at the Moab site was collected and stored at the BMPA. There was no off-site recycling event during 2002.

3.5.3 Affirmative Procurement

The Moab Project purchases materials with recycled content whenever practical. These efforts are coordinated under the DOE–Grand Junction Office's Contracts and Procurement group as part of their 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.

End of current text

4.0 Environmental Monitoring Summary

This section presents a summary of the monitoring data collected as a result of DOE's environmental air monitoring (including atmospheric radon, direct gamma radiation, airborne radioparticulates, and meteorological conditions), and surface water sampling programs conducted at the Moab site during 2002. Ground water monitoring results for 2002 are described in Section 5.0.

4.1 Environmental Air Monitoring

DOE developed and implemented an environmental air monitoring program at the Moab site during calendar year 2002 as described in the *Moab Project Environmental Air Monitoring Sampling and Analysis Plan* (DOE, updated March 2003a). This sampling and analysis plan was prepared to identify monitoring goals and objectives, and to document DOE's strategy for monitoring various airborne contaminants.

Because 2002 was the first year for DOE's environmental air monitoring program at Moab, environmental monitoring was at various stages of development and implementation throughout the year. As a result, not all parameters could be monitored for the entire year. Various logistical considerations (e.g., negotiating access with property owners to install monitoring equipment, installing electrical service to individual monitoring sites) affected the date that data collection actually began at individual monitoring locations. However, by the end of calendar year 2002, all monitoring locations had been established and were operational. As a result, the data set collected for environmental air monitoring during subsequent years should consist of a full year.

This section presents a summary of the environmental air monitoring data that DOE collected at the Moab site and throughout the Moab community during 2002.

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). Shown in Table 4−1, atmospheric radon concentrations exceeded this site-specific standard at eight of the on-site locations; 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, that this cover is not an engineered radon barrier that was specifically 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 (MPS-0119) and at the MEI location (adjacent to millsite's eastern property line) show 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 2002

Station Number	First Quarter 2002 (01/22/02 – 04/05/02)		Second Quarter 2002 (04/05/02 – 07/11/02)		Third Quarter 2002 (07/11/02 – 10/03/02)		Fourth Quarter 2002 (10/03/02 – 12/31/02)		Annual Average 2002	
	Radon (pCi/L)	Gamma (mR/91 d) (EAA)[e]	Radon (pCi/L)	Gamma (mR/91 d) (EAA)	Radon (pCi/L)	Gamma (mR/91 d) (EAA)	Radon (pCi/L)	Gamma (mR/91 d) (EAA)	Radon (pCi/L)	Gamma (mR/yr)
On-Site Locations										
MPS-0101[a]	1.7	70.0(281)	3.9	79.3(317)	3.3	84.2(338)	5.3	70.2(281)	3.6	304
MPS-0102[a]	1.3	24.0(97)	3.1	26.2(105)	1.1	26.6(107)	3.5	26.2(105)	2.3	104
MPS-0103[a]	2.3	26.0(104)	1.4	26.0(104)	1.8	28.1(113)	3.3	26.7(107)	2.2	107
MPS-0104[a]	3.6	34.4(138)	2.9	29.8(120)	2.2	35.3(142)	5.0	31.1(124)	3.4	131
MPS-0105[a]	4.2	51.2(205)	1.5	52.8(212)	2.5	52.8(212)	5.0	52.1(208)	3.3	209
MPS-0106[a]	12.7	41.4(166)	7.7	42.0(169)	5.5	45.4(182)	13.4	41.6(166)	9.8	171
MPS-0107[a]	7.6	56.1(225)	4.4	61.0(245)	4.8	60.6(243)	9.9	57.5(230)	6.7	236
MPS-0108[a]	NDA	130.4(523)	7.9	148.6(596)	6.5	144.7(580)	8.7	134.2(537)	7.7	559
MPS-0109[a]	2.0	53.5(215)	4.0	64.8(260)	3.3	63.6(255)	3.0	59.8(239)	3.1	242
MPS-0110[a]	1.5	74.7(300)	3.7	95.3(382)	7.1	94.9(381)	2.4	87.1(348)	3.7	333
MPS-0111[a]	1.0	NDA	0.4	65.8(264)	1.3	69.3(278)	1.0	61.0(244)	0.9	197
MPS-0112[a]	NDA	38.5(154.5)	2.3	40.3(161)	2.6	46.3(186)	2.9	39.1(156.4)	2.6	165
MPS-0113[a]	3.1	95.9(385)	11.3	96.5(387)	2.7	106.1(426)	5.1	86.3(345)	5.6	386
MPS-0114[a]	4.5	399.2(1602)	5.1	403.6(1619)	6.0	444.8(1784)	7.4	384.2(1537)	5.8	1636
MPS-0115[a]	5.9	242.9(975)	5.2	223.8(897)	5.4	268.0(1075)	6.6	213.8(855)	5.8	951
MPS-0116[a]	4.6	137.2(550)	5.1	143.4(575)	5.8	157.3(631)	7.6	139.5(558)	5.8	579
Off-Site Locations										
MPS-0117[b,c]	NDA	NDA	NDA	NDA	0.8	20.4(82)	0.6	22.0(88)	0.7	85
MPS-0118[b]	NDA	NDA	0.5	25.8(104)	0.8	23.5(94)	1.1	24.5(98)	0.8	99
MPS-0119[b]	NDA	NDA	0.4	21.6(87)	0.7	20.0(80)	1.1	22.4(90)	0.7	86
MPS-0120[b]	NDA	NDA	NDA	NDA	0.9	15.5(62)	0.9	17.8(71)	0.9	67
MPS-0121[b]	NDA	NDA	NDA	NDA	1.0	20.5(82)	0.3	21.2(85)	0.7	84
MPS-0122[b,c]	NDA	NDA	NDA	NDA	1.1	136.6(548)[f]	0.4	17.2(69)	0.8	69
MPS-0123[b,c]	NDA	NDA	0.4	NDA	0.4	21.1(85)	0.6	17.2(69)	0.5	77
MEI[d]	NDA	NA	1.3	NA	1.5	NA	2.8	NA	1.9	NA

[a]On-site monitoring location. Located within DOE property boundary.
[b]Off-site monitoring location.
[c]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.
[d]The maximally exposed individual (MEI) is the continually occupied residential property that is closest to the DOE property boundary.
[e]"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.
[f]Quarterly value considered an anomaly; not used in calculating annual average.
NA = Not Applicable.
NDA = No Data Available.

Based on these data, it can be demonstrated that radon emissions from the mill tailings stored at the Moab site are not affecting the general population of the city of Moab. However, unacceptable exposures to the public may result to individuals who camp or reside for extended periods of time along the southern property line (between State Highway 279 and the Colorado

River and within one-half mile of the DOE property boundary). Although this is private land, it has long been used as 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.

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, 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. Many of the elevated on-site readings are from monitoring locations directly on top of the tailings pile.

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).

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 particulates. 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.

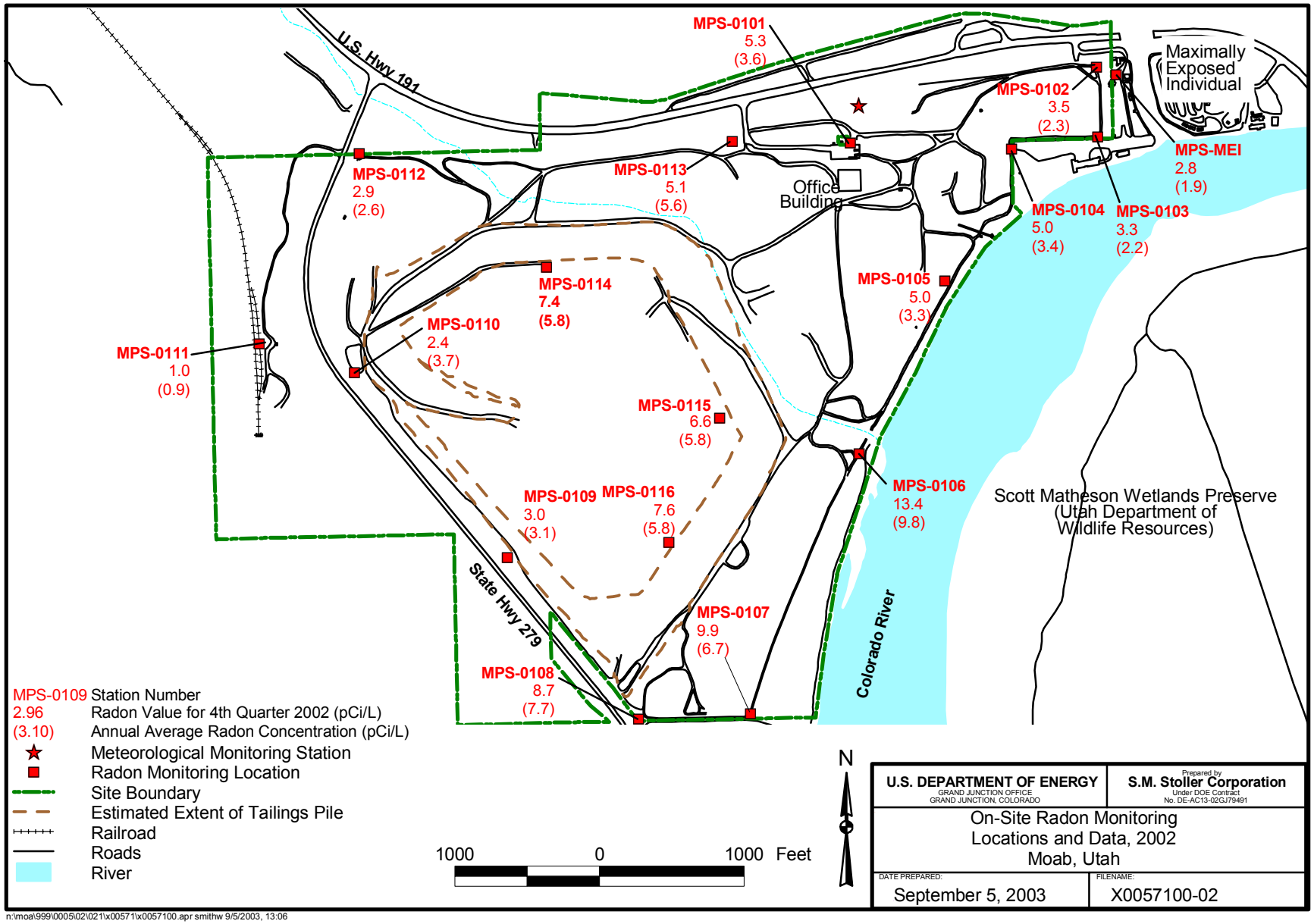

Figure 4–1. On-Site Radon Monitoring Locations and Data, 2002

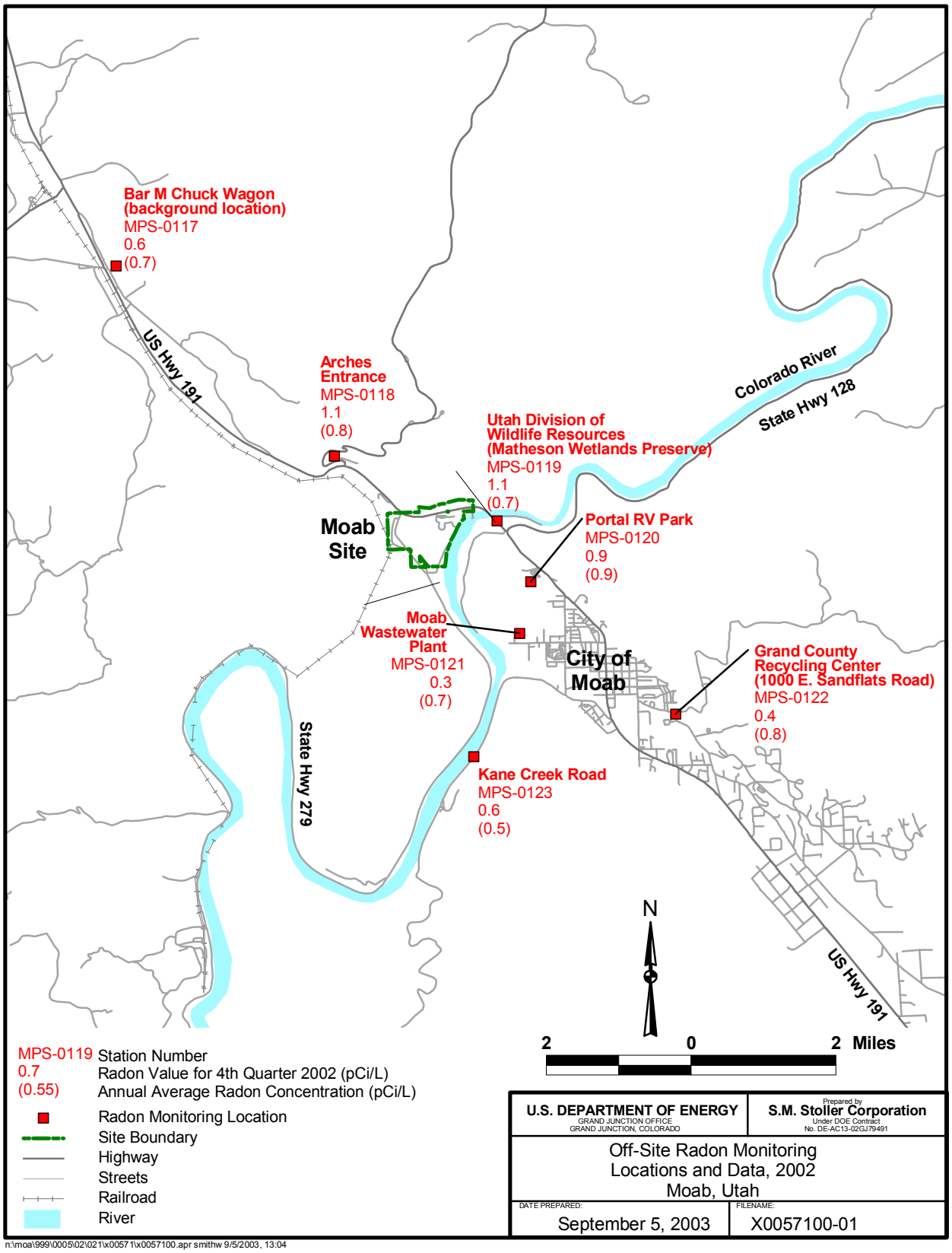

Figure 4–2. Off-Site Radon Monitoring Locations and Data, 2002

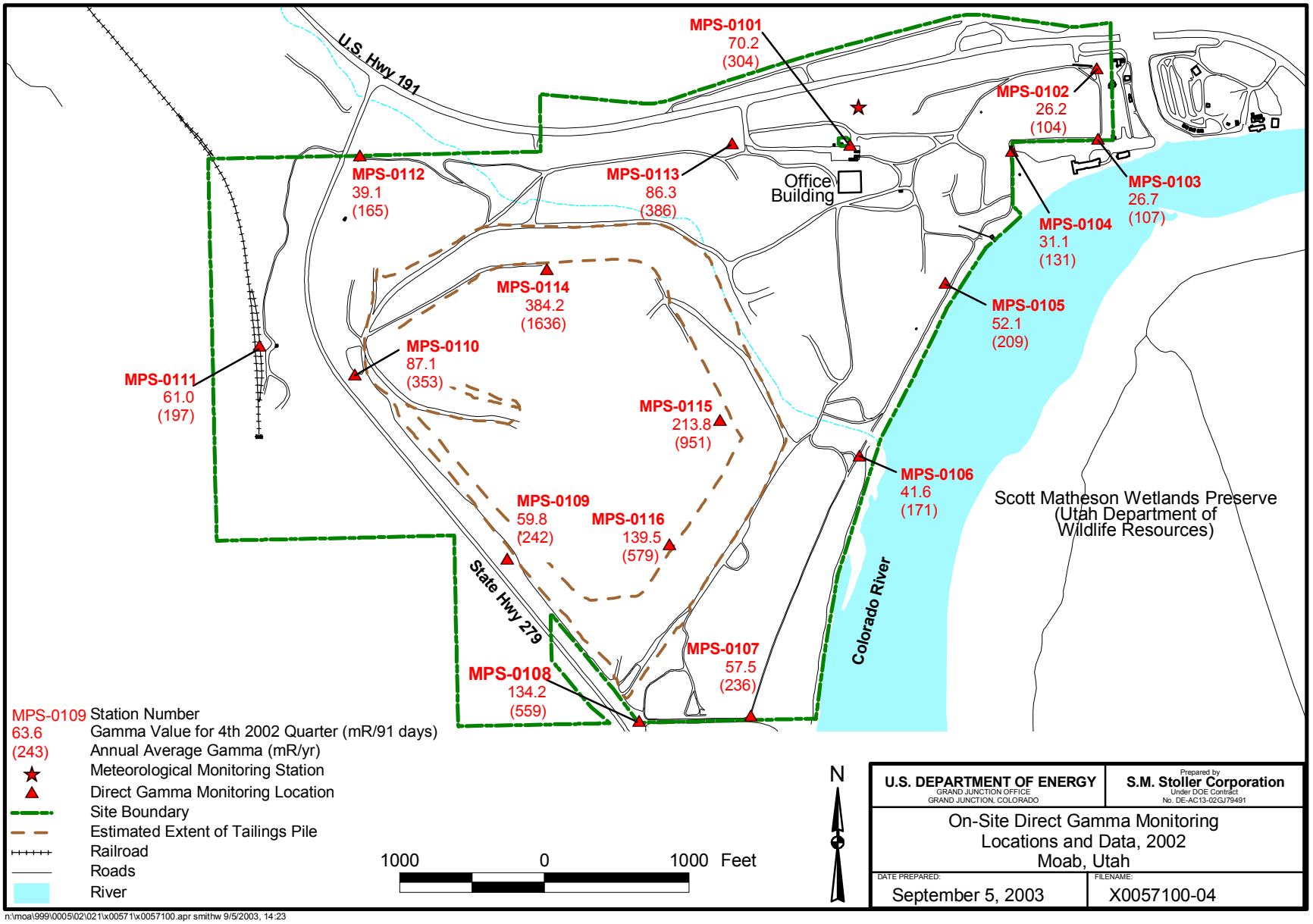

Figure 4–3. On-Site Direct Gamma Monitoring Locations and Data, 2002

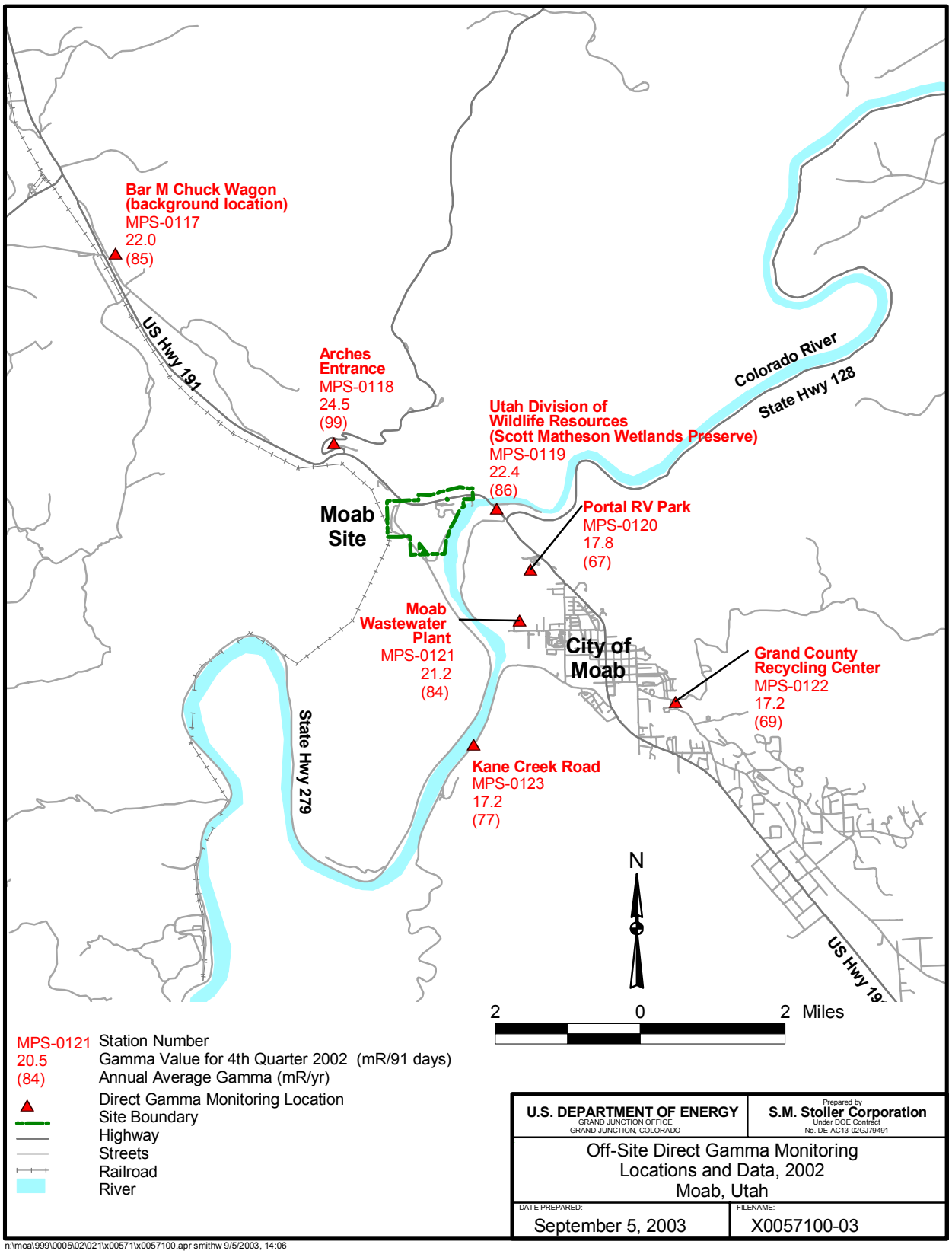

Figure 4–4. Off-Site Direct Gamma Monitoring Locations and Data, 2002

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 2002 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).

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 from monitoring location MPS-0102 are representative of the gamma exposure levels received by the MEI. The monitoring data collected at MPS-0102 indicate that the annual average gamma radiation dose at this location was 104 mrem/yr, well below the calculated site limit of 181 mrem/yr.

Table 4–3. Summary of Radioparticulate Air Monitoring Data for the Moab Site for Calendar Year 2002

Station Number	Isotope	Second Quarter 2002 (µCi/mL)	Third Quarter 2002 (µCi/mL)	Fourth Quarter 2002 (µCi/mL)	Annual Average (µCi/mL)
On-Site Locations					
MPS-0102 (East Property Line)	Total Uranium	1.9E-16	2.6E-16	9.6E-17	1.8E-16
	Thorium-230	1.6E-16	3.1E-16	2.0E-16	2.3E-16
	Radium-226	4.7E-16	3.5E-16	2.6E-16	3.6E-16
	Polonium-210	1.7E-15	2.7E-15	6.4E-15	3.6E-15
MPS-0105 (River Berm)	Total Uranium	4.8E-16	2.9E-15	2.2E-16	7.2E-16
	Thorium-230	4.7E-16	2.1E-15	3.9E-16	6.7E-16
	Radium-226	1.4E-15	1.1E-15	2.7E-16	8.9E-16
	Polonium-210	3.3E-15	3.6E-15	8.4E-15	5.5E-15
Off-Site Locations					
MPS-0117 (Bar M Chuck Wagon)	Total Uranium	No data	2.1E-16	9.2E-17	1.4E-16
	Thorium-230	No data	2.3E-16	1.6E-16	1.9E-16
	Radium-226	No data	2.9E-16	2.8E-16	2.8E-16
	Polonium-210	No data	3.0E-15	6.1E-15	4.8E-15
MPS-0118 (Arches National Park Entrance)	Total Uranium	2.7E-16	1.6E-16	8.9E-17	1.7E-16
	Thorium-230	3.2E-16	2.3E-16	2.0E-16	2.5E-16
	Radium-226	7.0E-16	3.3E-16	2.7E-16	4.3E-16
	Polonium-210	2.3E-15	3.5E-15	6.9E-15	4.2E-15
MPS-0119 (Scott Matheson Wetlands Preserve)	Total Uranium	2.4E-16	3.1E-16	1.2E-16	2.2E-16
	Thorium-230	2.9E-16	3.0E-16	2.4E-16	2.8E-16
	Radium-226	7.0E-16	3.5E-16	2.7E-16	4.4E-16
	Polonium-210	2.4E-15	3.2E-15	6.5E-15	4.0E-15
MPS-0120 (Portal RV Park)	Total Uranium	2.2E-16	1.7E-16	1.3E-16	1.6E-16
	Thorium-230	1.2E-16	2.8E-16	3.2E-16	2.8E-16
	Radium-226	9.8E-16	3.1E-16	2.5E-16	3.8E-16
	Polonium-210	3.2E-15	3.4E-15	5.6E-15	4.3E-15
MPS-0121 (Moab Wastewater Treatment Plant)	Total Uranium	No data	2.0E-16	8.8E-17	1.4E-16
	Thorium-230	No data	2.8E-16	2.4E-16	2.6E-16
	Radium-226	No data	3.8E-16	2.5E-16	3.2E-16
	Polonium-210	No data	3.2E-15	5.7E-15	4.5E-15
MPS-0122 (Grand County Recycling Center)	Total Uranium	No data	1.8E-16	9.3E-17	1.3E-16
	Thorium-230	No data	2.1E-16	3.4E-16	2.9E-16
	Radium-226	No data	3.4E-16	2.6E-16	3.0E-16
	Polonium-210	No data	3.0E-15	6.1E-15	4.9E-15
MPS-0123 (Kane Creek Road)	Total Uranium	1.8E-16	1.3E-16	7.3E-17	1.3E-16
	Thorium-230	2.3E-16	2.5E-16	1.9E-16	2.2E-16
	Radium-226	7.2E-16	2.9E-16	2.6E-16	4.2E-16
	Polonium-210	2.5E-15	3.4E-15	6.6E-15	4.2E-15

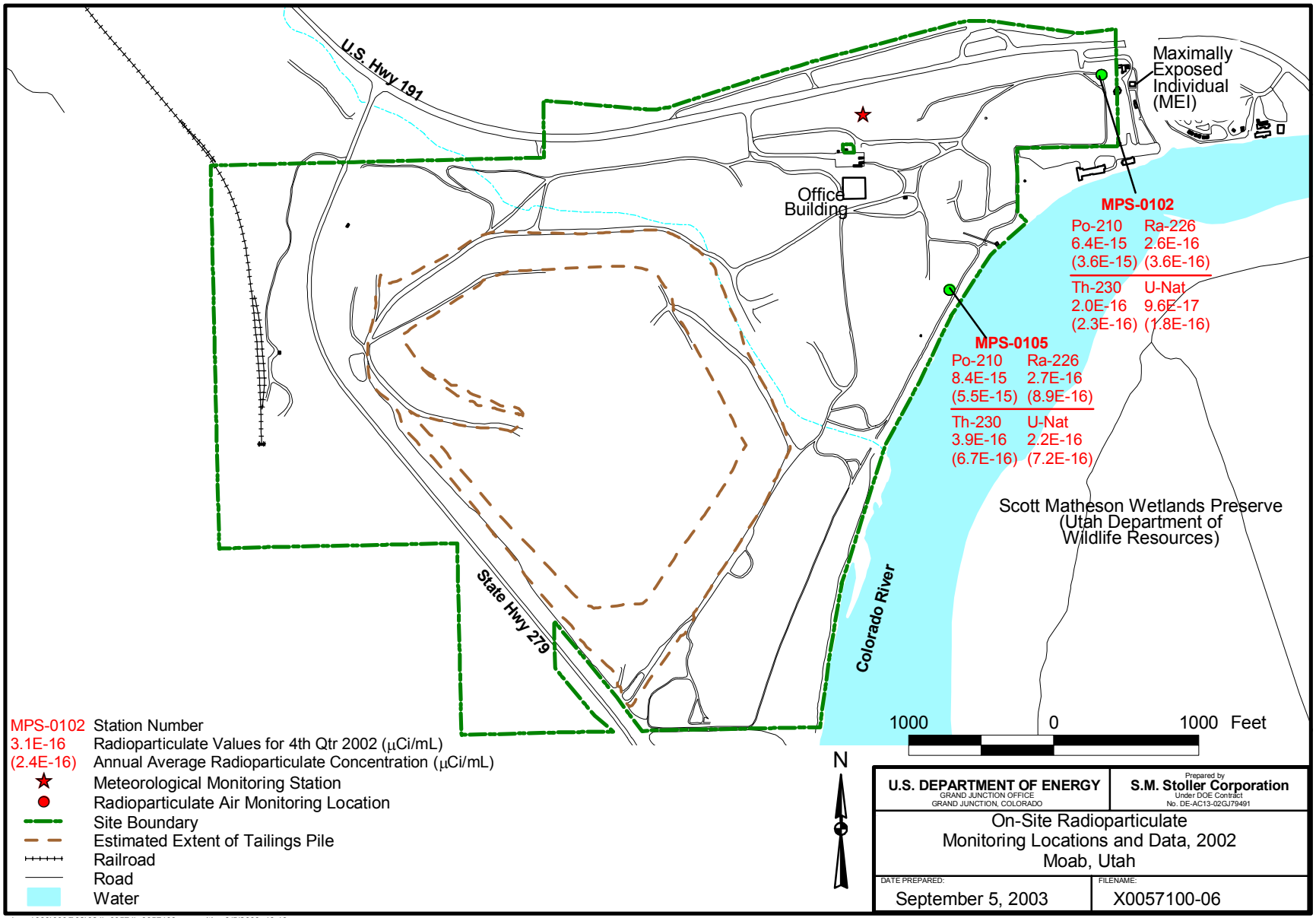

Figure 4–5. On-Site Radioparticulate Monitoring Locations and Data, 2002

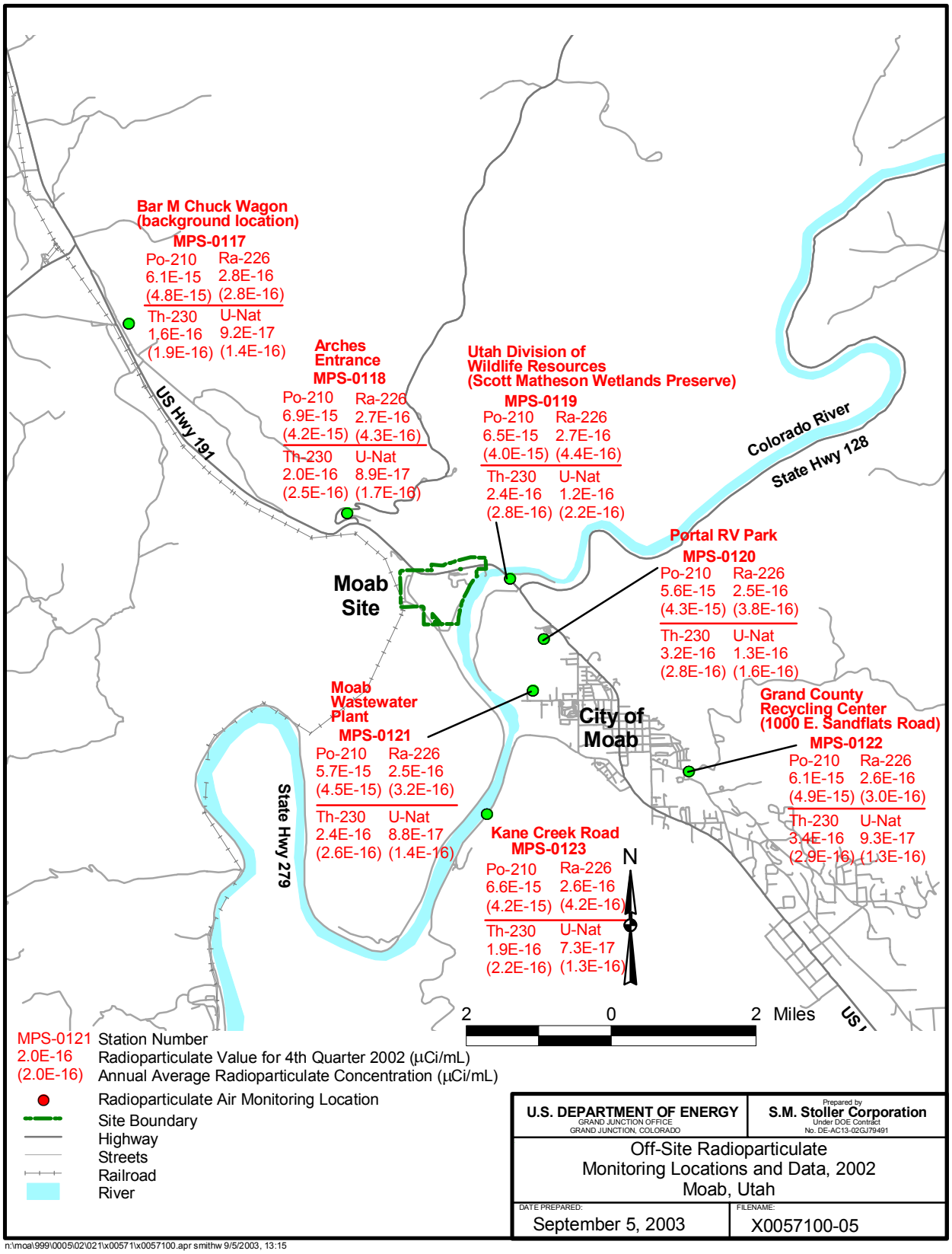

Figure 4–6. Off-Site Radioparticulate Monitoring Locations and Data, 2002

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.

4.1.5 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 2002 meteorological data for temperature, wind speed and direction, and precipitation.

Table 4–4. Meteorological Data Summary for the Moab Site for Calendar Year 2002

Month[a]	Temperature (°F)				Wind Speed (miles per hour−mph)		Precipitation Totals (inches/month)
	Average High	Average Low	Maximum Temp.	Minimum Temp.	Average	Peak Gust	
July	101.7	71.8	109.7	57.3	4.9	43.2	0.01
August	97.2	63.6	107.6	53.0	4.5	37.1	0.37
September	84.8	56.1	98.7	46.6	4.1	48.2	1.63
October	70.4	40.8	83.2	33.1	3.4	47.8	0.48
November	55.3	29.3	63.2	20.6	3.2	31.7	0.31
December	47.7	23.7	59.9	16.5	2.7	41.0	0.44

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

4.2 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 2002 surface-water chemistry results to State of Utah water quality standards is summarized in Table 4−5. Surface-water chemistry data collected in 2002 is presented in Table A−1.

Table 4–5. Comparison of State of Utah Water Quality Standards[a] with 2002 Maximum Concentrations in Colorado River[b]

Constituent	State Standard[a,b]	2002 Maximum[c,d]		
		Upstream Of Site	Adjacent To Site	Downstream Of Site
Anions				
Fluoride	1.4-2.4 mg/L	0.504	2.04	1.44
General				
Metals				
Arsenic	0.05 mg/L	0.0013	0.0021	0.0014
Barium	1.0 mg/L	0.14	0.182	0.124
Boron	0.75 mg/L	0.123	0.666	0.124
Cadmium	0.01 mg/L	<0.00028	0.0018	<0.00028
Chromium	0.05 mg/L	<0.0006	<0.0006	<0.0006
Copper	0.2 mg/L	0.0014	0.0019	0.0015
Lead	0.05 mg/L	<0.00085	<0.00081	0.00048
Mercury	0.002 mg/L	<0.0002	<0.0002	<0.0002
Selenium	0.01 mg/L	0.0079	0.0083	0.0077
Silver	0.05 mg/L	<0.00033	<0.00033	<0.00037
Radionuclides				
Gross Alpha	15 pCi/L	13.82	665.45	34.13
Gross Beta	50 pCi/L	13.78	192.93	27.14
Radium-226+228	5 pCi/L	0.23	1.27	0.29
Major Ions				
Ammonia Total as N[e]	2-4 mg/L	0.134	239.13	0.728
Nitrate as NO_3[f]	17.7 mg/L	5.51	21.7	5.58
Others				
Total dissolved solids	1,200 mg/L	1,060	10,800	1,240
pH	6.5-9.0 s.u.	8.02-8.6	7.3-8.62	8.07-8.71
Total Phosphorus as PO_4[g]	0.15 mg/L	<0.544	3.12	2.35

[a]mg/L = milligrams per liter, pCi/L = picocuries 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.
[f]"Nitrate (as NO_3)" standard was derived from "Nitrate (as N)" standard (4) multiplied by 4.427.
[g]"Total phosphorus as PO_4" standard was derived from "total phosphorus as P" standard (0.05) multiplied by 3.067.

Ground water discharge from the Moab site has caused localized degradation of surface water quality in the Colorado River. The constituents with concentrations that are most consistently elevated in the Colorado River are ammonia and uranium. Ammonia and uranium concentrations in the river water samples varied widely between sampling events because of changing conditions at the sampling location (e.g., river stage, flow patterns), and concentrations decrease significantly with distance from shoreline. The highest concentrations have been detected in areas next to the riverbank immediately downstream of Moab Wash at location CR2B. The highest ammonia (total as nitrogen) and uranium concentrations measured in 2002 were in the samples collected from CR2B (239.13 milligrams per liter and 1.22 milligrams per liter, respectively). Ammonia and uranium results will be discussed in more detail in forthcoming project documents (e.g. Site Observational Work Plan and EIS).

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 arsenic, cadmium, molybdenum, net alpha, nitrate, radium-226 + radium-228, selenium, and uranium were exceeded in samples collected from one or more alluvial wells in 2002 as shown in Figure 5−1. A summary of ground water chemistry data collected in 2002 is presented in Table A−2.

Ground water samples were collected and analyzed for volatile organic compounds, semivolatile organic compounds, herbicides, pesticides, and PCBs in 2002. All target volatile organic compounds, semivolatile organic compounds, pesticides, and PCBs were below their respective reporting limits. One herbicide (pentachlorophenol) was detected at a concentration of 1 microgram per liter. These data indicate the alluvial ground water has not been contaminated with organic compounds.

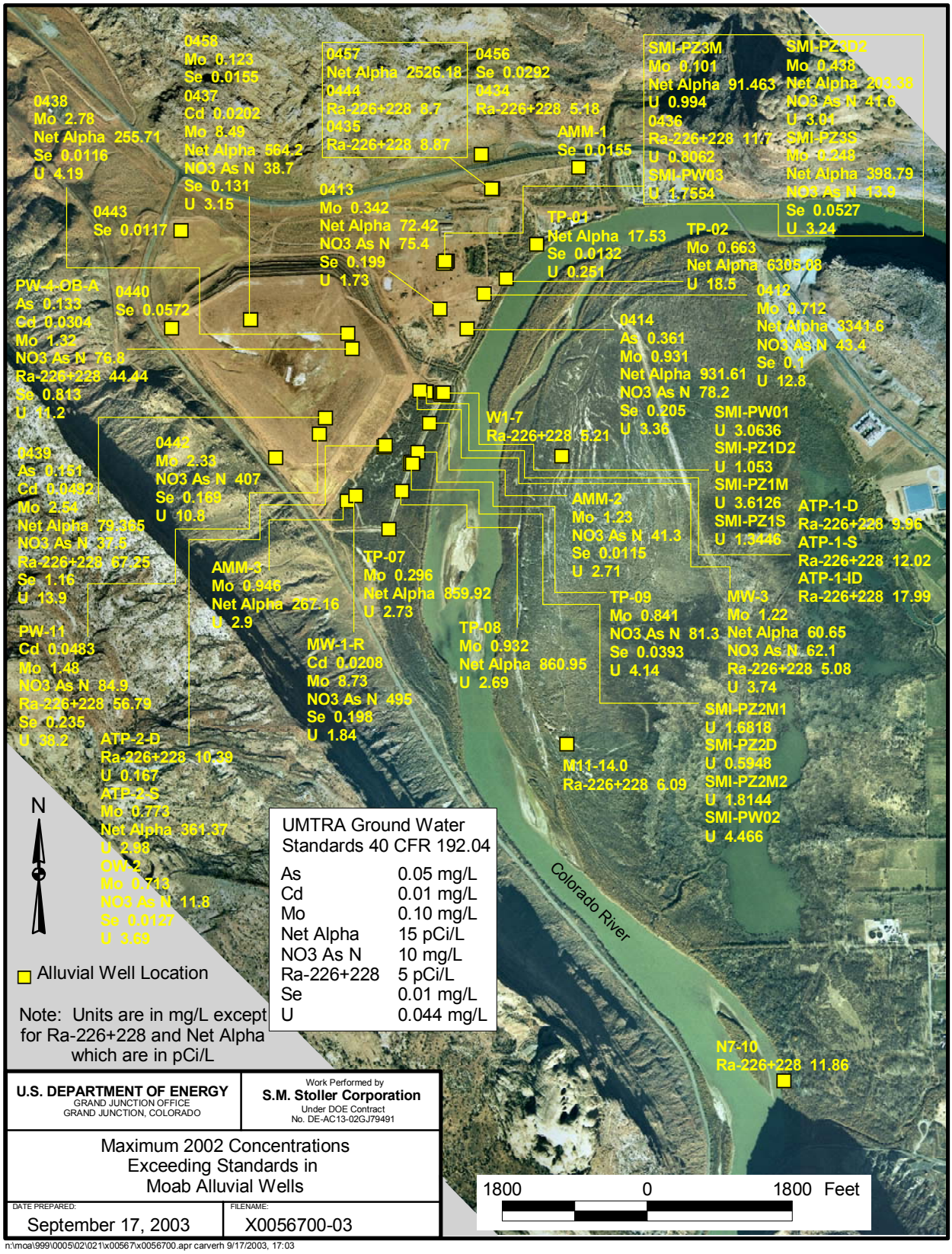

Figure 5–1. Maximum 2002 Concentrations Exceeding Standards in Moab Alluvial Wells

6.0 Quality Assurance

A QA program providing a structured approach for the application of QA principles to work performed under DOE−GJO is implemented through the *GJO Quality Assurance Manual* (GJO 1). The QA program is based on DOE Order 414.1A, *Quality Assurance,* and refers to documents that implement the QA Program. The *Moab Project Quality Assurance Program Plan* specifies project-specific implementation of the QA program. Implementation of the Quality Assurance Program Plan ensures that environmental data are valid and traceable and that they fulfill the requirements of the QA program.

6.1 Sampling

Strategies and objectives for effluent monitoring and environmental sampling at the Moab site are described in work plans and procedures. Plans or 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 GJO Analytical Chemistry Laboratory performs analyses in support of Moab environmental monitoring programs. The laboratory's objective is to provide high-quality analytical data that meet environmental monitoring program requirements. This objective is met by implementation of a documented QA plan, technically competent staff, suitable facilities and equipment, and written procedures.

The laboratory implements QA requirements through their QA plan as documented in the *Analytical Chemistry Laboratory Administrative Plan and Quality Control Procedures* (LAB-5). The QA plan is routinely reviewed for adequacy and effectiveness and revised as needed. QA staff frequently evaluate the effectiveness of the of the laboratory QA program. Elements of the QA plan include:

- Internal review of laboratory operations.
- Coordination and follow-up of external reviews.
- Nonconformance identification and reporting.
- Corrective action implementation and tracking.
- Periodic quality reports to management.
- Maintenance of laboratory certifications, accreditations, and proficiency testing programs.
- Document and record control.
- Monitoring of laboratory Quality Control and establishing acceptance criteria.
- Statistical quality control program.
- Calibration of measuring and test equipment.
- Control of chemical standards and reagents.
- Formal training and qualification of laboratory employees.
- Software QA program.

- Program for procurement of materials and services.
- Control of laboratory access.
- Coordination with the Technical Assistance Contractor's QA Manager to ensure compliance with the contractor QA Program.

The laboratory maintains certification with the State of Utah in accord with the 2000 National Environmental Laboratory Accreditation Conference Standard, approval with the DOE Environmental Management Consolidated Audit Program, and accreditation with the American Industrial Hygiene Association in the Industrial Hygiene Program for metals, inorganic acids, asbestos (both respirable and bulk), and gravimetric methods. The Laboratory participates in multiple proficiency testing programs required to maintain these endorsements.

6.3 Data and Records Management

Data and records management objectives for environmental monitoring are established to maximize active use, maintenance, disposition, and preservation of required program information in an efficient and cost-effective manner. These objectives have been achieved and are being maintained through the use of systematic and applied controls through all phases of a record's life cycle.

Records are created both on paper and electronically in a retrievable format and are protected against deterioration, damage, and inadvertent loss. Records generated in support of environmental monitoring are subject to the requirements of 36 CFR 1220 through 1234. The *GJO Records Management Manual* (GJO 9) and a project-specific records index implement the records regulations.

Laboratory analytical results of environmental samples are received electronically into an Oracle database. These data are maintained, protected, and archived by GJO Technical Support.

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Appendix A

Water Monitoring Data

Table A-1. Summary of Surface Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Date	Ag (mg/L)	Al (mg/L)	ALK (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Ca (mg/L)	Cd (mg/L)	Chloride (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	DO (mg/L)	EC (µmhos/cm)	Fe (mg/L)	Fluoride (mg/L)	GA (pCi/L)
0201	03/14/2002	<0.0001	--	129	<0.0006	0.0814	--	81.5	<0.0002	146	--	<0.0006	0.0015	--	1252	<0.0112	--	<8.71
	05/20/2002	<0.0001	--	124	0.00054	--	0.0562	91.6	<0.0001	126	--	<0.0006	<0.0006	10.89	1148	<0.0025	--	<7.78
	08/13/2002	<0.00037	0.0179	155	0.0013	0.116	0.124	141	<0.00028	130	<0.0013	<0.0005	<0.0004	6.38	1351	0.0078	1.440	<12.06
	12/03/2002	--	--	159	--	0.0861	0.0569J	--	--	177	--	--	--	11.56	1475	--	--	<8.81
0204	12/06/2002	--	--	184	--	0.0896	<0.002J	--	--	161	--	--	--	--	1393	--	--	21.56
	12/06/2002	--	--	--	--	0.0885	0.111J	--	--	167	--	--	--	--	--	--	--	22.92
0205	12/04/2002	--	--	164	--	0.0715	0.0613J	--	--	190	--	--	--	12.24	1678	--	--	<7.32
CR1	03/11/2002	<0.0001	--	159	<0.0006	0.0801	--	83.5	<0.0002	153	--	<0.0006	0.0014	--	1238	<0.012	--	<8.7
	05/20/2002	<0.0001	--	160	0.00052	--	0.0569	92.5	<0.0001	118	--	<0.0006	0.0008	10.24	1134	<0.0154	--	<7.66
	08/12/2002	<0.00033	0.0301	149	0.0013	0.123	0.140	141	<0.00028	112	<0.0013	<0.0005	<0.00071	6.77	1178	0.010	0.504	<11.88
	12/03/2002	--	--	161	--	0.114	0.0572J	--	--	172	--	--	--	11.59	1444	--	--	<7.31
CR2	03/12/2002	<0.0001	--	157	<0.0006	0.0648	--	81.3	<0.0002	150	--	<0.0006	0.00064	--	1256	<0.0062	--	26.01
	05/22/2002	<0.0001	--	150	0.00063	--	0.0547	89.3	<0.0001	97.1	--	<0.0006	<0.0006	10.38	1064	<0.005	--	14.82
	08/14/2002	<0.00031J	<0.0076	166	0.0012	0.104	0.0898	145	<0.00029	138	<0.0013	<0.0005	0.00066	4.98	1874	0.0065	0.329	24.53
	12/06/2002	--	--	178	--	0.090	0.0559J	--	--	176	--	--	--	13.46	1607	--	--	54.49
CR2-001	03/12/2002	<0.0001	--	148	<0.0006	0.0776	--	81.0	<0.0002	150	--	<0.0006	0.0014	--	1249	<0.0068	--	26.39
	05/22/2002	<0.0001	--	132	0.00057	--	0.0547	88.2	<0.0001	92.9	--	<0.0006	<0.0006	9.1	1040	<0.003	--	7.31
	08/14/2002	<0.00031J	<0.0076	158	0.0013	0.096	0.0972	142	<0.00027	120	<0.0013	<0.0005	0.00049	10.55	1355	0.0045	0.412	20.69
	12/06/2002	--	--	169	--	0.0916	0.0596J	--	--	167	--	--	--	13.31	1420	--	--	13.85
CR2B	03/12/2002	<0.0001	--	183	<0.0006	0.104	--	98.5	<0.0002	312	--	<0.0006	0.0014	--	2238	<0.0066	--	136.75J
	05/21/2002	<0.0001	--	144	0.00064	--	0.0537	117	0.00022	225	--	<0.0006	0.0019	9.19	1197	<0.0053	--	42.58
	08/14/2002	<0.00032	<0.0184	474	0.00069	0.358	0.182	392	0.0018	955	0.0113	<0.0005	0.0012	7.68	9584	0.0401	2.040	665.45
	12/03/2002	--	--	347	--	0.196	0.053J	--	--	903	--	--	--	10.21	3839	--	--	310.42
CR2B-001	03/12/2002	<0.0001	--	153	<0.0006	0.0835	--	84.5	<0.0002	168	--	<0.0006	0.00078	--	1184	<0.006	--	20.05
	05/21/2002	<0.0001	--	133	0.00061	--	0.0546	89.6	<0.0001	109	--	<0.0006	0.00069	9.38	1102	0.0048	--	<5.16
	08/14/2002	<0.00031	<0.0076	175	0.0013	<0.112	0.104	141	<0.00027	122	<0.0013	<0.0005	0.0008	8.18	1348	0.0055	0.467	<11.99
	12/03/2002	--	--	173	--	0.0966	0.0565J	--	--	183	--	--	--	13.35	1522	--	--	<15.48
CR3	03/12/2002	<0.0001	--	149	<0.0006	0.0846	--	85.3	<0.0002	237	--	<0.0006	0.00093	--	1564	<0.0055	--	<10.33
	05/21/2002	<0.0001	--	123	0.00065	--	0.0516	94.1	<0.0001	158	--	<0.0006	0.0012	9.01	1372	0.007	--	<10.8
	08/13/2002	<0.00031	<0.0076	137	0.0014	0.141	0.103	142	<0.00029	450	<0.0013	<0.0005	0.00074	12.89	2473	0.010	0.521	40.58
	12/03/2002	--	--	158	--	0.0808	0.0586J	--	--	231	--	--	--	13.09	1767	--	--	<17.55

Table A-1. Summary of Surface Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Date	GB (pCi/L)	Hg (mg/L)	K (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	NH_3+NH_4 as N (mg/L)	Ni (mg/L)	NO_3 (mg/L)	ORP (mV)	Pb (mg/L)	Pb-210 (pCi/L)	pH (s.u.)	Po-210 (pCi/L)	PO_4 (mg/L)
0201	03/14/2002	7.97	<0.0002	4.52	--	30.1	0.0286	0.0028	125	0.220	<0.0008	2.020	20.6	0.00048	<1.07	8.71	<0.0592	--
	05/20/2002	9.28	<0.0002	3.83	--	<29.9	<0.0044	0.0033	104	0.0659	0.001	0.886	245	<0.0001	<1.46	8.68	0.0359	--
	08/13/2002	<12.77	--	5.42	0.0548	43.1	0.021	0.0057	128	0.162	--	5.350	171	<0.00083	<1.3	8.09	0.0549	<0.544
	12/03/2002	9.91	--	--	--	--	0.0144J	<0.009	--	0.0792J	--	--	90.4	--	--	8.28	--	--
0204	12/06/2002	14.85	--	--	--	--	<0.0005J	<0.009	--	0.021J	--	--	167	--	--	7.89	--	--
	12/06/2002	11.76	--	--	--	--	0.0276J	<0.009	--	--	--	--	--	--	--	--	--	--
0205	12/04/2002	<6.86	--	--	--	--	0.0139J	<0.009	--	<0.003J	--	--	219	--	--	8.18	--	--
CR1	03/11/2002	<7.14	<0.0002	4.14	--	29.8	0.0326	0.0032	123	<0.0187	<0.0008	1.860	-10.8	<0.00053	<1.04	8.27	0.1142	--
	05/20/2002	8.76	<0.0002	3.80	--	<30.1	<0.0031	0.003	102	0.0217	0.0011	0.776	246	<0.0001	<1.48	8.6	<0.0743	--
	08/12/2002	<12.8	--	5.31	0.0557	41.7	0.0093	0.0094	121	0.132	--	5.400	212	<0.00085	<1.25	8.33	0.0648	<0.544
	12/03/2002	<6.87	--	--	--	--	0.0136J	<0.009	--	<0.003J	--	--	122	--	--	8.02	--	--
CR2	03/12/2002	15.53	<0.0002	4.33	--	29.6	0.0337	0.0094	126	0.555	<0.0008	2.480	98.1	<0.00039	<1.11	8.44	<0.0629	--
	05/22/2002	11.45	<0.0002	<3.98	--	<29.2	<0.0099	0.0071	<94.4	0.255	<0.0008	2.710	130	<0.0001	<1.47	8.5	<0.0547	--
	08/14/2002	23.06	--	6.48J	0.066	48.2J	0.0505	0.0194	160	3.401	--	12.500	84	<0.00078	<1.17	8.24	<0.0563	<0.544
	12/06/2002	33.18	--	--	--	--	0.0489J	0.0152	--	3.020J	--	--	138	--	--	8.35	--	--
CR2-001	03/12/2002	15.64	<0.0002	4.23	--	29.2	0.0332	0.0094	123	0.365	<0.0008	2.430	112.5	<0.00052	<1.15	8.43	<0.0389	--
	05/22/2002	9.11	<0.0002	<3.64	--	<27.8	<0.006	0.0052	<86.3	0.0792	<0.0008	1.520	190	<0.0001	<1.47	8.52	0.0681	--
	08/14/2002	<12.88	--	5.43J	0.0602	42.8J	0.0221	0.0095	133	0.330	--	5.550	90.6	<0.00079	<1.15	8.29	<0.0503	2.980
	12/06/2002	<9.19	--	--	--	--	0.0235J	<0.009	--	0.097J	--	--	135	--	--	8.42	--	--
CR2B	03/12/2002	<41.94	<0.0002	12.7	--	63.0	0.215	0.0563	341	39.984	<0.0008	15.300	158.7	<0.00039	<1.18	8.12	<0.0661	--
	05/21/2002	33.85	<0.0002	12.0	--	62.3	0.156	0.0595	<263	14.053	0.0013	20.000	117	<0.0001	<1.43	8.58	0.0464	--
	08/14/2002	166.4	--	59.3	0.310	387	11.500	0.594	1460	235.248	--	20.800	142	<0.00081	<1.31	7.3	0.0756	<0.544
	12/03/2002	146.98	--	--	--	--	1.010J	0.168	--	185.559J	--	--	69.6	--	--	7.55	--	--
CR2B-001	03/12/2002	13.06	<0.0002	5.17	--	34.7	0.062	0.0146	148	5.652	<0.0008	4.090	149.1	<0.00039	<1.06	8.37	<0.0565	--
	05/21/2002	7.03	<0.0002	3.79	--	28.7	0.0084	0.0049	<95.6	0.335	<0.0008	1.100	117	<0.0001	<1.41	8.62	<0.066	--
	08/14/2002	<12.81	--	5.53	0.0585	43.0	0.0216	0.0093	130	0.8152	--	5.720	133	<0.00079	<1.17	7.92	0.0702	<0.544
	12/03/2002	8.55	--	--	--	--	0.0216J	<0.009	--	0.623J	--	--	43	--	--	8.39	--	--
CR3	03/12/2002	13.39	<0.0002	6.21	--	33.8	0.0638	<0.0059	179	2.880	<0.0008	2.670	138.4	<0.00042	<1.11	8.38	<0.0432	--
	05/21/2002	11.85	<0.0002	5.21	--	39.3	0.0156	0.0059	<158	1.219	<0.0008	2.010	179	<0.0001	<1.47	8.55	0.0531	--
	08/13/2002	<18.51	--	13.1	0.0671	60.4	0.125	0.011	331	11.335	--	7.480	115	<0.0008	<1.19	8.29	0.0611	<0.544
	12/03/2002	10.86	--	--	--	--	0.0468J	<0.009	--	2.888J	--	--	2.5	--	--	8.37	--	--

Table A-1. Summary of Surface Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Date	Ra-226 (pCi/L)	Ra-228 (pCi/L)	Rn-222 (pCi/L)	Sb (mg/L)	Se (mg/L)	SO_4 (mg/L)	Sr (mg/L)	TDS (mg/L)	Th-230 (pCi/L)	Tl (mg/L)	TMP (C)	TOC (mg/L)	Turbidity (NTU)	U (mg/L)	U-234 (pCi/L)	U-238 (pCi/L)	V (mg/L)	Zn (mg/L)
0201	03/14/2002	<0.13	<0.87	--	<0.0005	0.0044	277	0.951	825	<1.6	<0.0001	9.46	--	21	0.0073J	--	--	0.00076	0.004
	05/20/2002	0.22	<0.77	--	<0.00025	0.0051	301	1.060	790	<1.6	<0.0001	20.71	--	98.5	0.0057	11.7	2.3	0.0015	0.0012
	08/13/2002	0.18	<0.75	<23.36	<0.00048	0.0072	433	1.650	1040	<1.5	<0.00072	20.34	4.1	9.7	0.008J	5.6	3.1	0.003	<0.0008
	12/03/2002	--	--	--	--	0.0077	432	1.460	1070	--	--	3.55	--	8.77	0.0086	--	--	--	--
0204	12/06/2002	--	--	--	--	0.0061	378	<0.0005	1020	--	--	4.78	--	9.42	0.0322	--	--	--	--
	12/06/2002	--	--	--	--	0.0062	390	2.690	1020	--	--	--	--	--	0.029	--	--	--	--
0205	12/04/2002	--	--	--	--	0.0063	393	1.400	1060	--	--	5.44	--	6.37	0.0072	--	--	--	--
CR1	03/11/2002	0.23	<0.91	--	<0.0005	0.0043	273	0.965	830	<1.6	<0.00012	7.71	--	20.3	0.0058J	--	--	0.00073	0.005
	05/20/2002	0.16	<0.79	--	<0.00029	0.005	296	1.070	790	<1.6	<0.0001	20.78	--	114	0.0049	3.5	2	0.0016	0.0026
	08/12/2002	0.16	<0.74	<26.19	<0.0004	0.0076	429	1.630	1020	<1.5	<0.00072	25.88	4	--	0.0075J	4.7	2.9	0.0031	<0.0008
	12/03/2002	--	--	--	--	0.0079	439	1.450	1060	--	--	3.65	--	9.37	0.0078	--	--	--	--
CR2	03/12/2002	0.16	<0.92	--	<0.0005	0.0038	277	0.958	783	<1.6	<0.0001	9.12	--	27.2	0.040J	--	--	0.0011	0.0028
	05/22/2002	0.17	<0.76	--	<0.00052	0.0051	<290	<1.020	727	<1.6	<0.0001	17	--	107	0.0238	9	9.1	<0.0017	<0.0016
	08/14/2002	0.2	<0.8	<17.84	<0.00011	0.0082	516	1.600	1220	<1.5	<0.0007	22.57	7.8	--	0.0367	12.9J	13.8	0.0032	<0.0008
	12/06/2002	--	--	--	--	0.0063	453	1.450	1160	--	--	7.01	--	33.8	0.093	--	--	--	--
CR2-001	03/12/2002	0.19	<0.94	--	<0.0005	0.0042	277	0.940	785	<1.6	<0.0001	8.71	--	15.7	0.0395J	--	--	0.0013	0.0038
	05/22/2002	0.17	<0.7	--	<0.00024	0.0049	<275	<0.998	697	<1.6	<0.0001	16.6	--	114	0.015	4.7	5.5	<0.0015	<0.0012
	08/14/2002	0.18	<0.79	<14.96	<0.0001	0.0082	440	1.520	1080	<1.5	<0.0007	22.05	4.1	--	0.0246	11.8J	10	0.003	<0.0008
	12/06/2002	--	--	--	--	0.006	386	1.340	1020	--	--	5.1	--	293	0.0155	--	--	--	--
CR2B	03/12/2002	0.22	<0.97	--	<0.0005	0.0043	783	1.470	1540	<1.6	<0.00011	11.64	--	11.5	0.139J	--	--	0.00088	0.0031
	05/21/2002	0.17	<0.86	--	<0.0003	0.0048	637	1.630	1370	<1.6	<0.0001	18.97	--	201	0.0997	27	5.4	0.0015	0.0017
	08/14/2002	1.27	<0.77	280.78	<0.0022	0.0036	4770	7.520	8650	<1.5	<0.00071	19.89	11.8	--	1.140J	369	413	<0.0003	0.0011
	12/03/2002	--	--	--	--	0.0066	3090	4.260	6030	--	--	10.79	--	14.5	0.732	--	--	--	--
CR2B-001	03/12/2002	0.16	<0.91	--	<0.0005	0.0043	350	1.030	927	<1.6	<0.0001	9.99	--	10.1	0.0358J	--	--	0.00097	0.0025
	05/21/2002	<0.13	<0.73	--	<0.00058	0.0046	<280	1.030	748	<1.6	<0.0001	18.88	--	143	0.0089	3.6	3.4	0.0016	0.0014
	08/14/2002	0.25	<0.72	<22.63	<0.00046	0.0073	442	1.570	1070	<1.5	<0.0007	21.47	4.2	63.3	0.0165J	8.9	6.6	0.003	<0.0008
	12/03/2002	--	--	--	--	0.0068	449	1.430	1080	--	--	4.52	--	10.6	0.0186	--	--	--	--
CR3	03/12/2002	0.2	<0.98	--	<0.0005	0.0042	316	1.060	985	<1.6	<0.00011	7.68	--	22.5	0.0259J	--	--	0.00074	0.0027
	05/21/2002	0.25	<0.78	--	<0.00029	0.0049	<363	1.130	1020	<1.6	<0.0001	18.21	--	354	0.022	8.1	8.5	0.0018	0.0016
	08/13/2002	0.2	<0.73	<25.19	<0.0014	0.0073	597	1.960	1780	<1.5	<0.00071	28.18	5.7	29.6	0.0509J	18.7	18.9	0.0033	<0.0008
	12/03/2002	--	--	--	--	0.007	469	1.520	1210	--	--	6.01	--	13.2	0.0257	--	--	--	--

Table A-1. Summary of Surface Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Date	Ag (mg/L)	Al (mg/L)	ALK (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Ca (mg/L)	Cd (mg/L)	Chloride (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	DO (mg/L)	EC (µmhos/cm)	Fe (mg/L)	Fluoride (mg/L)	GA (pCi/L)
CR3-001	03/12/2002	<0.0001	--	140	<0.0006	0.0805	--	84.5	<0.0002	235	--	<0.0006	0.00094	--	1606	<0.0076	--	19.72
	05/21/2002	<0.0001	--	127	0.0006	--	0.0545	90.1	<0.0001	124	--	<0.0006	0.00074	9.18	1166	0.0042	--	6.08
	08/13/2002	<0.00033	<0.0076	294	0.0021	0.666	0.119	399	<0.00053	7990	0.0027	<0.0005	<0.0004	12.19	19670	3.080	1.420	390.48
	12/03/2002	--	--	171	--	0.130	0.0572J	--	--	230	--	--	--	13.05	1729	--	--	<10.42
CR4	03/12/2002	<0.0001	--	--	<0.0006	0.0767	--	83.9	<0.0002	202	--	<0.0006	0.0012	--	1434	<0.0079	--	<9.57
	05/21/2002	<0.0001	--	123	0.00054	--	0.055	90.5	<0.0001	129	--	<0.0006	<0.0006	8.82	1149	0.0036	--	<7.7
	08/13/2002	<0.00031	<0.0076	152	0.0014	0.118	0.113	141	<0.00028	216	<0.0013	<0.0005	0.00062	--	1623	0.0062	0.472	<12.87
	12/03/2002	--	--	168	--	0.0817	0.0559J	--	--	198	--	--	--	12.42	1569	--	--	<7.51
CR5	03/11/2002	<0.0001	--	124	<0.0006	0.0873	--	84.2	<0.0002	199	--	<0.0006	0.0011	--	1405	<0.0113	--	<9.51
	03/11/2002	<0.0001	--	--	<0.0006	0.0794	--	84.8	<0.0002	199	--	<0.0006	0.001	--	--	<0.0114	--	9.73
	05/20/2002	<0.0001	--	124	0.00057	--	0.0562	92.0	<0.0001	132	--	<0.0006	<0.0006	10.58	1184	0.0089	--	<7.8
	08/13/2002	<0.00033	<0.0076	154	0.0014	0.116	0.121	142	<0.00027	158	<0.0013	<0.0005	0.00059	6.85	1445	0.0074	0.531	<12.37
	12/03/2002	--	--	152	--	0.0928	0.0576J	--	--	186	--	--	--	12.01	1492	--	--	<7.38
CRA	03/12/2002	<0.0001	--	143	<0.0006	0.0761	--	82.5	<0.0002	151	--	<0.0006	0.001	--	1245	<0.0067	--	70.56
	05/22/2002	<0.0001	--	130	0.00062	--	0.0548	86.7	<0.0001	93.0	--	<0.0006	0.00093	9.37	1037	<0.0045	--	15.21
	08/15/2002	<0.00031J	0.0197	165	0.0013	0.0952	0.0875	133	<0.00027	124	<0.0013	<0.0005	0.00055	--	1102	0.0094	0.360	32.74
	08/15/2002	<0.00031J	<0.0076	--	0.0013	0.0975	0.0887	137	<0.00026	126	<0.0013	<0.0005	0.00072	--	--	<0.004	0.415	38.5
	08/20/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	12/06/2002	--	--	170	--	0.0882	0.0551J	--	--	179	--	--	--	14.15	1466	--	--	182.37
CRC	03/12/2002	<0.0001	--	143	<0.0006	0.0795	--	84.7	<0.0002	230	--	<0.0006	0.0012	--	1525	<0.0114	--	12.72
	05/21/2002	<0.0001	--	124	0.00061	--	0.0556	90.3	<0.0001	122	--	<0.0006	<0.0006	9.02	1148	0.008	--	<7.72
	08/13/2002	<0.00031	<0.0076	143	0.0014	0.128	0.116	146	<0.00028	293	<0.0013	<0.0005	<0.0004	12.04	1874	0.0064	0.460	16.72
	12/03/2002	--	--	163	--	0.0808	0.0603J	--	--	245	--	--	--	13.2	1736	--	--	<14.08
CRD	03/12/2002	<0.0001	--	134	<0.0006	0.081	--	84.3	<0.0002	210	--	<0.0006	0.00099	--	1421	<0.0075	--	<9.52
	05/21/2002	<0.0001	--	131	0.00059	--	0.0547	90.4	<0.0001	124	--	<0.0006	0.00088	8.05	920	0.0046	--	<7.67
	05/21/2002	<0.0001	--	--	0.00056	--	0.055	89.2	<0.0001	125	--	<0.0006	0.00072	--	--	0.0033	--	<7.65
	08/13/2002	<0.00032	<0.0076	177	0.0014	0.124	0.112	140	<0.00028	187	<0.0013	<0.0005	0.001	11.57	1551	0.0059	0.498	<12.54
	12/03/2002	--	--	146	--	0.0933	0.0569J	--	--	186	--	--	--	11.44	1275	--	--	<7.4
CRE	03/11/2002	<0.0001	--	114	<0.0006	0.0827	--	83.9	<0.0002	175	--	<0.0006	0.00095	45.1	1323	<0.0091	--	<8.98
	05/20/2002	<0.0001	--	124	0.00056	--	0.0557	91.9	<0.0001	126	--	<0.0006	0.0009	10.42	1168	0.0044	--	<7.73
	08/13/2002	<0.00034	<0.0076	159	0.0014	0.116	0.121	142	<0.00027	135	<0.0013	<0.0005	0.00045	6.38	1367	0.0052	0.540	<12.02
	12/03/2002	--	--	160	--	0.103	0.0563J	--	--	179	--	--	--	11.78	1470	--	--	<8.45

Table A-1. Summary of Surface Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Date	GB (pCi/L)	Hg (mg/L)	K (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	NH_3+NH_4 as N (mg/L)	Ni (mg/L)	NO_3 (mg/L)	ORP (mV)	Pb (mg/L)	Pb-210 (pCi/L)	pH (s.u.)	Po-210 (pCi/L)	PO_4 (mg/L)
CR3-001	03/12/2002	18.6	<0.0002	6.08	--	33.0	0.0619	<0.006	173	3.261	<0.0008	2.840	139	<0.00042	<1.11	8.37	<0.0998	--
	05/21/2002	11.85	<0.0002	4.14	--	31.0	0.0154	0.0057	<109	1.033	<0.0008	1.960	177	<0.0001	<1.44	8.55	0.0683	--
	08/13/2002	185.23	--	192	0.200	305	1.590	0.102	5130	33.385	--	13.000	-101	<0.00076	<1.28	7.34	<0.055	<0.544
	12/03/2002	13.35	--	--	--	--	0.0461J	<0.009	--	2.306J	--	--	11.1	--	--	8.44	--	--
CR4	03/12/2002	<7.61	<0.0002	5.04	--	30.7	0.0442	<0.0043	155	0.646	<0.0008	1.990	14	<0.00041	<1.17	8.39	0.0626	--
	05/21/2002	7.32	<0.0002	4.00	--	29.1	0.0088	0.0029	<105	0.415	<0.0008	1.150	190	<0.0001	<1.49	8.54	0.0485	--
	08/13/2002	<12.86	--	6.57	0.0552	44.9	0.0316	0.009	178	0.728	--	5.530	-106	<0.00079	<1.25	8.43	<0.0934	<0.544
	12/03/2002	7.92	--	--	--	--	0.020J	<0.009	--	0.373J	--	--	208	--	--	8.16	--	--
CR5	03/11/2002	9.81	<0.0002	4.90	--	31.1	0.0388	<0.0047	149	0.477	<0.0008	2.100	143.9	<0.00043	<1.09	8.25	<0.0634	--
	03/11/2002	12.28	<0.0002	4.84	--	30.7	0.0382	<0.0049	150	0.495	<0.0008	2.040	--	<0.00042	<1.11	--	<0.0695	--
	05/20/2002	8.36	<0.0002	4.06	--	30.5	0.0056	0.0023	<109	0.167	0.00087	0.829	238	<0.0001	<1.51	8.65	<0.0816	--
	08/13/2002	<12.82	--	5.91	0.0571	43.1	0.0204	0.0078	148	0.293	--	5.530	118	<0.00079	<1.19	8.21	<0.0755	2.350
	12/03/2002	9.39	--	--	--	--	0.0177J	<0.009	--	0.259J	--	--	44	--	--	8.4	--	--
CRA	03/12/2002	31.98	<0.0002	4.30	--	29.9	0.0314	<0.0061	127	0.097	<0.0008	2.340	-8	<0.00039	<1.14	8.35	<0.0666	--
	05/22/2002	11.58	<0.0002	<3.55	--	<27.4	<0.0042	0.0025	86.5	0.0227	<0.0008	1.460	174	<0.0001	<1.47	8.55	0.0415	--
	08/15/2002	<12.95	--	5.28J	0.0581	45.5J	0.0122	0.0108	131	0.0688	--	5.290	98	<0.0008	<1.29	7.95	<0.0856	<0.544
	08/15/2002	14.17	--	5.68J	0.0613	43.3J	0.0105	0.011	139	0.0656	--	5.270	--	<0.00079	<1.16	--	<0.0455	<0.544
	08/20/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	12/06/2002	67.97	--	--	--	--	0.0279J	<0.009	--	0.138J	--	--	164	--	--	8.4	--	--
CRC	03/12/2002	16	<0.0002	5.59	--	32.0	0.0514	<0.0058	168	1.421	<0.0008	2.280	109.6	<0.0004	<1.15	8.4	<0.0689	--
	05/21/2002	6.92	<0.0002	4.02	--	29.7	0.0112	0.0042	<105	0.672	<0.0008	1.290	178	<0.0001	<1.45	8.55	0.0814	--
	08/13/2002	<12.93	--	8.33	0.059	51.0	0.0656	0.0094	224	2.562	--	5.860	110	<0.00078	<1.22	8.41	<0.0679	3.120
	12/03/2002	9.94	--	--	--	--	0.0401J	<0.009	--	1.227J	--	--	149	--	--	8.31	--	--
CRD	03/12/2002	11.22	<0.0002	5.13	--	31.0	0.0446	<0.0046	156	0.627	<0.0008	1.990	83.4	<0.00039	<1.1	8.29	0.0764	--
	05/21/2002	7.18	<0.0002	3.88	--	28.9	0.0075	0.0033	<102	0.313	<0.0008	1.030	228	<0.0001	<1.47	8.43	<0.0765	--
	05/21/2002	6.36	<0.0002	3.81	--	28.5	0.0079	0.0029	<102	0.293	<0.0008	1.050	--	<0.0001	<1.46	--	<0.1011	--
	08/13/2002	<12.83	--	6.27	0.056	44.0	0.0266	0.0088	164	0.517	--	5.470	96	<0.0008	<1.27	8.39	0.0605	2.280
	12/03/2002	<6.87	--	--	--	--	0.0214J	<0.009	--	0.339J	--	--	20.8	--	--	8.45	--	--
CRE	03/11/2002	11.84	<0.0002	4.49	--	30.2	0.034	0.0036	136	0.235	<0.0008	1.970	124	<0.00048	<1.08	8.38	0.0533	--
	05/20/2002	7.44	<0.0002	3.88	--	30.1	0.005	0.0046	<104	0.0784	<0.0008	0.832	238.1	<0.0001	<1.47	8.66	<0.0633	--
	08/13/2002	<12.81	--	5.47	0.0554	42.9	0.0105	0.0074	130	0.175	--	5.470	152	<0.0008	<1.24	8.07	<0.0617	<0.544
	12/03/2002	8.36	--	--	--	--	0.0155J	<0.009	--	0.0978J	--	--	54	--	--	8.38	--	--

Table A-1. Summary of Surface Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Date	Ra-226 (pCi/L)	Ra-228 (pCi/L)	Rn-222 (pCi/L)	Sb (mg/L)	Se (mg/L)	SO_4 (mg/L)	Sr (mg/L)	TDS (mg/L)	Th-230 (pCi/L)	Tl (mg/L)	TMP (C)	TOC (mg/L)	Turbidity (NTU)	U (mg/L)	U-234 (pCi/L)	U-238 (pCi/L)	V (mg/L)	Zn (mg/L)
CR3-001	03/12/2002	0.17	<0.96	--	<0.0005	0.0042	315	1.040	978	<1.6	<0.0001	7.85	--	13.8	0.025J	--	--	0.00084	0.0022
	05/21/2002	<0.14	<0.78	--	<0.00025	0.0046	<317	1.040	810	<1.6	<0.0001	18.16	--	189	0.0144	4.8	3	0.0013	0.0018
	08/13/2002	0.52	<0.77	66.63	<0.00016	0.005	2880	10.200	10800	<1.5	<0.00071	26.66	6.1	--	0.630J	222	243	<0.0003	<0.0008
	12/03/2002	--	--	--	--	0.0075	482	1.500	1150	--	--	5.56	--	9.34	0.0246	--	--	--	--
CR4	03/12/2002	0.26	<0.98	--	<0.0005	0.0042	272	0.992	885	<1.6	<0.0001	6.3	--	18.4	0.0118J	--	--	0.0011	0.0026
	05/21/2002	<0.14	<0.78	--	<0.00024	0.0046	<284	1.020	790	<1.6	<0.0001	17.37	--	108	0.0083	3.4	3.3	0.0013	0.0013
	08/13/2002	0.19	<0.76	<25.13	<0.00028	0.0074	454	1.660	1240	<1.5	<0.00071	25.17	4.1	62	0.0125J	6.1	4.9	0.0033	<0.0008
	12/03/2002	--	--	--	--	0.0076	455	1.450	1100	--	--	4.76	--	8.37	0.012	--	--	--	--
CR5	03/11/2002	0.15	<0.92	--	<0.0005	0.0044	283	1.000	890	<1.6	<0.00011	7.7	--	14.3	0.010J	--	--	0.00075	0.0026
	03/11/2002	0.13	<0.96	--	<0.0005	0.0044	281	1.000	890	<1.6	<0.0001	--	--	--	0.010J	--	--	0.00065	0.0025
	05/20/2002	0.18	<0.81	--	<0.00046	0.005	<301	1.080	812	<1.6	<0.0001	20.92	--	104	0.0066	4	2.6	0.0014	0.002
	08/13/2002	0.29	<0.74	<23.38	<0.00046	0.0074	437	1.640	1110	<1.5	<0.00071	21.75	4.4	119	0.0095J	4.8	3.6	0.003	<0.0008
	12/03/2002	--	--	--	--	0.0076	443	1.450	1080	--	--	3.99	--	11	0.010	--	--	--	--
CRA	03/12/2002	0.18	<0.88	--	<0.0005	0.0045	275	0.976	805	<1.6	<0.0001	8.54	--	12.2	0.0931J	--	--	0.0019	0.003
	05/22/2002	0.15	<0.73	--	<0.00024	0.0049	<276	<0.998	692	<1.6	<0.0001	17.06	--	114	0.0268	8.9	8.9	<0.0016	<0.0017
	08/15/2002	0.17	<0.84	--	<0.0001	0.0083	449	1.640	1090	<1.5	<0.00071	26.41	4.2	112.1	0.0621	23J	23.7	0.0033	<0.0008
	08/15/2002	0.14	<0.79	--	<0.00042	0.0082	443	1.520	1100	<1.5	<0.00071	--	4.1	--	0.0767	25.3J	28.9	0.0032	<0.0008
	08/20/2002	--	--	24.51	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	12/06/2002	--	--	--	--	0.0067	424	1.430	1120	--	--	5.31	--	22.8	0.268	--	--	--	--
CRC	03/12/2002	0.23	<0.94	--	<0.0005	0.0042	297	1.020	945	<1.6	<0.0001	6.95	--	14.2	0.0183J	--	--	0.00072	0.0036
	05/21/2002	<0.13	<0.72	--	<0.00024	0.0046	<289	1.030	795	<1.6	<0.0001	17.6	--	148	0.0098	4.4	3.8	0.0015	0.00094
	08/13/2002	0.2	<0.72	<25.15	<0.00013	0.0076	491	1.800	1400	<1.5	<0.00071	26.84	4.2	35	0.0229J	10	9.3	0.0034	<0.0008
	12/03/2002	--	--	--	--	0.0077	478	1.500	1190	--	--	5.23	--	11.8	0.0195	--	--	--	--
CRD	03/12/2002	0.22	<0.88	--	<0.0005	0.0042	282	0.992	885	<1.6	<0.0001	6.09	--	15.7	0.0115J	--	--	0.00061	0.0025
	05/21/2002	0.15	<0.79	--	<0.00024	0.0046	<282	1.020	773	<1.6	<0.0001	17.61	--	124	0.0075	3.3	3	0.0014	0.0021
	05/21/2002	<0.13	<0.81	--	<0.00025	0.0046	<286	1.010	788	<1.6	<0.0001	--	--	--	0.0075	4	8.5	0.0014	0.0012
	08/13/2002	0.19	<0.77	<25.06	<0.00038	0.0074	446	1.620	1180	<1.5	<0.00071	24.65	4	--	0.011J	9.1	4.5	0.0032	<0.0008
	12/03/2002	--	--	--	--	0.0077	444	1.460	1100	--	--	5.47	--	130	0.0112	--	--	--	--
CRE	03/11/2002	0.17	<0.93	--	<0.0005	0.0044	274	0.979	857	<1.6	<0.00017	7.7	--	14.4	0.0077J	--	--	0.00073	0.0025
	05/20/2002	0.15	<0.77	--	<0.00088	0.0049	295	1.060	798	<1.6	<0.0001	20.79	--	91.1	0.0056	4.2	2.3	0.0014	0.0019
	08/13/2002	0.23	<0.73	<23.38	<0.00071	0.0074	437	1.620	1050	<1.5	<0.00071	21.45	4	138	0.0083J	4.4	3.3	0.003	<0.0008
	12/03/2002	--	--	--	--	0.0077	439	1.460	1060	--	--	3.75	--	9.52	0.009	--	--	--	--

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

"--" indicates no data.

"J" indicates an estimated value.

Analyte abbreviations ALK, DO, EC, GA, GB, ORP, TDS, TOC are Total Alkalinity (as CaCO3), Dissolved Oxygen, Specific Conductance, Gross Alpha, Gross Beta, Oxidation Reduction Potential, Total Dissolved Solids, Total Organic Carbon, respectively.

Table A-2. Summary of Ground Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Elevation	Sample Date	Ag (mg/L)	Al (mg/L)	ALK (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Ca (mg/L)	Cd (mg/L)	Chloride (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	DO (mg/L)	EC (µmhos/cm)	Fe (mg/L)	Fluoride (mg/L)	GA (pCi/L)
0410	3959.7	05/23/2002	<0.0001	--	434	0.00089	--	0.030	<91.5	0.00035	334	--	<0.0006	0.00069	--	2677	<0.0089	--	423.28
	3959.7	09/18/2002	--	--	--	--	--	--	--	--	278	--	--	--	--	2726	--	0.649	--
0412	3957.44	05/23/2002	<0.0001	--	396	0.0204	--	0.0227	<193	0.0014	714	--	<0.0006	0.0025	10.38	4915	<0.0098	--	11881.6
	3957.44	05/23/2002	<0.0001	--	--	0.0203	--	0.0223	<193	0.0014	721	--	<0.0006	0.0024	--	--	<0.0061	--	10850.27
	3957.44	09/17/2002	<0.0001	0.0241	405	0.020	0.264	0.0225	189	0.0013	745	0.0043	<0.0006	<0.0029	0.4	5143	<0.0011	0.426	10958.86
	3952.46	12/03/2002	--	--	386	0.0241	0.257	--	--	0.0015	736	--	--	--	0.41	5053	<0.0075	0.566	11558.4
0413	3957.02	05/23/2002	<0.0001	--	257	0.00095	--	0.0263	117	0.00074	238	--	<0.0006	<0.0006	--	2955	<0.001	--	1559.16
	3957.02	09/18/2002	<0.0001	<0.0055	252	0.0011	0.280	0.0318	128	0.0007	263	0.0026	<0.0006	<0.00094	--	3388	<0.0033	0.721	1129.42
0414	3958.83	05/23/2002	<0.0001	--	545	0.361	--	0.0201	14.4	0.002	255	--	<0.0006	0.0018	--	4153	<0.001	--	3420.66
	3958.83	09/18/2002	<0.0001	0.0347	579	0.313	0.677	0.0216	14.8	0.0016	262	0.002	<0.0006	<0.0027	--	4269	<0.0051	1.080	--
	3952.6	12/03/2002	--	--	--	0.315	0.631	--	--	0.0018	244	--	--	--	4.18	4250	<0.0075	1.370	3116.27
0430	3926.6	08/19/2002	<0.00031J	<0.0098	175	0.00022	0.111	0.133	98.8	<0.00029	694	<0.0013	<0.0005	<0.0004	5.67	2417	<0.004	0.454	<14.97
	3925.6	12/04/2002	--	--	141	0.0003	0.112	--	--	<0.0001	368	--	--	--	0.69	5357	0.0467	0.113	<11.76
	3925.6	12/04/2002	--	--	--	0.00021	0.0954	--	--	<0.0001	376	--	--	--	--	--	<0.0081	0.133	<7.04
	3916.6	12/04/2002	--	--	--	0.00044	0.116	--	--	<0.0001	1700	--	--	--	--	--	0.297	0.401	<21.17
0431	3915.4	09/19/2002	<0.0001	<0.0055	160	<0.0001	0.946	0.0469	485	0.00018	12200	0.0034	<0.0006	<0.0016	--	30930	0.0292	2.780	<166.89
	3913.54	12/06/2002	--	--	177	0.00011	0.995	--	--	0.0001	13300	--	--	--	0.43	33973	0.433	0.994	<174.15
0432	3951.7	08/15/2002	<0.00032J	<0.0076	139	<0.0001	0.117	0.0211	94.5	<0.00026	729	<0.0013	<0.0005	<0.0004	3.93	2814	0.0555	0.489	<18.45
	3946.47	12/05/2002	--	--	151	<0.0001	0.122	--	--	<0.0001	738	--	--	--	4.23	2924	0.0251	<0.108	<12.77
0433	3896.2	08/20/2002	<0.0001	<0.0076	147	<0.0001	0.135	0.023	103	<0.0001	1180	<0.0013	<0.0005	<0.0004	2.07	4147	0.0418	0.454	<24.86
	3890.99	12/05/2002	--	--	160	<0.0001	0.146	--	--	<0.0001	1190	--	--	--	2.1	4275	0.0572	0.330	<17.65
0434	3915.6	08/15/2002	<0.00034J	<0.038	177	<0.0001	0.537	0.0675	477	<0.00037	15700	<0.0065	<0.0025	<0.002	0.58	37835	0.520	<0.502	<339.53
	3910.21	12/05/2002	--	--	201	0.0004	0.540	--	--	<0.0001	15800	--	--	--	0.4	40040	1.580	3.080	<205.35
0435	3798.1	09/18/2002	0.0018	<0.0275	--	0.0001	1.290	0.0759	1320	<0.0005	56300	0.0094	<0.003	<0.002	0.18	116.5	2.080	7.880	<646.23
	3795.67	12/04/2002	--	--	108	<0.0001	1.210	--	--	0.00016	55400	--	--	--	2.36	118260	2.420	8.080	<727.31
0436	3773.5	09/19/2002	<0.0005	<0.0275	81	0.0002	4.210	0.0763	1470	<0.0005	59500	<0.0065	<0.003	<0.002	0.26	124.2	6.240	<2.510	<801.39
	3770.8	12/04/2002	--	--	92	0.00022	4.100	--	--	<0.0001	59600	--	--	--	0.27	126160	6.050	3.900	<830.53
0437	3955.9	09/26/2002	<0.0001	0.0098	525	0.00085	0.445	0.0398	174	0.0113	1250	0.0056	<0.0006	<0.0031	0.82	7571	<0.0069	1.190	2501.27
	3950.25	12/10/2002	--	--	610	0.00082	0.496	--	--	0.0155	1460	--	--	--	0.58	10660	0.0355	1.600	2728.25
0438	3943	09/17/2002	<0.0001	<0.0301	647	0.00029	0.384	0.0285	446	0.00041	997	<0.0046	<0.0006	<0.00056	0.25	8040	0.525	1.080	1428.71
	3934.22	12/10/2002	--	--	640	0.00083	0.389	--	--	0.00068	990	--	--	--	1.58	8095	3.630	0.611	1261.26
0439	3942.9	09/17/2002	<0.0001	<0.0055	838	<0.0001	0.714	0.0291	405	0.00028	1110	<0.0068	<0.0006	<0.0024	0.28	9018	0.0758	0.943	506.98
	3935.27	12/09/2002	--	--	837	0.00011	0.686	--	--	0.00036	1100	--	--	--	--	8712	<0.0075	<0.166	673.62
0440	3959.3	09/24/2002	<0.0001	<0.0055	106	0.0001	0.689	0.0297	701	0.00043	2090	0.0046	<0.0006	<0.0021	4.11	8840	<0.0145	0.857	<45.53
	3951.21	12/06/2002	--	--	1121	<0.0001	0.626	--	--	0.00088	1850	--	--	--	3.53	8074	<0.0075	0.377	<41.74
0442	3959.2	09/25/2002	<0.0001	0.0177	1915	0.0075	0.830	0.0213	233	0.0056	1260	0.0098	<0.0006	0.0336	2.21	19830	0.018	<0.502	6729.67
	3955.28	12/09/2002	--	--	1486	0.0039	0.651	--	--	0.006	1240	--	--	--	1.71	28107	<0.0075	0.935	6048.38
0443	3934.4	09/19/2002	<0.0001	<0.0055	130	0.00027	0.180	0.0376	209	<0.0001	1200	0.002	<0.0006	<0.00066	2.21	4540	0.0193	0.411	<19.22
	3931.72	12/06/2002	--	--	138	0.00039	0.219	--	--	<0.0001	1860	--	--	--	1.55	5878	<0.0075	0.562	<24.63
0444	3858.9	09/18/2002	<0.0005	<0.0275	106	0.00031	1.130	0.0842	1230	0.0006	49900	0.0166	<0.003	<0.002	0.16	111.5	6.590	7.180	<640.88
	3858.9	09/18/2002	<0.0005	<0.0275	--	0.00017	1.060	0.0813	1220	<0.0005	49800	0.0189	<0.003	<0.002	--	--	5.960	8.210	<641.75
	3852.99	12/04/2002	--	--	114	0.00047	1.170	--	--	<0.0001	50700	--	--	--	0.2	115150	10.800	2.280	<724.31
0455	3946.85	10/10/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	3944.2	12/05/2002	--	--	168	0.00053	0.191	--	--	<0.0001	678	--	--	--	0.57	2768	0.115	<0.151	<18.16
0456	3940.2	10/10/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	3937.96	12/05/2002	--	--	171	0.00018	0.314	--	--	<0.0001	2390	--	--	--	2.41	8381	0.0194	0.546	<37.38

Table A-2. Summary of Ground Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Elevation	Sample Date	GB (pCi/L)	Hg (mg/L)	K (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	NH_3+NH_4 as N (mg/L)	Ni (mg/L)	NO_3 (mg/L)	Organics (µg/L)	ORP (mV)	pH (s.u.)	Po-210 (pCi/L)	PO_4 (mg/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)
0410	3959.7	05/23/2002	153.23	<0.0002	5.23	--	<95.1	<0.931	<0.0858	<372	0.0144	0.0035	29.200	No Detect	261	7.22	<0.0625	--	0.14	<0.72
	3959.7	09/18/2002	--	--	--	--	--	--	--	--	0.0249	--	35.500	--	102	7.61	--	<0.272	--	--
0412	3957.44	05/23/2002	3623.83	<0.0002	17.0	--	<141	<0.0676	<0.565	<736	1.040	0.0041	183.000	See Table	137	7.35	<0.0958	--	<0.12	<0.65
	3957.44	05/23/2002	3623.46	<0.0002	17.5	--	<141	<0.0658	<0.564	<734	0.955	0.0034	184.000	See Table	--	--	<0.0977	--	<0.11	<0.69
	3957.44	09/17/2002	1848.67	--	15.9	0.0776	133	0.0564	0.700	789	1.180	--	185.000	--	90.5	7.06	<0.106	0.496	<0.09	<0.74
	3952.46	12/03/2002	3018.82	--	--	0.0783	--	0.0605	0.687	848	1.009J	--	192.000J	--	191	7.15	--	--	<0.1	<0.74
0413	3957.02	05/23/2002	495.48	<0.0002	<19.8	--	160	<0.159	0.320	<293	8.7733	0.0023	282.000	See Table	149	7.85	<0.0589	--	<0.12	<0.64
	3957.02	09/18/2002	244.88	--	21.4	0.0942	177	0.196	0.342	309	8.7733	--	334.000	--	29.4	7.73	<0.0802	<0.272	<0.08	<0.69
0414	3958.83	05/23/2002	997.93	<0.0002	<14.5	--	<25.3	<0.0395	0.931	<845	31.522	0.0037	242.000	See Table	170	8.37	<0.0564	--	<0.13	<0.72
	3958.83	09/18/2002	--	--	14.4	0.0738	24.6	0.0581	0.845	847	32.997	--	266.000	--	80	7.62	--	0.451	--	--
	3952.6	12/03/2002	798.14	--	--	0.0785	--	0.063	0.805	923	24.612J	--	346.000J	--	199	7.66	--	--	0.12	<0.81
0430	3926.6	08/19/2002	<12.95	--	13.8J	0.0303	64.8J	0.251	0.008	337	0.0189	--	1.620	--	106	7.53	<0.031	<0.544	0.44	<0.74
	3925.6	12/04/2002	15.62	--	--	0.0263	--	0.296	0.010	253	0.0051J	--	3.370	--	35.3	7.29	--	--	0.23	<0.74
	3925.6	12/04/2002	14.05	--	--	0.0255	--	0.368	<0.009	211	<0.003J	--	4.060	--	--	--	--	--	0.23	<0.75
	3916.6	12/04/2002	30.18	--	--	0.0447	--	1.040	<0.009	663	<0.003J	--	<0.020	--	--	--	--	--	0.68	1.33
0431	3915.4	09/19/2002	<150.1	--	112	0.122	238	0.745	0.002	5880	0.0839	--	5.030	--	98.7	7.19	<0.0584	<0.544	0.94	2.32
	3913.54	12/06/2002	174.24	--	--	0.116J	--	0.961	<0.009	7410	0.0262J	--	--	--	119	7.15	--	--	0.93	1.99
0432	3951.7	08/15/2002	<16.17	--	18.2J	0.0186	51.4J	0.0061	<0.0018	476	0.0496	--	1.010	--	7.7	7.4	0.0527	1.860	0.18	<0.73
	3946.47	12/05/2002	19.84	--	--	0.0179	--	0.0017	<0.009	444	<0.003J	--	1.070	--	129	7.5	--	--	0.14	<0.71
0433	3896.2	08/20/2002	<21.59	--	24.6J	0.0208	56.9J	0.0279	<0.0018	725	<0.003	--	0.827	--	4.1	7.48	0.0607	1.460	<0.13	<0.71
	3890.99	12/05/2002	<14.94	--	--	0.0222	--	0.0123	<0.009	746	<0.003J	--	0.901	--	59.5	7.56	--	--	<0.1	<0.69
0434	3915.6	08/15/2002	<321.03	--	199J	0.235	245J	1.440	<0.009	9490	0.205	--	<0.020	--	-526	6.98	0.0554	4.800	2.14	0.77
	3910.21	12/05/2002	221.35	--	--	0.222	--	2.890	<0.009	8910	0.0854J	--	<0.020	--	-118	7.21	--	--	3.11	2.07
0435	3798.1	09/18/2002	753.43	--	667	0.392	551	1.460	<0.0085	28100	2.772	--	<0.020	--	-316	6.91	<0.0801	<1.360	8.42	3.04
	3795.67	12/04/2002	<638.66	--	--	0.383	--	1.120	<0.009	30700	2.756J	--	--	--	-300	7	--	--	6.81	2.06
0436	3773.5	09/19/2002	<748.75	--	650	0.318	515	3.730	<0.0085	31200	4.231	--	0.0217	--	-375	7.18	<0.0496	<2.720	0.65	11.05
	3770.8	12/04/2002	<744.48	--	--	0.306	--	3.900	<0.009	33600	3.835J	--	--	--	-334	7.2	--	--	0.57	11.09
0437	3955.9	09/26/2002	371.51	--	17.6	0.0837	170	1.200	4.720	1880	1.887	--	40.000	--	70.7	7.4	0.0457	0.815	1.35	<0.75
	3950.25	12/10/2002	770.24	--	--	0.0938J	--	1.160	7.150	2300	1.234	--	54.300	--	164	7.58	--	--	0.96	<0.75
0438	3943	09/17/2002	330.12	--	34.0	0.188	362	2.060	0.217	1140	21.506	--	7.900	--	102	6.63	<0.0832	<0.272	1.77	<0.79
	3934.22	12/10/2002	408.09	--	--	0.190J	--	3.150	0.190	1170	24.767	--	1.620	--	-72	6.93	--	--	2.26	<0.82
0439	3942.9	09/17/2002	200.06	--	65.7	0.408	550	2.680	0.0635	1170	16.615	--	125.000	--	103	6.65	<0.0406	<0.272	0.14	1.11
	3935.27	12/09/2002	291.84	--	--	0.407J	--	2.770	0.0744	1220	15.528	--	137.000	--	95	6.77	--	--	<0.19	1.38
0440	3959.3	09/24/2002	50.16	--	32.1	0.166	207	1.890	0.0465	1050	0.306	--	19.700	--	172	7.21	0.0498	<0.544	0.29	<0.77
	3951.21	12/06/2002	51.95	--	--	0.136J	--	1.280	0.0351	999	0.0507J	--	33.300J	--	165	7.51	--	--	0.23	<0.85
0442	3959.2	09/25/2002	1539.13	--	184	0.817	532	0.875	2.330	3500	1063.665	--	1100.000	--	73.2	7.01	0.2062	0.935	0.82	<0.78
	3955.28	12/09/2002	2752.78	--	--	0.884J	--	1.920	2.260	4520	1374.224	--	1800.000J	--	232	7.43	--	--	1.32	<0.87
0443	3934.4	09/19/2002	<18	--	18.1	0.0366	93.5	0.197	0.0033	497	0.0716	--	12.000	--	69.4	7.18	<0.0657	<0.272	0.15	<0.71
	3931.72	12/06/2002	<22.31	--	--	0.0432J	--	0.0375	<0.009	708	<0.003J	--	15.500J	--	1.29	7.28	--	--	<0.12	<0.84
0444	3858.9	09/18/2002	<564.08	--	638	0.445	515	2.030	<0.0085	27500	2.252	--	<0.020	--	-368	6.83	<0.0692	<1.360	1.56	6.87
	3858.9	09/18/2002	607.23	--	616	0.443	513	1.990	<0.0085	27200	2.205	--	<0.020	--	--	--	<0.0777	4.310	1.56	7.14
	3852.99	12/04/2002	<638.27	--	--	0.432	--	1.910	<0.009	29900	2.376J	--	--	--	-443	7.09	--	--	1.8	5.54
0455	3946.85	10/10/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	3944.2	12/05/2002	<16.01	--	--	0.0222	--	0.079	0.0113	447	<0.003J	--	0.377	--	-96	7.64	--	--	0.2	<0.75
0456	3940.2	10/10/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	3937.96	12/05/2002	45.77	--	--	0.0457	--	0.0157	<0.009	1570	<0.003J	--	5.760	--	107	7.73	--	--	<0.12	<0.7

Table A-2. Summary of Ground Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Elevation	Sample Date	Rn-222 (pCi/L)	Sb (mg/L)	Se (mg/L)	SO_4 (mg/L)	Sp Gravity	Sr (mg/L)	TDS (mg/L)	Th-230 (pCi/L)	Tl (mg/L)	TMP (C)	TOC (mg/L)	Turbidity (NTU)	U (mg/L)	U-234 (pCi/L)	U-238 (pCi/L)	V (mg/L)	Zn (mg/L)
0410	3959.7	05/23/2002	--	<0.0008	0.0057	560	--	2.600	1870	<1.6	<0.0001	18.38	--	440	<0.531	213	204	<0.0023	0.00069
	3959.7	09/18/2002	--	--	--	629	--	--	1880	--	--	21.53	2.8	800	--	--	--	--	--
0412	3957.44	05/23/2002	--	<0.00038	0.100	1290	--	6.190	3860	<1.6	<0.0001	16.97	--	2.5	12.800	4170	4370	<0.312	0.0012
	3957.44	05/23/2002	--	<0.00034	0.0997	1320	--	6.210	3870	<1.6	<0.0001	--	--	--	12.700	4050	4600	<0.311	<0.0006
	3957.44	09/17/2002	116.7	0.00047	0.0959	1350	--	5.530	3910	<1.5	<0.0001	22.27	4.4	3	12.400	3880	4210	0.354	<0.0008
	3952.46	12/03/2002	--	--	0.0936	1260	1.01	5.740	3810	--	--	17.2	--	7.82	12.200	--	--	0.337	--
0413	3957.02	05/23/2002	--	<0.00036	0.199	857	--	7.110	2300	<1.6	<0.0001	17.41	--	263	1.730	555	585	<0.0011	<0.0006
	3957.02	09/18/2002	306.83	0.00044	0.187	939	--	7.370	2500	<1.5	<0.0001	21.74	2.4	90	1.610	500	557	0.0017	<0.0008
0414	3958.83	05/23/2002	--	<0.0016	0.205	1090	--	<1.080	2920	<1.6	<0.0001	17.26	--	9.8	3.360	1050	1180	6.450	<0.0012
	3958.83	09/18/2002	--	0.0019	0.132	1060	--	1.200	2880	<1.5	<0.0001	21.48	3.9	115	2.820	920	1040	7.100	<0.0008
	3952.6	12/03/2002	--	--	0.167	925	1.01	1.390	2860	--	--	14.6	--	--	3.180	--	--	6.050	--
0430	3926.6	08/19/2002	54.76	<0.0017	0.0039	139	--	2.600	1420	<1.5	<0.00072	20.44	<0.57	3.73	0.010	4.1J	4.3	0.0022	<0.0008
	3925.6	12/04/2002	--	--	0.0038	122	1	2.160	957	--	--	17.27	--	0.9	0.0094	--	--	0.0021	--
	3925.6	12/04/2002	--	--	0.0047	133	--	1.900	962	--	--	--	--	--	0.0106	--	--	<0.002	--
	3916.6	12/04/2002	--	--	0.00034	152	1.01	5.040	2980	--	--	--	--	--	0.0054	--	--	<0.002	--
0431	3915.4	09/19/2002	159.21	0.0006	0.0036	1790	--	11.500	21000	<1.5	<0.0001	18.7	<0.26	--	0.011	<4.1	4.1	0.00074	<0.0047
	3913.54	12/06/2002	--	--	0.0024	1870	1.02	12.300	23400	--	--	16.5	--	9.72	0.009	--	--	<0.002	--
0432	3951.7	08/15/2002	<128.01	<0.0039	0.0018	326	--	2.510	1850	<1.5	<0.00069	20.59	2.1	1.26	0.0018	1.4J	0.76	0.00046	<0.0008
	3946.47	12/05/2002	--	--	0.0018	342	1	2.590	1780	--	--	19.36	--	5.32	0.0019	--	--	<0.002	--
0433	3896.2	08/20/2002	261.85	<0.00016	0.0018	341	--	2.840	2550	<1.5	<0.00015	18.94	<0.42	8.53	0.0021	<1.2J	0.81	0.00051	<0.0008
	3890.99	12/05/2002	--	--	0.0018	364	1.01	2.870	2570	--	--	18.71	--	6.7	0.002	--	--	<0.002	--
0434	3915.6	08/15/2002	<498.29	<0.0001	0.00029	1530	--	12.200	27800	<1.5	<0.0022	21.05	<0.37	2.66	0.0174	8.7J	8.1	0.0017	<0.004
	3910.21	12/05/2002	--	--	<0.0001	1030	1.02	12.700	27600	--	--	17.46	--	1.66	0.0149	--	--	<0.002	--
0435	3798.1	09/18/2002	77.61	0.003	<0.0001	4370	--	36.700	94000	<1.5	0.0025	17.97	<0.46	0.1	0.0273	8.6	11	0.0024	0.0068
	3795.67	12/04/2002	--	--	<0.0001	4980	1.07	36.900	95300	--	--	16.9	--	7.75	0.0231	--	--	0.0029	--
0436	3773.5	09/19/2002	<17.78	0.0018	<0.0001	5040	--	31.000	101000	<1.5	<0.0005	18.92	<0.21	3.9	0.0068	<0.74	1	<0.0015	<0.004
	3770.8	12/04/2002	--	--	<0.0001	5040	1.07	30.900	104000	--	--	17.6	--	2.83	0.0025	--	--	<0.002	--
0437	3955.9	09/26/2002	826.66	0.00033	0.069	3470	--	8.860	7330	<1.5	<0.0001	17.72	3.4	9.23	2.760	931	1010	<0.0003	0.0064
	3950.25	12/10/2002	--	--	0.0771	3750	1.01	11.500	8520	--	--	14.31	--	9.69	3.150	--	--	<0.002	--
0438	3943	09/17/2002	193.25	0.00014	0.0068	3530	--	10.100	7250	<1.5	<0.0001	18.87	<2	0.76	1.660	556	617	<0.0003	0.0035
	3934.22	12/10/2002	--	--	0.0011	3390	1.01	10.300	7400	--	--	16.03	--	1.09	1.480	--	--	<0.002	--
0439	3942.9	09/17/2002	163.77	0.00024	0.0016	3740	--	12.700	8290	<1.5	<0.0001	17.52	2.7	42	0.853	304	323	0.0008	0.0049
	3935.27	12/09/2002	--	--	0.0014	3730	1.01	13.200	8310	--	--	14.93	--	1.92	0.865	--	--	<0.002	--
0440	3959.3	09/24/2002	393.12	0.001	0.0522	2100	--	15.200	6500	<1.5	<0.0001	23.18	2.4	>1000	0.0285	12.8	11.5	0.00061	<0.0034
	3951.21	12/06/2002	--	--	0.0525	2310	1.01	14.600	6380	--	--	16.4	--	73.5	0.0313	--	--	<0.002	--
0442	3959.2	09/25/2002	2024.87	0.00051	0.125	12200	--	8.770	18400	<1.5	0.0063	19.83	6.2	31.1	10.600	3060	3760	0.270	<0.0052
	3955.28	12/09/2002	--	--	0.169	15500	1.02	9.780	22000	--	--	12.6	--	1.82	10.800	--	--	0.138	--
0443	3934.4	09/19/2002	755.33	<0.0001	0.0083	318	--	5.490	2510	<1.5	<0.0001	18.86	<0.55	9.6	0.0114	5	4.4	0.0033	<0.0021
	3931.72	12/06/2002	--	--	0.0117	449	1	7.380	3980	--	--	17.7	--	8.41	0.0108	--	--	0.0045	--
0444	3858.9	09/18/2002	116.6	0.0016	<0.0001	4110	--	35.100	89500	<1.5	<0.0005	18.07	<0.45	7.76	0.010	2.4	3.5	0.0022	<0.004
	3858.9	09/18/2002	108.29	0.0011	<0.0001	4080	--	35.100	89200	<1.5	<0.0005	--	<0.28	--	0.010	2.7	3.1	<0.0015	<0.004
	3852.99	12/04/2002	--	--	<0.0001	4550	1.07	35.300	93000	--	--	17.7	--	2.29	0.0042	--	--	<0.002	--
0455	3946.85	10/10/2002	--	--	--	--	--	--	1755	--	--	--	--	--	--	--	--	--	--
	3944.2	12/05/2002	--	--	0.0014	327	1	2.280	1720	--	--	15.96	--	121	0.0025	--	--	0.0021	--
0456	3940.2	10/10/2002	--	--	--	--	--	--	5530	--	--	--	--	--	--	--	--	--	--
	3937.96	12/05/2002	--	--	0.0266	1140	1.01	3.440	5530	--	--	17.9	--	144	0.0202	--	--	<0.002	--

Table A-2. Summary of Ground Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Elevation	Sample Date	Ag (mg/L)	Al (mg/L)	ALK (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Ca (mg/L)	Cd (mg/L)	Chloride (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	DO (mg/L)	EC (µmhos/cm)	Fe (mg/L)	Fluoride (mg/L)	GA (pCi/L)
0457	3943.06	10/10/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	3939.8	12/04/2002	--	--	184	0.0052	0.269	--	--	<0.0001	1520	--	--	--	0.69	5426	0.219	0.309	<24.69
0458	3797.4	09/26/2002	<0.0001	<0.0055	--	<0.0001	0.163	0.0313	116	0.00044	2420	0.0028	<0.0006	0.0136	--	--	<0.0106	0.832	--
0459	3760.05	09/26/2002	<0.0001	0.0072	--	<0.0001	0.338	0.0754	130	0.0002	4570	0.0025	<0.0006	<0.0004	--	--	0.990	<0.251	--
AMM-1	3952.75	03/13/2002	<0.0001	--	137	<0.0006	0.477	--	226	<0.0002	3350	--	<0.0006	0.001	--	11420	<0.0028	--	<53.77J
	3952.75	03/13/2002	<0.0001	--	--	<0.0006	0.499	--	224	<0.0002	3470	--	<0.0006	<0.0006	--	--	<0.0037	--	<53.49J
	3952.75	05/22/2002	<0.0001	--	156	0.00036	--	0.0323	294	<0.0001	4050	--	<0.0006	<0.0006	3.69	14040	<0.001	--	<73.92
	3952.75	08/14/2002	<0.0004J	<0.0076	138	0.00055	0.397	0.0234	215	<0.00027	3410	<0.0013	<0.0005	<0.0004	--	8198	<0.004	1.460	<72.62
	3952.75	08/14/2002	<0.00042J	<0.0076	--	0.00055	0.360	0.024	214	<0.00028	3360	<0.0013	<0.0005	<0.0004	--	--	<0.004	1.100	<72.61
	3952.02	12/03/2002	--	--	157	0.0012	0.474	--	--	<0.0001	3300	--	--	--	3.99	10560	<0.0075	0.941	<50.19
	3952.02	12/03/2002	--	--	--	0.0012	0.485	--	--	<0.0001	3310	--	--	--	--	--	<0.0075	0.695	<50.12
	3917.02	12/03/2002	--	--	155	0.00058	0.437	--	--	<0.0001	3350	--	--	--	0.9	12850	<0.0075	<0.193	<51.41
AMM-2	3955.5	03/13/2002	<0.0001	--	1074	0.001	0.672	--	428	0.0024	2360	--	<0.0006	0.0096	--	23990	<0.0031	--	1464.82J
	3955.5	05/29/2002	<0.0001	--	1089	0.00074	--	0.0271	427	0.0046	2250	--	<0.0006	0.0084	--	22900	<0.0025	--	1453.33
	3955.5	08/13/2002	<0.00036	<0.0312	981	0.001	0.620	0.0229	432	0.0044	2240	0.0056	<0.0005	0.007	5.75	16520	0.0084	3.000	1126.69
	3952.74	12/05/2002	--	--	774	--	--	--	--	--	2250	--	--	--	0.37	16885	--	--	--
	3917.74	12/05/2002	--	--	1036	--	--	--	--	--	2360	--	--	--	0.32	24027	--	--	--
AMM-3	3935.7	03/13/2002	<0.0001	--	954	0.0025	1.000	--	480	0.00042	1220	--	<0.0006	0.0008	--	15360	12.500	--	1567.17J
	3935.7	05/29/2002	<0.0001	--	989	0.0021	--	0.0181	<469	0.0025	1310	--	<0.0006	<0.0006	2.3	15570	<7.490	--	1838.23
	3935.7	05/29/2002	<0.0001	--	--	0.0022	--	0.0186	<466	0.0024	1270	--	<0.0006	<0.0006	--	--	<7.370	--	1989.19
	3935.7	08/13/2002	<0.00034	<0.0076	987	0.0027	1.280	0.0213	501	<0.00074	1230	0.0019	<0.0005	<0.0004	5.86	11480	17.100	2.010	996.16
	3935.7	08/13/2002	<0.00034	0.0159	--	0.0026	1.130	0.0205	482	0.0011	1230	0.0024	<0.0005	<0.0004	--	--	14.900	2.440	787.28
	3917.69	12/05/2002	--	--	936	--	--	--	--	--	1230	--	--	--	0.35	15471	--	--	--
ATP-1-D	3571.73	12/10/2002	--	--	40	<0.0001	3.930	--	--	<0.0001	65700	--	--	--	0.17	133476	0.0313	10.300	<934.74
ATP-1-ID	3660.87	12/10/2002	--	--	96	0.00086	4.120	--	--	<0.0001	65800	--	--	--	0.37	131922	1.870	7.680	<930.37
ATP-1-S	3823.2	09/25/2002	<0.0005	<0.0275	35	0.001	4.140	0.0626	1400	<0.0005	61300	0.0086	<0.003	<0.002	0.81	94870	1.690	<2.510	<775.43
	3831.14	12/09/2002	--	--	54	--	--	--	--	--	61800	--	--	--	0.28	125350	--	--	--
ATP-2-D	3884.4	08/15/2002	<0.00035J	0.0629	158	0.00035	2.810	0.0648	1430	<0.00035	49400	<0.0065	<0.0025	<0.002	--	86090	15.800	<1.260	<959.19
	3876.05	12/05/2002	--	--	169	--	--	--	--	--	49800	--	--	--	0.13	116790	--	--	--
ATP-2-S	3935.4	03/14/2002	<0.0001	--	794	0.00062	0.664	--	494	0.0012	4070	--	<0.0006	0.00099	--	21460	0.341	--	3416.93J
	3935.4	05/29/2002	<0.0001	--	783	0.00067	--	0.0218	<502	0.0022	3900	--	<0.0006	<0.0014	1.37	20560	<0.825	--	2374.37
	3935.4	08/14/2002	<0.00033	<0.0215	864	0.00039	0.631	0.0204	505	0.0024	3160	0.0096	<0.0005	<0.0004	3.07	14810	0.621	2.210	1813.73
	3929.04	12/05/2002	--	--	819	--	--	--	--	--	4390	--	--	--	0.52	21093	--	--	--
ATP-3	3944.1	09/25/2002	<0.0001	<0.0055	161	0.0031	0.132	0.0488	71.9	<0.0001	573	0.0015	<0.0006	<0.0004	2.63	2188	0.399	0.492	<15.02
	3945.89	12/06/2002	--	--	167	--	--	--	--	--	660	--	--	--	2.49	2636	--	--	--
EE-3	3996.3	05/30/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M11-14.0	3920.03	12/11/2002	--	--	187	0.0046	1.330	--	--	<0.0001	29500	--	--	--	0.69	70850	17.900	3.280	<360.83
MW-1-R	3959.6	08/13/2002	<0.00034	0.0111	1350	0.0059	0.422	0.012	486	0.0208	1380	0.0185	<0.0005	0.0226	5.66	25280	<0.004	4.500	934.67
	3950.35	12/05/2002	--	--	1432	--	--	--	--	--	1280	--	--	--	0.62	33982	--	--	--
MW-3	0	03/13/2002	<0.0001	--	1353	0.00097	1.170	--	438	0.0014	4040	--	<0.0006	0.0023	--	33330	4.580	--	2547.59J
	0	05/22/2002	<0.0001	--	1340	0.00089	--	0.0288	440	0.003	4320	--	<0.0012	0.0021	0.21	32230	<0.997	--	1883.55
	0	08/14/2002	<0.00039	<0.0277	1300	0.00079	0.947	0.029	466	0.0035	4380	0.0066	<0.0005	0.0017	3.02	24670	0.742	2.480	1891.56
	3915.21	12/05/2002	--	--	1398	--	--	--	--	--	4420	--	--	--	0.49	32900	--	--	--
N2-12.8	3926.64	03/14/2002	<0.0001	--	207	0.0071	0.0975	--	720	<0.0002	902	--	<0.0006	0.0011	--	5093	36.100	--	<30.9J
N7-10	3929.64	12/11/2002	--	--	151	0.00015	1.110	--	--	<0.0001	32300	--	--	--	0.27	78390	5.170	3.370	<473.08

Table A-2. Summary of Ground Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Elevation	Sample Date	GB (pCi/L)	Hg (mg/L)	K (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	NH_3+NH_4 as N (mg/L)	Ni (mg/L)	NO_3 (mg/L)	Organics (µg/L)	ORP (mV)	pH (s.u.)	Po-210 (pCi/L)	PO_4 (mg/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)
0457	3943.06	10/10/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	3939.8	12/04/2002	<22.32	--	--	0.0334J	--	0.548	0.010	1000	0.014J	--	--	--	-320	7.84	--	--	<0.14	<0.97
0458	3797.4	09/26/2002	--	--	64.5	0.106	112	0.562	0.123	1500	338.509	--	14.400	--	--	--	--	<0.544	--	--
0459	3760.05	09/26/2002	--	--	64.3	0.0265	53.9	0.990	0.099	2210	0.8929	--	0.0967	--	--	--	--	<0.544	--	--
AMM-1	3952.75	03/13/2002	<55.16	<0.0002	50.3	--	135	<0.00022	0.004	2000	<0.0033	<0.0008	1.360	--	114.5	7.4	<0.035	--	0.16	<0.78
	3952.75	03/13/2002	<55.6	<0.0002	52.7	--	135	<0.0001	0.0042	2010	<0.0033	<0.0008	1.340	--	--	--	<0.0639	--	<0.12	<0.73
	3952.75	05/22/2002	<60.25	<0.0002	<50.8	--	188	<0.0013	<0.0018	2080	<0.003	<0.0008	1.220	--	242	7.22	<0.0379	--	<0.14	1
	3952.75	08/14/2002	<64.4	--	55.1J	0.0714	131J	<0.0001	0.0059	1960	0.0380	--	1.490	--	185	7.19	<0.0772	2.020	<0.1	<0.67
	3952.75	08/14/2002	<64.46	--	56.8J	0.0716	130J	<0.0001	0.0032	1950	<0.003	--	1.500	--	--	--	<0.0558	<0.544	<0.11	<0.71
	3952.02	12/03/2002	<44.72	--	--	0.0816	--	<0.0005	0.010	1960	<0.003J	--	--	--	242	7.91	--	--	<0.11	<0.78
	3952.02	12/03/2002	<44.62	--	--	0.0826	--	<0.00056	<0.009	1970	<0.003J	--	--	--	--	--	--	--	<0.11	<0.76
	3917.02	12/03/2002	46.02	--	--	0.0726	--	<0.0005	<0.009	2020	<0.003J	--	6.300J	--	234	7.19	--	--	<0.11	<0.76
AMM-2	3955.5	03/13/2002	<769.19	<0.0002	220	--	856	7.740	1.180	4040	939.441	0.0265	170.000	--	138	7.02	0.069	--	<0.17	2.03
	3955.5	05/29/2002	885.97	<0.0002	203	--	811	8.090	<1.210	3710	954.9689	0.0211	147.000	--	246	6.91	0.0803	--	<0.21	2.77
	3955.5	08/13/2002	426.23	--	176	0.631	765	7.660	1.110	3490	822.9814	--	183.000	--	191	6.67	0.0619	1.540	<0.17	1.73
	3952.74	12/05/2002	--	--	--	--	--	--	0.877	--	313.665J	--	--	--	27.5	6.75	--	--	--	--
	3917.74	12/05/2002	--	--	--	--	--	--	1.230	--	939.441J	--	--	--	2.1	6.91	--	--	--	--
AMM-3	3935.7	03/13/2002	<538.76	<0.0002	167	--	892	3.360	0.467	2680	104.814	<0.0008	<0.0305	--	-68.8	7.08	0.0991	--	0.16	<0.8
	3935.7	05/29/2002	962.8	<0.0002	<193	--	673	<3.470	0.937	<2760	220.497	<0.0019	<0.020	--	-54	6.92	<0.0865	--	<0.16	1.17
	3935.7	05/29/2002	1079.86	<0.0002	<161	--	657	<3.450	0.946	<2560	212.733	<0.0019	<0.020	--	--	--	0.0513	--	<0.15	1.22
	3935.7	08/13/2002	236.17	--	129	0.572	965	3.480	0.181	2590	82.2981	--	<0.020	--	-85	6.87	0.0775	<0.272	0.16	<0.7
	3935.7	08/13/2002	166.9	--	127	0.516	917	3.460	0.314	2580	105.590	--	<0.020	--	--	--	<0.0554	<0.272	<0.13	<0.7
	3917.69	12/05/2002	--	--	--	--	--	--	0.484	--	108.696J	--	--	--	-98.2	6.95	--	--	--	--
ATP-1-D	3571.73	12/10/2002	<889.63	--	--	0.238J	--	0.158	<0.009	36000	3.936	--	--	--	-313	7.89	--	--	<0.43	9.96
ATP-1-ID	3660.87	12/10/2002	<888.94	--	--	0.253J	--	0.202	<0.009	35800	3.998	--	--	--	-283	7.62	--	--	1.5	15.91
ATP-1-S	3823.2	09/25/2002	<748.57	--	797	0.255	550	0.451	<0.0085	29600	3.106	--	<0.020	--	-211	7.69	<0.0862	<2.720	1.07	10.95
	3831.14	12/09/2002	--	--	--	--	--	--	<0.009	--	3.626	--	--	--	-71.6	7.59	--	--	--	--
ATP-2-D	3884.4	08/15/2002	1000.39	--	1290J	0.677	670J	3.070	0.0249	30700	563.665	--	<0.020	--	-225	7.22	<0.0481	13.700	<0.3	10.39
	3876.05	12/05/2002	--	--	--	--	--	--	0.0145	--	601.708J	--	--	--	-237	7.52	--	--	--	--
ATP-2-S	3935.4	03/14/2002	<841.43	<0.0002	132	--	805	4.330	0.758	3390	978.2609	0.0116	0.933	No Detect	0.7	7.05	<0.0696	--	<0.18	2.15
	3935.4	05/29/2002	1021.83	<0.0002	<127	--	697	4.320	0.773	<3050	482.919	<0.010	0.894	--	-39	6.86	<0.0673	--	<0.19	2.32
	3935.4	08/14/2002	318.5	--	136	0.617	733	5.110	0.691	2960	648.292	--	2.870	--	13	6.76	0.04	1.360	<0.16	1.02
	3929.04	12/05/2002	--	--	--	--	--	--	0.760	--	424.689J	--	--	--	-60.2	7.06	--	--	--	--
ATP-3	3944.1	09/25/2002	<17.75	--	9.86	0.0201	41.7	0.212	0.0029	339	0.0671	--	0.146	--	-79	7.63	<0.0662	<0.544	0.19	<0.76
	3945.89	12/06/2002	--	--	--	--	--	--	<0.009	--	0.0286J	--	--	--	172	7.57	--	--	--	--
EE-3	3996.3	05/30/2002	--	--	--	--	--	--	--	--	--	--	--	No Detect	--	--	--	--	--	--
M11-14.0	3920.03	12/11/2002	<299.61	--	--	0.105J	--	2.910	<0.009	16300	1.910	--	<0.020	--	-103	7.04	--	--	<0.32	6.09
MW-1-R	3959.6	08/13/2002	341.33	--	219	1.710	1790	8.220	8.730	7100	1250.000	--	2190.000	--	140	6.75	0.2492	<0.544	0.17	<0.65
	3950.35	12/05/2002	--	--	--	--	--	--	8.430	--	1226.708J	--	--	--	101	6.94	--	--	--	--
MW-3	0	03/13/2002	<1099.92	<0.0002	183	--	1400	8.050	1.130	6680	923.913	0.0055	231.000	--	2	7	0.0734	--	2.97	2.11
	0	05/22/2002	1394.23	<0.0002	163	--	1350	8.290	<1.100	6220	869.5652	0.0069	267.000	--	56	7.02	0.0654	--	2.62	2.25
	0	08/14/2002	<329.79	--	200	0.716	1370	8.780	1.120	6350	916.1491	--	273.000	--	10	6.76	0.1024	<0.544	2.44	1.37
	3915.21	12/05/2002	--	--	--	--	--	--	1.220	--	815.2174J	--	--	--	104	6.91	--	--	--	--
N2-12.8	3926.64	03/14/2002	<26.3	<0.0002	10.9	--	201	2.160	<0.0018	166	0.153	<0.0008	<0.0305	--	-116	7.1	0.0647	--	<0.14	0.91
N7-10	3929.64	12/11/2002	<444.99	--	--	0.120J	--	0.369	<0.009	18000	1.755	--	0.075	--	-121	7.18	--	--	9.26	2.6

Table A-2. Summary of Ground Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Elevation	Sample Date	Rn-222 (pCi/L)	Sb (mg/L)	Se (mg/L)	SO_4 (mg/L)	Sp Gravity	Sr (mg/L)	TDS (mg/L)	Th-230 (pCi/L)	Tl (mg/L)	TMP (C)	TOC (mg/L)	Turbidity (NTU)	U (mg/L)	U-234 (pCi/L)	U-238 (pCi/L)	V (mg/L)	Zn (mg/L)
0457	3943.06	10/10/2002	--	--	--	--	--	--	3258	--	--	--	--	--	--	--	--	--	--
	3939.8	12/04/2002	--	--	<0.0001	503	1	1.770	3240	--	--	17.5	--	3.49	0.0016	--	--	<0.002	--
0458	3797.4	09/26/2002	<15.13	0.0012	0.0155	1780	--	2.750	5830	<1.5	<0.0001	--	4.1	--	0.0046	<2.7	2.1	0.00049	0.0458
0459	3760.05	09/26/2002	<14.62	0.00063	0.0004	454	--	2.370	7900	<1.5	<0.0001	--	6.3	--	0.0021	3.9	0.85	0.00034	<0.003
AMM-1	3952.75	03/13/2002	--	<0.0005	0.015	969	--	6.050	7090	<1.6	<0.00011	18.56	--	8.1	0.0058J	--	--	0.00061	0.0017
	3952.75	03/13/2002	--	<0.0005	0.0155	990	--	5.980	7160	<1.6	<0.00018	--	--	--	0.0052J	--	--	0.00099	0.0028
	3952.75	05/22/2002	--	<0.00019	0.0107	944	--	8.450	7820	<1.6	<0.0001	18.29	--	0.5	0.0065	5.6	3.2	<0.00082	<0.0006
	3952.75	08/14/2002	<392.82	<0.00077	0.0146	986	--	5.300	7070	<1.5	<0.00071	19.31	<2.6	0.44	0.0054	6.1J	1.8	0.0014	<0.0008
	3952.75	08/14/2002	<559.98	<0.0003	0.0148	981	--	5.280	7090	<1.5	<0.00071	--	<0.55	--	0.004	5J	1.8	0.0014	<0.0008
	3952.02	12/03/2002	--	--	0.0134	1040	1.01	5.570	6760	--	--	14.3	--	1.52	0.0073	--	--	0.0029	--
	3952.02	12/03/2002	--	--	0.0131	1070	1.01	5.620	6720	--	--	--	--	--	0.0074	--	--	0.0036	--
	3917.02	12/03/2002	--	--	0.0136	990	1.01	5.650	7000	--	--	16	--	3.8	0.0044	--	--	0.003	--
AMM-2	3955.5	03/13/2002	--	<0.0005	0.0115	11900	--	12.200	19500	<1.6	<0.0004	16.28	--	0	2.660J	--	--	0.0146	0.0075
	3955.5	05/29/2002	--	<0.00045	0.010	11700	--	12.500	19600	<1.6	<0.0001	15.45	--	0	2.710	911	896	<0.0095	0.0047
	3955.5	08/13/2002	182.9	<0.00046	0.010	10700	--	11.900	18300	<1.5	<0.001	16.45	2.4	2.5	2.460J	862	912	0.0114	0.0032
	3952.74	12/05/2002	--	--	--	7260	1.01	--	14600	--	--	14.1	--	3.31	1.950	--	--	--	--
	3917.74	12/05/2002	--	--	--	12000	1.02	--	20500	--	--	14.9	--	2.08	2.670	--	--	--	--
AMM-3	3935.7	03/13/2002	--	<0.0005	<0.0003	8450	--	20.200	15500	<1.6	<0.00012	20.29	--	0.1	1.900J	--	--	<0.0003	0.0039
	3935.7	05/29/2002	--	<0.00016	<0.0002	8340	--	17.700	15000	<1.6	<0.0001	20.43	--	5.98	2.890	1010	1090	<0.0003	0.0015
	3935.7	05/29/2002	--	<0.00016	<0.0002	8100	--	17.300	15000	<1.6	<0.0001	--	--	--	2.900	1020	1080	<0.0003	0.0018
	3935.7	08/13/2002	27.96	<0.00031	0.00023	8510	--	22.400	16100	<1.5	<0.00069	20.73	2.9	2.75	0.990J	350	379	<0.0003	<0.0008
	3935.7	08/13/2002	26.85	<0.0001	0.00024	8350	--	21.500	15600	<1.5	<0.00069	--	3	--	1.370J	480	501	<0.0003	<0.0008
	3917.69	12/05/2002	--	--	--	8370	1.01	--	15900	--	--	17.9	--	9.65	1.920	--	--	--	--
ATP-1-D	3571.73	12/10/2002	--	--	<0.0001	5330	1.08	32.000	111000	--	--	16.5	--	7.88	0.00026	--	--	<0.002	--
ATP-1-ID	3660.87	12/10/2002	--	--	<0.0001	5030	1.07	32.300	109000	--	--	16.2	--	9.81	0.00028	--	--	<0.002	--
ATP-1-S	3823.2	09/25/2002	27.86	0.00058	<0.0001	4880	--	30.600	102000	<1.5	<0.0005	17.76	<0.36	5.36	0.002	<0.6	<0.5	<0.0015	<0.004
	3831.14	12/09/2002	--	--	--	5460	1.07	--	102000	--	--	15.6	--	1.27	0.0011	--	--	--	--
ATP-2-D	3884.4	08/15/2002	<201.44	<0.00088	0.00019	5050	--	35.600	90100	<1.5	<0.00069	23.05	<0.36	278	0.121	45.3J	63.3	0.0016	<0.004
	3876.05	12/05/2002	--	--	--	5730	1.06	--	91700	--	--	16.7	--	30.8	0.100	--	--	--	--
ATP-2-S	3935.4	03/14/2002	--	<0.0005	0.0027	7340	--	13.900	16400	<1.6	<0.00028	16.32	--	7.9	2.880J	--	--	<0.0003	0.0047
	3935.4	05/29/2002	--	<0.0006	0.0029	7190	--	14.800	16400	<1.6	<0.0001	17.99	--	5.62	2.870	973	1040	<0.0003	0.0031
	3935.4	08/14/2002	107.72	<0.00035	0.0044	8120	--	13.300	16400	<1.5	<0.001	16.85	1.9	1.85	2.820J	923	1050	<0.0003	0.0012
	3929.04	12/05/2002	--	--	--	6950	1.01	--	17100	--	--	15.8	--	6.34	2.720	--	--	--	--
ATP-3	3944.1	09/25/2002	101.82	<0.0001	<0.0001	265	--	2.520	1440	<1.5	<0.0001	19.12	<0.74	1.47	0.0046	1.6	1.7	0.00063	0.0071
	3945.89	12/06/2002	--	--	--	263	1.01	--	1590	--	--	16.6	--	1.07	0.005	--	--	--	--
EE-3	3996.3	05/30/2002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M11-14.0	3920.03	12/11/2002	--	--	<0.0001	2990	1.04	24.800	52200	--	--	13.1	--	1.87	0.0011	--	--	<0.002	--
MW-1-R	3959.6	08/13/2002	331.21	<0.0001	0.198	21600	--	15.500	33000	<1.5	<0.0016	19.77	11.2	27.6	1.790J	617	663	0.0984	0.0022
	3950.35	12/05/2002	--	--	--	23300	1.03	--	34000	--	--	16.5	--	8.75	1.780	--	--	--	--
MW-3	0	03/13/2002	--	<0.0005	0.0019	16900	--	12.300	30000	<1.6	<0.00012	17.84	--	1.4	3.620J	--	--	<0.0003	0.0108
	0	05/22/2002	--	<0.00079	0.0049	16300	--	13.300	30400	<1.6	<0.0001	17.85	--	8.2	3.600	1330	1330	<0.0006	0.0047
	0	08/14/2002	111.27	<0.00032	0.0039	16900	--	12.600	30200	<1.5	<0.00069	18.25	3.5	2.55	3.560J	1280	1370	<0.0003	0.0031
	3915.21	12/05/2002	--	--	--	16400	1.03	--	30800	--	--	15.7	--	1.92	3.570	--	--	--	--
N2-12.8	3926.64	03/14/2002	--	<0.0005	<0.0003	1650	--	5.970	3910	<1.6	<0.0001	8.79	--	7.2	<0.00079J	--	--	<0.0003	<0.0021
N7-10	3929.64	12/11/2002	--	--	<0.0001	2580	1.04	23.200	57000	--	--	11.51	--	7.75	0.0038	--	--	<0.002	--

Table A-2. Summary of Ground Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Elevation	Sample Date	Ag (mg/L)	Al (mg/L)	ALK (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Ca (mg/L)	Cd (mg/L)	Chloride (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	DO (mg/L)	EC (µmhos/cm)	Fe (mg/L)	Fluoride (mg/L)	GA (pCi/L)
OW-2	3935.45	12/05/2002	--	--	1096	0.00032	0.565	--	--	0.002	1510	--	--	--	0.43	20758	0.111	1.400	2342.67
	3935.45	12/05/2002	--	--	--	0.00037	0.593	--	--	0.002	1500	--	--	--	--	--	<0.0075	1.350	2234.86
PW-11	4049	05/30/2002	0.0019	--	--	0.0099	--	0.0171	<452	0.0483	736	--	<0.0006	<1.210	--	--	<0.0954	--	16472.89
PW-4-OB-A	4044.5	05/30/2002	0.0013	--	--	0.133	--	0.0218	<450	0.0304	638	--	<0.0006	<0.409	--	--	<0.010	--	5783.58
RW-01	3953.3	05/31/2002	<0.00025	--	147	0.0012	--	0.0285	<47.4	<0.0001	135	--	<0.00093	<0.0006	--	1129	<0.0019	--	7.64
	3953.3	08/19/2002	<0.00031J	<0.0076	189	0.0014	0.106	0.033	54.6	<0.00025	148	<0.0013	0.0011	<0.00043	6.94	1078	<0.004	0.313	<7.16
	3946.81	12/04/2002	--	--	153	0.0015	0.116	--	--	<0.0001	174	--	--	--	5.05	1152	<0.0131	0.319	<6.73
SMI-PZ3D2	3898.02	05/31/2002	<0.00032	--	775	0.00041	--	0.0225	<459	0.0027	3440	--	<0.0006	0.0027	--	21870	<0.001	--	2267.38
	3898.02	08/15/2002	<0.00034J	0.0228	714	0.00043	0.367	0.0219	462	0.0026	3380	0.0048	<0.0005	<0.0019	--	16360	<0.004	<0.251	1308.28
	3895.13	12/04/2002	--	--	645	0.00048	0.329	--	--	0.0021	3250	--	--	--	0.36	20805	<0.0075	<0.251	1463.52
SMI-PZ3M	3918.5	05/30/2002	<0.00026	--	214	0.00081	--	0.0279	<126	0.00034	182	--	<0.0006	<0.0006	--	8501	<0.0504	--	570.92
	3918.5	08/15/2002	<0.00031J	0.0147	222	0.0011	0.172	0.0266	113	<0.00046	1840	<0.0013	<0.0005	<0.0004	--	5996	0.0691	0.841	450.9
	3914.63	12/04/2002	--	--	218	0.00063	0.189	--	--	0.00017	2050	--	--	--	0.31	8393	0.127	0.589	549.38
SMI-PZ3S	3950.96	05/30/2002	<0.00025	--	444	0.0191	--	0.039	<28.8	0.00038	934	--	<0.0006	<0.0006	0.24	5263	<0.0015	--	1326.96
	3950.96	08/15/2002	<0.00031J	0.0248	444	0.019	0.221	0.0361	27.7	<0.00067	962	<0.0013	<0.0005	0.00041	--	3991	<0.004	1.040	1694.79
	3947.73	12/04/2002	--	--	497	0.0246	0.235	--	--	0.00057	909	--	--	--	0.97	5240	<0.0075	0.262	3368.24
TP-01	3948.6	03/12/2002	<0.0001	--	189	0.0018	0.371	--	375	<0.0002	5040	--	<0.0006	0.0014	--	18710	<0.0036	--	<156.6J
	3948.6	05/22/2002	<0.0001	--	162	0.0016	--	0.0253	377	0.00028	5240	--	<0.0006	0.00099	5.34	18330	<0.0032	--	174.93
	3948.6	08/14/2002	<0.00035J	<0.0094	180	0.0017	0.329	0.0277	458	<0.00051	5400	<0.0013	<0.0005	<0.0004	3.08	14830	0.0081	1.560	<144.6
	3945.59	12/03/2002	--	--	197	--	--	--	--	--	5220	--	--	--	0.32	18577	--	--	--
TP-02	3946.9	03/12/2002	<0.0001	--	637	0.0026	0.295	--	283	0.00052	493	--	<0.0006	0.0022	--	5589	<0.0166	--	19014.58J
	3946.9	05/22/2002	<0.0001	--	661	0.0019	--	0.0183	265	0.0016	552	--	<0.0006	0.0017	--	5636	<0.004	--	17219.45
	3946.9	08/14/2002	<0.00033J	0.0868	656	0.0019	0.277	0.0178	301	0.0019	551	0.0036	<0.0005	<0.00058	1.94	4318	0.0081	0.825	16257.59
	3943.95	12/03/2002	--	--	596	--	--	--	--	--	536	--	--	--	0.42	4891	--	--	--
TP-07	3940.1	03/13/2002	<0.0001	--	884	<0.0006	1.140	--	487	<0.0002	2230	--	<0.0006	<0.0006	--	18300	0.389	--	2687.34J
	3940.1	05/29/2002	<0.0001	--	876	0.0003	--	0.0188	<482	0.00079	2070	--	<0.0006	<0.0006	2.31	17360	<0.527	--	1527.65
	3940.1	08/13/2002	<0.00033	<0.0287	914	0.00029	1.080	0.0185	479	0.001	2050	0.0062	<0.0005	<0.0004	6.68	13120	0.625	1.560	1733.82
	3937.12	12/05/2002	--	--	876	--	--	--	--	--	2160	--	--	--	0.29	17436	--	--	--
TP-08	3939.8	03/13/2002	<0.0001	--	889	<0.0006	0.922	--	477	0.0012	2560	--	<0.0006	0.0024	--	19820	0.0474	--	2640.28J
	3939.8	05/29/2002	<0.0001	--	851	0.00051	--	0.0177	<479	0.0026	2470	--	<0.0006	<0.0019	1.32	18540	<0.140	--	1663.58
	3939.8	08/13/2002	<0.00033	<0.0161	880	0.00055	0.668	0.0174	515	0.003	2540	0.0028	<0.0005	<0.001	5.61	14660	<0.004	1.400	1544.66
TP-09	3942.8	03/13/2002	<0.0001	--	1084	0.0018	0.685	--	426	0.0011	1520	--	<0.0006	0.008	--	22230	<0.001	--	2506.31J
	3942.8	05/29/2002	<0.0001	--	1089	0.0017	--	0.0176	<423	0.0025	1460	--	<0.0006	<0.0056	3.2	21170	<0.0023	--	2267.02
	3942.8	08/13/2002	<0.00034	<0.0226	1047	0.0017	0.590	0.0166	446	0.0027	1690	0.0079	<0.0005	0.0056	4.14	15340	<0.004	3.900	2005.66
TP-11	3936.11	12/03/2002	--	--	366	--	--	--	--	--	6410	--	--	--	0.27	20060	--	--	--
TP-17	3935.69	12/03/2002	--	--	176	--	--	--	--	--	58000	--	--	--	0.2	124300	--	--	--
TP-18	3942.73	12/04/2002	--	--	177	--	--	--	--	--	63500	--	--	--	0.91	121800	--	--	--
TP-19	3933.17	12/04/2002	--	--	212	--	--	--	--	--	63000	--	--	--	--	120600	--	--	--
TP-20	3932.55	12/04/2002	--	--	171	--	--	--	--	--	62600	--	--	--	0.75	119100	--	--	--
W1-4.3	3955.06	03/14/2002	<0.0001	--	109	<0.0006	0.395	--	2370	<0.0002	29200	--	<0.003	0.007	--	69080	6.960	--	--
W1-7	3941.36	12/11/2002	--	--	226	0.0005	0.552	--	--	<0.0001	30300	--	--	--	0.22	67730	22.300	1.850	<356.33

Table A-2. Summary of Ground Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Elevation	Sample Date	GB (pCi/L)	Hg (mg/L)	K (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	NH_3+NH_4 as N (mg/L)	Ni (mg/L)	NO_3 (mg/L)	Organics (µg/L)	ORP (mV)	pH (s.u.)	Po-210 (pCi/L)	PO_4 (mg/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)
OW-2	3935.45	12/05/2002	1001.57	--	--	0.845J	--	6.610	0.689	2790	1024.845J	--	45.700J	--	-49.2	6.87	--	--	<0.16	1.84
	3935.45	12/05/2002	968.1	--	--	0.839J	--	6.570	0.696	2790	1040.373J	--	51.100J	--	--	--	--	--	<0.16	1.81
PW-11	4049	05/30/2002	11383.47	<0.0002	281	--	1190	7.950	1.480	6260	3928.571	<0.299	376.000	See Table	--	--	3.4886	--	52.73	4.06
PW-4-OB-A	4044.5	05/30/2002	4020.3	<0.0002	334	--	1690	16.100	1.320	5230	4347.826	<0.596	340.000	See Table	--	--	7.2717	--	39.23	5.21
RW-01	3953.3	05/31/2002	17.37	<0.0002	<10.1	--	<30.7	<0.00022	<0.0018	<128	<0.003	<0.0008	14.200	--	116	8.11	<0.0455	--	<0.1	<0.7
	3953.3	08/19/2002	7.39	--	9.29J	0.0278	31.4J	<0.0001	<0.0018	136	<0.003	--	13.800	--	91	7.67	<0.0301	<0.544	<0.11	<0.64
	3946.81	12/04/2002	11.71	--	--	0.0418	--	<0.0005	<0.009	140	<0.003J	--	15.900	--	619	7.69	--	--	<0.11	<0.7
SMI-PZ3D2	3898.02	05/31/2002	1158.79	<0.0002	229	--	760	5.430	<0.440	3980	541.925	0.0041	184.000	No Detect	278	6.84	0.0885	--	<0.2	2.92
	3898.02	08/15/2002	517.27	--	244J	0.565	682J	5.050	0.413	3880	591.615	--	164.000	--	128	6.86	<0.0475	<0.544	<0.17	2.1
	3895.13	12/04/2002	747.8	--	--	0.489	--	5.140	0.412	3750	454.969J	--	142.000J	--	238	6.93	--	--	<0.15	2.29
SMI-PZ3M	3918.5	05/30/2002	297.17	<0.0002	<35.3	--	<72.6	<1.260	0.101	1630	39.363	<0.0008	<0.020	See Table	34.4	7.51	0.0849	--	<0.15	1.31
	3918.5	08/15/2002	116.83	--	35.9J	0.0471	75.0J	1.290	0.075	1240	47.671	--	0.340	--	13	7.41	<0.0636	<0.544	<0.12	<0.7
	3914.63	12/04/2002	188.79	--	--	0.0466	--	1.460	0.0679	1610	38.199J	--	--	--	136	7.43	--	--	<0.13	1.17
SMI-PZ3S	3950.96	05/30/2002	464.39	<0.0002	<19.0	--	<218	<0.0335	0.126	<839	11.491	<0.0008	15.900	See Table	182	7.94	0.0594	--	<0.12	<0.66
	3950.96	08/15/2002	353.36	--	20.0J	0.0584	203J	0.0311	0.158	881	11.335	--	28.200	--	182	7.9	<0.0521	1.930	<0.12	<0.79
	3947.73	12/04/2002	863.14	--	--	0.055	--	0.0259	0.248	934	10.792J	--	61.600J	--	147	8.03	--	--	<0.14	<1
TP-01	3948.6	03/12/2002	<179.88	<0.0002	73.3	--	183	1.550	0.0204	4000	<0.0033	<0.0008	26.000	--	132	7.51	0.0482	--	0.09	<0.76
	3948.6	05/22/2002	149	<0.0002	<82.0	--	192	<1.650	0.0167	3760	<0.003	<0.0008	28.000	--	226	7.5	0.0465	--	<0.12	<0.68
	3948.6	08/14/2002	<129.41	--	83.0J	0.0941	223J	1.950	0.0199	4010	0.020	--	39.100	--	127	7.27	0.0365	1.290	<0.12	<0.7
	3945.59	12/03/2002	--	--	--	--	--	--	0.0179	--	<0.003J	--	--	--	214	7.33	--	--	--	--
TP-02	3946.9	03/12/2002	3956.73	<0.0002	21.1	--	196	0.461	0.649	854	0.8929	0.0035	2.060	--	73.9	7.09	<0.0426	--	0.15	<0.85
	3946.9	05/22/2002	5292.71	<0.0002	<24.7	--	210	<0.445	0.663	<855	1.141	0.0039	0.817	--	164	7.18	0.0389	--	<0.13	<0.68
	3946.9	08/14/2002	1878.69	--	25.9J	0.109	231J	0.494	0.572	856	1.460	--	0.198	--	66	6.89	<0.0879	<0.544	<0.11	<0.68
	3943.95	12/03/2002	--	--	--	--	--	--	0.452	--	1.087J	--	--	--	179	6.93	--	--	--	--
TP-07	3940.1	03/13/2002	<755.88	<0.0002	170	--	702	4.540	0.290	3460	71.584	0.0042	1.360	--	82	7.07	0.0606	--	0.2	<0.84
	3940.1	05/29/2002	878.68	<0.0002	<166	--	664	4.610	0.296	3220	81.5217	<0.0045	<0.020	--	49	6.91	<0.0654	--	<0.15	1.11
	3940.1	08/13/2002	504.17	--	188	0.491	691	4.650	0.274	3370	676.242	--	<0.020	--	14	6.79	0.0372	<0.544	0.24	<0.71
	3937.12	12/05/2002	--	--	--	--	--	--	0.279	--	68.401J	--	--	--	5.3	6.96	--	--	--	--
TP-08	3939.8	03/13/2002	<671.05	<0.0002	161	--	747	2.270	0.920	3580	336.180	0.0092	21.100	--	91.8	6.98	0.0598	--	0.17	0.89
	3939.8	05/29/2002	841.82	<0.0002	<179	--	707	<2.320	0.903	3290	364.907	<0.009	19.800	--	91	6.93	<0.0472	--	<0.17	1.11
	3939.8	08/13/2002	366.11	--	157	0.663	714	2.270	0.930	3700	384.317	--	22.000	--	154	6.68	0.0578	1.090	<0.13	<0.72
TP-09	3942.8	03/13/2002	<1074.08	<0.0002	183	--	913	6.250	0.841	2940	555.124	0.0167	360.000	--	111.6	6.94	0.0533	--	0.13	1.61
	3942.8	05/29/2002	1211.42	<0.0002	<185	--	847	6.310	0.827	2780	1063.665	<0.0169	346.000	--	239	6.85	0.0788	--	<0.17	1.62
	3942.8	08/13/2002	554.04	--	195	1.010	825	6.370	0.727	2690	954.9689	--	233.000	--	179	6.62	<0.0364	<0.544	<0.14	0.85
TP-11	3936.11	12/03/2002	--	--	--	--	--	--	0.0119	--	1.165J	--	--	--	-4.7	7.12	--	--	--	--
TP-17	3935.69	12/03/2002	--	--	--	--	--	--	<0.009	--	3.898J	--	--	--	-103	7.1	--	--	--	--
TP-18	3942.73	12/04/2002	--	--	--	--	--	--	<0.009	--	4.394J	--	--	--	-157	6.93	--	--	--	--
TP-19	3933.17	12/04/2002	--	--	--	--	--	--	<0.009	--	3.929J	--	--	--	-309	6.59	--	--	--	--
TP-20	3932.55	12/04/2002	--	--	--	--	--	--	<0.009	--	4.387J	--	--	--	-163	7.03	--	--	--	--
W1-4.3	3955.06	03/14/2002	--	<0.0002	150	--	2290	38.500	<0.009	12700	0.0288	<0.004	<0.0305	--	179	6.91	--	--	--	--
W1-7	3941.36	12/11/2002	<299.19	--	--	0.335J	--	19.100	<0.009	12000	0.244	--	0.0379	--	-89	6.64	--	--	<0.29	5.21

Table A-2. Summary of Ground Water Chemistry Data Collected At and Near the Moab Project Site During 2002

Sample Location	Sample Elevation	Sample Date	Rn-222 (pCi/L)	Sb (mg/L)	Se (mg/L)	SO_4 (mg/L)	Sp Gravity	Sr (mg/L)	TDS (mg/L)	Th-230 (pCi/L)	Tl (mg/L)	TMP (C)	TOC (mg/L)	Turbidity (NTU)	U (mg/L)	U-234 (pCi/L)	U-238 (pCi/L)	V (mg/L)	Zn (mg/L)
OW-2	3935.45	12/05/2002	--	--	0.0121	11100	1.02	11.300	17000	--	--	16.8	--	6.14	3.500	--	--	<0.002	--
	3935.45	12/05/2002	--	--	0.0127	11600	1.02	11.200	16900	--	--	--	--	--	3.690	--	--	<0.002	--
PW-11	4049	05/30/2002	--	<0.00082	0.235	30100	--	11.500	43100	<8	0.0318	--	--	--	38.200	12700	12600	<0.0292	0.190
PW-4-OB-A	4044.5	05/30/2002	--	<0.0032	0.813	31800	--	10.100	44000	<1.6	0.0169	--	--	--	11.200	3490	4000	<1.530	0.970
RW-01	3953.3	05/31/2002	--	<0.0001	0.0097	180	--	<2.250	702	<1.6	<0.0001	19.14	--	9.67	0.0111	<10.7	4.7	<0.0141	<0.0006
	3953.3	08/19/2002	431.46	<0.00019	0.0096	185	--	2.430	677	<1.5	<0.00069	18.85	<0.51	7.95	0.0114	4.2J	4.7	0.0158	<0.0008
	3946.81	12/04/2002	--	--	0.0091	214	1	2.340	745	--	--	17.38	--	5.64	0.012	--	--	0.0164	--
SMI-PZ3D2	3898.02	05/31/2002	--	<0.0004	0.0071	10000	--	16.700	19700	<1.6	<0.0001	18.48	--	1.69	3.010	974	1090	<0.0025	0.0009
	3898.02	08/15/2002	<154.59	<0.00021	0.0074	9330	--	15.200	18400	<1.5	<0.00087	18.82	<2.2	3.22	2.610	800J	990	0.0033	0.0016
	3895.13	12/04/2002	--	--	0.005	8710	1.02	15.000	17500	--	--	16.3	--	2.68	2.370	--	--	0.0066	--
SMI-PZ3M	3918.5	05/30/2002	--	<0.00047	0.00061	<173	--	<4.010	5930	<1.6	<0.0001	20.55	--	0.81	0.801	278	317	<0.0032	<0.0006
	3918.5	08/15/2002	<185.57	<0.00025	0.0015	1500	--	3.360	5260	<1.5	<0.00071	19.16	<1.2	0.62	0.712	235J	290	0.0016	<0.0008
	3914.63	12/04/2002	--	--	0.00043	1610	1.01	4.220	5520	--	--	17.2	--	2.99	0.672	--	--	<0.002	--
SMI-PZ3S	3950.96	05/30/2002	--	<0.00072	0.0195	1150	--	<2.100	3720	<1.6	<0.0001	19	--	7.76	1.520	516	518	<0.134	0.0017
	3950.96	08/15/2002	<202.33	<0.00063	0.0248	1120	--	1.920	3700	<1.5	<0.00073	18.77	2.2	1.72	1.930	576J	720	0.139	<0.0008
	3947.73	12/04/2002	--	--	0.0527	1080	1	1.760	3520	--	--	18.5	--	2.4	3.240	--	--	0.145	--
TP-01	3948.6	03/12/2002	--	<0.0005	0.0118	3620	--	11.600	13400	<1.6	<0.00013	16.52	--	8.9	0.220J	--	--	0.0008	0.0021
	3948.6	05/22/2002	--	<0.00062	0.0127	3680	--	12.500	13700	<1.6	<0.0001	15.88	--	9.4	0.213	73.7	83.7	<0.00079	<0.00096
	3948.6	08/14/2002	368.99	<0.0029	0.0132	4030	--	13.500	14800	<1.5	<0.00074	16.88	<1.3	8.67	0.248	83J	103	0.0013	<0.0008
	3945.59	12/03/2002	--	--	--	3840	1.01	--	13900	--	--	15.7	--	9.8	0.227	--	--	--	--
TP-02	3946.9	03/12/2002	--	<0.0005	0.006	2010	--	6.500	4650	<1.6	<0.0001	15.71	--	8.2	18.500J	--	--	<0.0003	0.0043
	3946.9	05/22/2002	--	<0.0006	0.0076	2230	--	6.890	4900	<1.6	<0.0001	18.44	--	9.2	17.600	6570	6390	<0.0003	<0.0029
	3946.9	08/14/2002	306.98	<0.0007	0.0061	2190	--	6.880	4980	<1.5	<0.00069	17.11	6	7.6	16.500	5310J	5830	<0.0003	<0.0008
	3943.95	12/03/2002	--	--	--	1710	1.01	--	4080	--	--	15.5	--	9.99	13.000	--	--	--	--
TP-07	3940.1	03/13/2002	--	<0.0005	<0.0003	8420	--	16.000	16700	<1.6	<0.0001	16.06	--	8.8	2.660J	--	--	<0.0003	0.008
	3940.1	05/29/2002	--	<0.00084	<0.0002	8070	--	16.300	16200	<1.6	<0.0001	17.35	--	3.5	2.680	954	962	<0.0003	0.005
	3940.1	08/13/2002	114.08	<0.00063	0.00024	8310	--	15.900	16500	<1.5	<0.00069	17.92	2.7	2.77	2.660J	902	976	<0.0003	0.0016
	3937.12	12/05/2002	--	--	--	8380	1.01	--	16500	--	--	14.4	--	4.12	2.630	--	--	--	--
TP-08	3939.8	03/13/2002	--	<0.0005	0.00056	9030	--	15.500	17000	<1.6	<0.00023	15.62	--	8.3	2.590J	--	--	<0.0003	0.015
	3939.8	05/29/2002	--	<0.00057	0.0005	8770	--	16.100	16800	<1.6	<0.0001	17.18	--	9.56	2.630	900	928	<0.0003	0.0163
	3939.8	08/13/2002	366.97	<0.00047	0.00069	8930	--	15.600	17200	<1.5	<0.00078	16.62	3	9.56	2.580J	869	962	<0.0003	0.0087
TP-09	3942.8	03/13/2002	--	<0.0005	0.0393	11400	--	11.700	17900	<1.6	0.0014	15.25	--	8.6	4.140J	--	--	<0.0003	0.011
	3942.8	05/29/2002	--	<0.00057	0.0367	10900	--	12.100	17100	<1.6	0.001	16.58	--	0	4.070	1380	1450	<0.0003	0.0076
	3942.8	08/13/2002	194.47	<0.00034	0.0282	10400	--	11.500	16800	<1.5	<0.0016	16.66	2.4	3.15	3.520J	1130	1320	<0.0003	0.006
TP-11	3936.11	12/03/2002	--	--	--	2530	1.01	--	14100	--	--	15.7	--	63.5	0.00079	--	--	--	--
TP-17	3935.69	12/03/2002	--	--	--	5430	1.07	--	99000	--	--	12.42	--	8.41	0.0062	--	--	--	--
TP-18	3942.73	12/04/2002	--	--	--	5720	1.08	--	108000	--	--	14.31	--	9.71	0.0116	--	--	--	--
TP-19	3933.17	12/04/2002	--	--	--	5580	1.08	--	107000	--	--	13.6	--	8.01	<0.0001	--	--	--	--
TP-20	3932.55	12/04/2002	--	--	--	5520	1.07	--	105000	--	--	15.53	--	3.7	0.0012	--	--	--	--
W1-4.3	3955.06	03/14/2002	--	<0.0005	<0.0003	2960	--	55.200	47800	<1.6	<0.00014	12.78	--	--	0.0026J	--	--	<0.0015	0.0261
W1-7	3941.36	12/11/2002	--	--	0.009	3110	1.04	65.000	52300	--	--	14.94	--	0.82	0.0269	--	--	0.0028	--

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

"--" indicates no data.

"J" indicates an estimated value.

Analyte abbreviations ALK, DO, EC, GA, GB, ORP, TOC are Total Alkalinity (as CaCO3), Dissolved Oxygen, Specific Conductance, Gross Alpha, Gross Beta, Oxidation Reduction Potential, Total Organic Carbon, respectively.

"See Table" indicates that the reader should refer to Table A-3 for a list of detected constituents.

Table A-3. Ground Water Organics Detected

Sample Location	Sample Elevation	Sample Date	Analyte Name	Concentration (µg/L)	Category
0412	3957.44	5/23/2002	Phosphine oxide, triphenyl-	9.2NJ	Semivolatile
	3957.44	5/23/2002	Phosphine oxide, triphenyl-	10.1NJ	Semivolatile
	3957.44	5/23/2002	Unknown	5.7J	Semivolatile
	3957.44	5/23/2002	Unknown	6.8J	Semivolatile
0413	3957.02	5/23/2002	Phosphine oxide, triphenyl-	9.1NJ	Semivolatile
0414	3958.83	5/23/2002	Pentachlorophenol	1	Semivolatile
PW-11	4049	5/30/2002	1,3-Isobenzofurandione, 4,7-dimethyl-	17.5NJ	Semivolatile
	4049	5/30/2002	1,8-Naphthalic anhydride	9.9NJ	Semivolatile
	4049	5/30/2002	Phosphoric acid, tributyl ester	19NJ	Semivolatile
	4049	5/30/2002	Unknown	8.5J	Semivolatile
	4049	5/30/2002	Unknown	10J	Semivolatile
	4049	5/30/2002	Unknown	12.2J	Semivolatile
	4049	5/30/2002	Unknown	14J	Semivolatile
	4049	5/30/2002	Unknown	14.2J	Semivolatile
	4049	5/30/2002	Unknown	6J	Semivolatile
	4049	5/30/2002	Unknown	28.6J	Semivolatile
	4049	5/30/2002	Unknown	22.9J	Semivolatile
	4049	5/30/2002	Unknown	62.4J	Semivolatile
	4049	5/30/2002	Unknown	9.8J	Semivolatile
	4049	5/30/2002	Unknown	11.5J	Semivolatile
	4049	5/30/2002	Unknown	29.5J	Semivolatile
	4049	5/30/2002	Unknown Hydrocarbon	45.6J	Semivolatile
	4049	5/30/2002	Unknown Hydrocarbon	14.5J	Semivolatile
	4049	5/30/2002	Unknown Phthalate	9.3J	Semivolatile
PW-4-OB-A	4044.5	5/30/2002	2-Fluoro-6-nitrophenol	7.1NJ	Semivolatile
	4044.5	5/30/2002	Phosphine oxide, triphenyl-	62.5NJB	Semivolatile
	4044.5	5/30/2002	Phosphoric acid, tributyl ester	224.2NJ	Semivolatile
	4044.5	5/30/2002	Unknown	5.4J	Semivolatile
	4044.5	5/30/2002	Unknown	13.4J	Volatile
	4044.5	5/30/2002	Unknown	6.1J	Semivolatile
	4044.5	5/30/2002	Unknown	5.6J	Semivolatile
	4044.5	5/30/2002	Unknown	10J	Semivolatile
	4044.5	5/30/2002	Unknown	23.8J	Semivolatile
	4044.5	5/30/2002	Unknown	10.3J	Semivolatile
	4044.5	5/30/2002	Unknown	12.3J	Semivolatile
	4044.5	5/30/2002	Unknown	24.9J	Semivolatile
	4044.5	5/30/2002	Unknown Aldol Condensate	7.6JA	Semivolatile

Table A-3. Ground Water Organics Detected

Sample Location	Sample Elevation	Sample Date	Analyte Name	Concentration (µg/L)	Category
	4044.5	5/30/2002	Unknown Aldol Condensate	24.9JA	Semivolatile
	4044.5	5/30/2002	Unknown Hydrocarbon	24.3J	Semivolatile
	4044.5	5/30/2002	Unknown Hydrocarbon	6J	Semivolatile
	4044.5	5/30/2002	Unknown Phthalate	5.1J	Semivolatile
	4044.5	5/30/2002	Unknown Phthalate	6.3J	Semivolatile
	4044.5	5/30/2002	Unknown Phthalate	13.1J	Semivolatile
SMI-PZ3M	3918.5	5/30/2002	Bromomethane	8J	Volatile
	3918.5	5/30/2002	Chloromethane	9J	Volatile
	3918.5	5/30/2002	Unknown	66.2J	Volatile
	3918.5	5/30/2002	Unknown	4.9J	Semivolatile
	3918.5	5/30/2002	Unknown	7.5J	Semivolatile
	3918.5	5/30/2002	Unknown	6.9J	Semivolatile
	3918.5	5/30/2002	Unknown	5.7J	Semivolatile
	3918.5	5/30/2002	Unknown	10.8J	Semivolatile
	3918.5	5/30/2002	Unknown Phthalate	9.8J	Semivolatile
SMI-PZ3S	3950.96	5/30/2002	Dodecanoic acid, 1,2,3-propanetriyl ester	8NJ	Semivolatile
	3950.96	5/30/2002	Unknown Phthalate	10.3J	Semivolatile

Laboratory result qualifiers:
"A" TIC is a suspected aldol-condensation product.
"B" Analyte also found in method blank.
"J" Indicates an estimated value.
"N" Tentatively identified compound (TIC).