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Office of Environmental Management – Grand Junction

MOAB UTAH

UMTRA Project

Environmental Air Monitoring Sampling and Analysis Plan for the Moab Project Site and the Crescent Junction Disposal Site, Utah

March 2007

U.S. Department of Energy

Office of Environmental Management

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

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Abbreviations and Acronyms

BLM	U.S. Bureau of Land Management
CFR	*Code of Federal Regulations*
cm	centimeters
DOE	U.S. Department of Energy
EM	Office of Environmental Management
Hrs	hours
km	kilometers
L	liters
LPM	liters per minute
MEI	Maximally Exposed Individual
mph	miles per hour
mrem	millirem
mrem/yr	millirem per year
NPS	National Park Service
pCi/L	picocuries per liter
PVC	polyvinyl chloride
NRC	U.S. Nuclear Regulatory Commission
QA	quality assurance
SAP	Sampling and Analysis Plan
TLD	Thermoluminescent Dosimeter
U.A.C.	*Utah Administrative Code*
UMTRA	Uranium Mill Tailings Remedial Action
URC	Uranium Reduction Company

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1.0 Introduction

This sampling and analysis plan (SAP) describes the environmental air monitoring activities that are conducted at the Moab Uranium Mill Tailings Remedial Action Project Site (hereafter referred to as the Moab Site) in Moab, Utah, and at the Crescent Junction Disposal Site (hereafter referred to as the Crescent Junction Site) near Crescent Junction, Utah. Air monitoring at these sites consists of meteorological stations; and stations for sampling airborne radioparticulates, radon, and direct gamma radiation at on site locations and at various off-site locations in the surrounding communities, and at selected background locations. Data collected from these monitoring activities are used to determine the radiological exposure conditions at the site boundaries and the resulting doses to members of the public. Opacity conditions are also monitored.

The U.S. Department of Energy (DOE) Office of Environmental Management (EM) conducts environmental air monitoring at these sites to assess compliance with DOE orders and applicable federal and state air requirements. DOE Order 5400.1, *General Environmental Protection Program*, specifies that effluent monitoring and environmental surveillance be conducted to determine the effect of DOE activities upon "…on-site and off-site environmental and natural resources," and to "…verify compliance with applicable Federal, State, and local effluent regulations and DOE Orders." Public dose limits are defined by DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, and the *Utah Administrative Code* (U.A.C.) Rule R313–15–301. The *Environmental Regulatory Guide for Radiologic Effluent Monitoring and Environmental Surveillance* (DOE 1991), hereafter referred to as the DOE Regulatory Guide, recommends identifying and monitoring diffuse sources such as tailings piles. National primary and secondary air quality standards (codified at Title 40 *Code of Federal Regulations* [CFR] Part 50) define maximum acceptable levels of particulate matter that are protective of public health. U.A.C. Rule R307–205 specifies that fugitive emissions shall not exceed 20 percent opacity.

1.1 Site Locations

The Moab Site is a former uranium-ore-processing facility located approximately 3 miles northwest of the city of Moab in Grand County, Utah (Figure 1–1). The Moab Site is irregularly shaped; a uranium mill tailings pile occupies much of the western portion of the site. 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 parallels the northern site boundary, and State Highway 279 parallels the southwestern boundary. Arches National Park is located adjacent to the northern site boundary, and Canyonlands National Park is located approximately 12 miles to the southwest. The Union Pacific Railroad traverses a small section of the site just west of Highway 279, then enters a tunnel and emerges several miles to the southwest. Moab Wash runs in a southeasterly direction through the center of the site and joins with the Colorado River. The wash is an ephemeral stream that flows only after precipitation or during snowmelt. The entire site covers approximately 435 acres, of which 130 acres are covered by the tailings pile. Figure 1–2 shows the major features of the Moab Site.

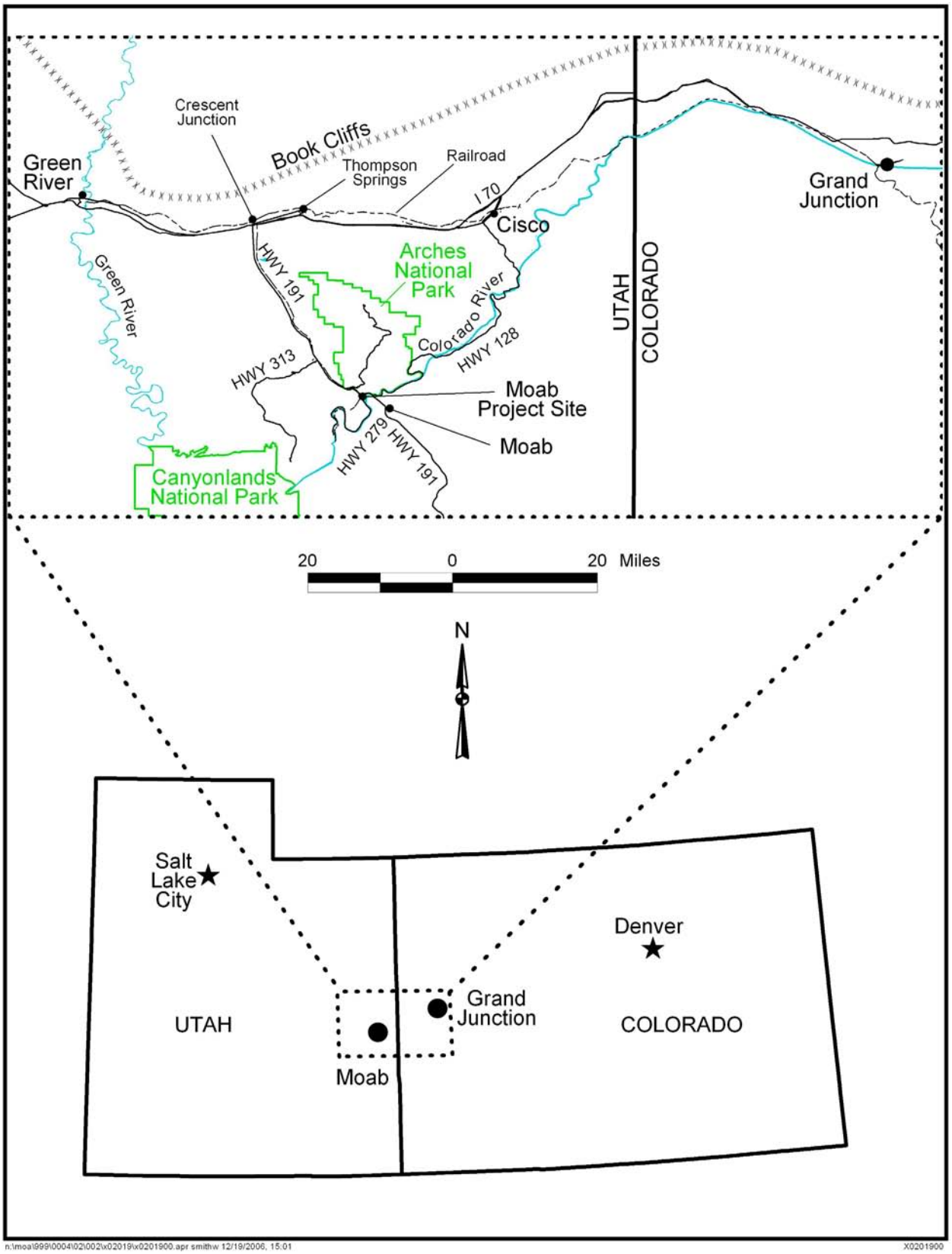

Figure 1–1. Area Location Map

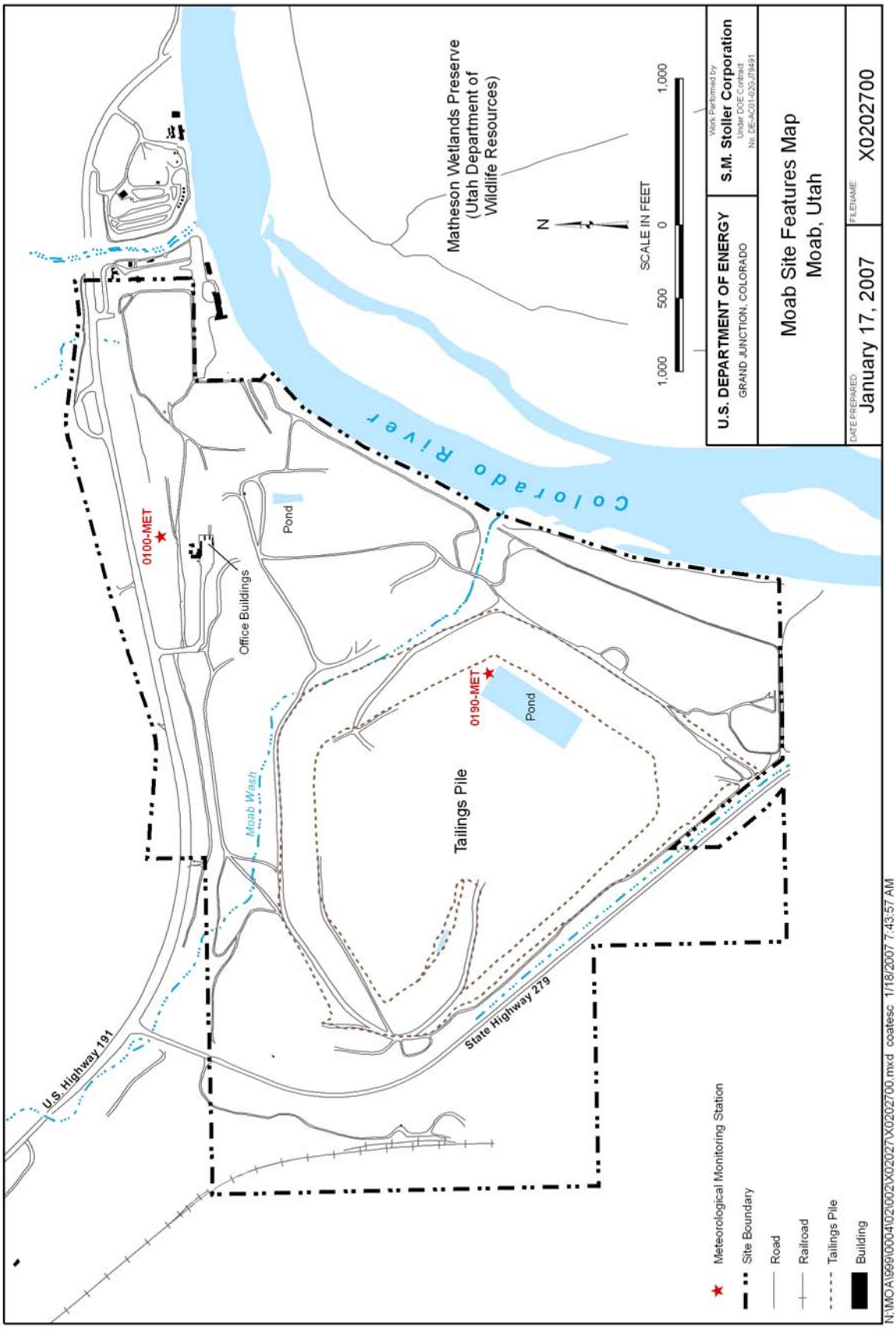

Figure 1–2. Site Features Map for the Moab Project Site

The Crescent Junction Site is located in Grand County, Utah, about 1.5 miles east of the intersection of U.S. Highway 191 and U.S. Interstate 70 and north of the Union Pacific Railroad. It is about 30 miles north of Moab and 20 miles east of Green River, Utah. Thompson Springs is approximately 6 miles east of the site (Figure 1–1).

The temporary DOE withdrawal area for the Crescent Junction Site is located within portions of Sections 22, 23, 24, 25, 26, and 27, T21S, R19E, Salt Lake Prime Meridian. The majority of the area that will be used for the repository and site activities is in Sections 22, 25, 26, and 27, T21S, R19E, Salt Lake Prime Meridian. Figure 1–3 shows the major features of the Crescent Junction Site.

The Crescent Junction Site is surrounded on three sides by land administered by the U.S. Bureau of Land Management (BLM). The talus slopes of the Book Cliffs abut the northern boundary. To the east and west the surrounding areas are basically flat, and drainage is generally to the southwest toward the Green River. To the south, the Union Pacific Railroad and County Road 175 bound the property. Further south is U.S. Interstate 70.

1.2 Site History

Originally, the Moab Site property and facility were owned by the Uranium Reduction Company (URC) and were regulated by the U.S. Atomic Energy Commission, a predecessor agency to DOE. In 1956, URC began operation of the Moab mill. In 1962, the Atlas Minerals Corporation (Atlas) acquired URC and operated the mill until operations ceased in 1984. Between 1956 and 1984, uranium mill tailings were disposed of on site in an unlined impoundment. Decommissioning of the mill began in 1988; between 1989 and 1995, an interim cover was placed on the tailings impoundment. In 1996, Atlas proposed to reclaim the tailings pile for permanent disposal in its current location. However, Atlas declared bankruptcy in 1998, and subsequently, the U.S. Nuclear Regulatory Commission (NRC) appointed PricewaterhouseCoopers as trustee of the Moab reclamation trust and licensee for the site.

Stakeholders have expressed concern about the effects of contaminants from the site on the Colorado River. These stakeholders include local citizens, Utah officials, environmental groups and agencies, as well as downstream water users of the Colorado River. Responsibility for remediation of the Moab Site was effectively transferred from PricewaterhouseCoopers to DOE by passage of the Floyd D. Spence National Defense Authorization Act in 2001. This act further designates that the Moab Site undergo remediation in accordance with Title I of the Uranium Mill Tailings Radiation Control Act of 1978.

DOE has determined that an engineered disposal cell will be constructed at a previously undisturbed location near Crescent Junction, Utah, to provide for the long-term containment of the Moab tailings as required at 40 CFR 192. DOE has temporarily withdrawn 2,300 acres of public domain lands near Crescent Junction from the BLM for the construction of the tailings disposal cell, construction support area, and a surrounding buffer zone (Figure 1–3). Construction of infrastructure, such as paving access roads and parking areas, installing perimeter fencing and a storm water retention pond, and setting up office trailers, occurred at the Crescent Junction Site during the summer of 2006.

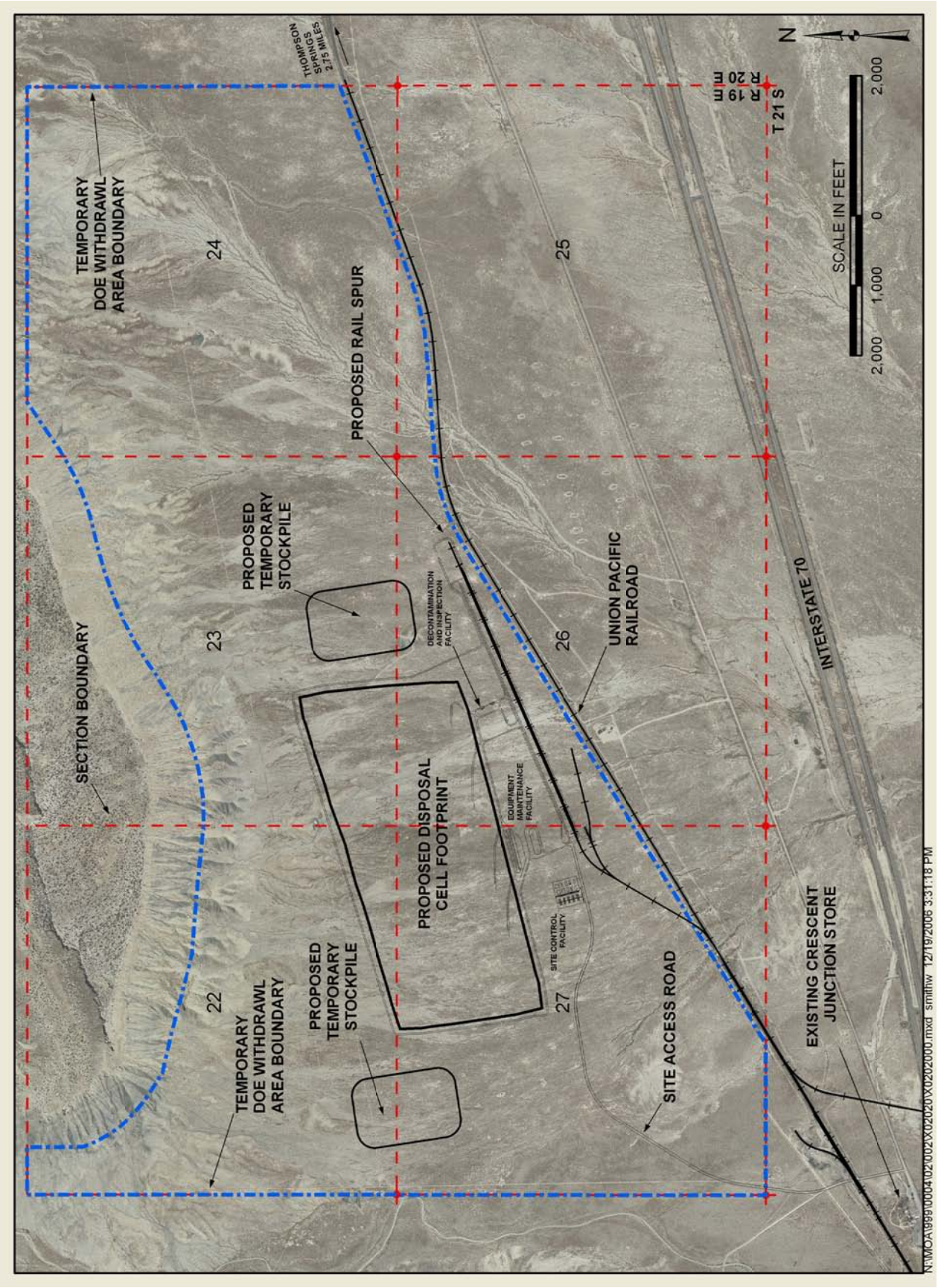

Figure 1–3. Site Features Map for the Crescent Junction Disposal Site

No final decisions have been made at this time regarding the cell design. However, it is anticipated that the disposal cell will be roughly rectangular in shape, that it will encompass approximately 260 acres, and that it will be oriented in a general east-west direction (Figure 1–3).

Once Moab Site remediation is complete, DOE will retain permanent ownership of the Crescent Junction Site repository, a buffer area, and access to the repository; the remaining acreage will be returned to BLM. The final area that will be permanently withdrawn from other uses is approximately 300 acres.

1.3 Climate

The climate of the Moab and Crescent Junction region is semiarid. The average annual temperature in Moab is approximately 14 ºC (57 ºF). January is the coldest month, averaging –1 ºC (30 ºF), and July is the warmest month, averaging 28 C (82 ºF). Extreme temperatures have ranged from –28 ºC (–18 ºF) in January 1963 to 44 ºC (114 ºF) in July 1989. Temperatures of 32 ºC (90 ºF) or higher occur about 100 days per year; about 80 percent of those occur during June, July, and August. Temperatures below freezing occur on average 123 days per year; about 80 percent of those occur during November through February. The effects of high temperature on human comfort are moderated by the low relative humidity, which is often less than 50 percent during daytime hours.

Average annual precipitation at Moab is 23 centimeters (cm) (9.0 inches) (DOE 2005b). This precipitation is distributed approximately equally among the seasons with slight peaks during the spring and fall. Potential evapotranspiration (about 127 cm [50 inches] per year) greatly exceeds annual precipitation. Mean pan evaporation (about 140 cm [55 inches] per year) and lake evaporation (about 97 cm [38 inches] per year) also greatly exceed the total annual precipitation.

Low humidity in the region limits fog occurrences (visibility less than 0.5 kilometer [km] [0.3 mile]) to fewer than 10 days per year. Thunderstorms occur about 40 days per year. Hail occurs approximately 3 days per year.

DOE installed a meteorological monitoring station (0100–MET) north of the main construction office for the Moab Site in July 2002 to better assess actual on-site meteorological and climatological conditions. A “wind rose” diagram was plotted (Figure 1–4) using data obtained at the Moab Site meteorological station between January 1 and December 31, 2006, to identify direction and velocity of the prevailing winds at the Moab Site. As indicated in the Figure 1–4 diagram, the prevailing wind directions at the Moab Site are generally from the west-southwest and the southeast. In July 2006, DOE installed a second meteorological monitoring station (0190–MET) on the tailings pile to obtain more site-specific wind data. The locations of the two Moab Site meteorological stations are shown in Figure 1–2.

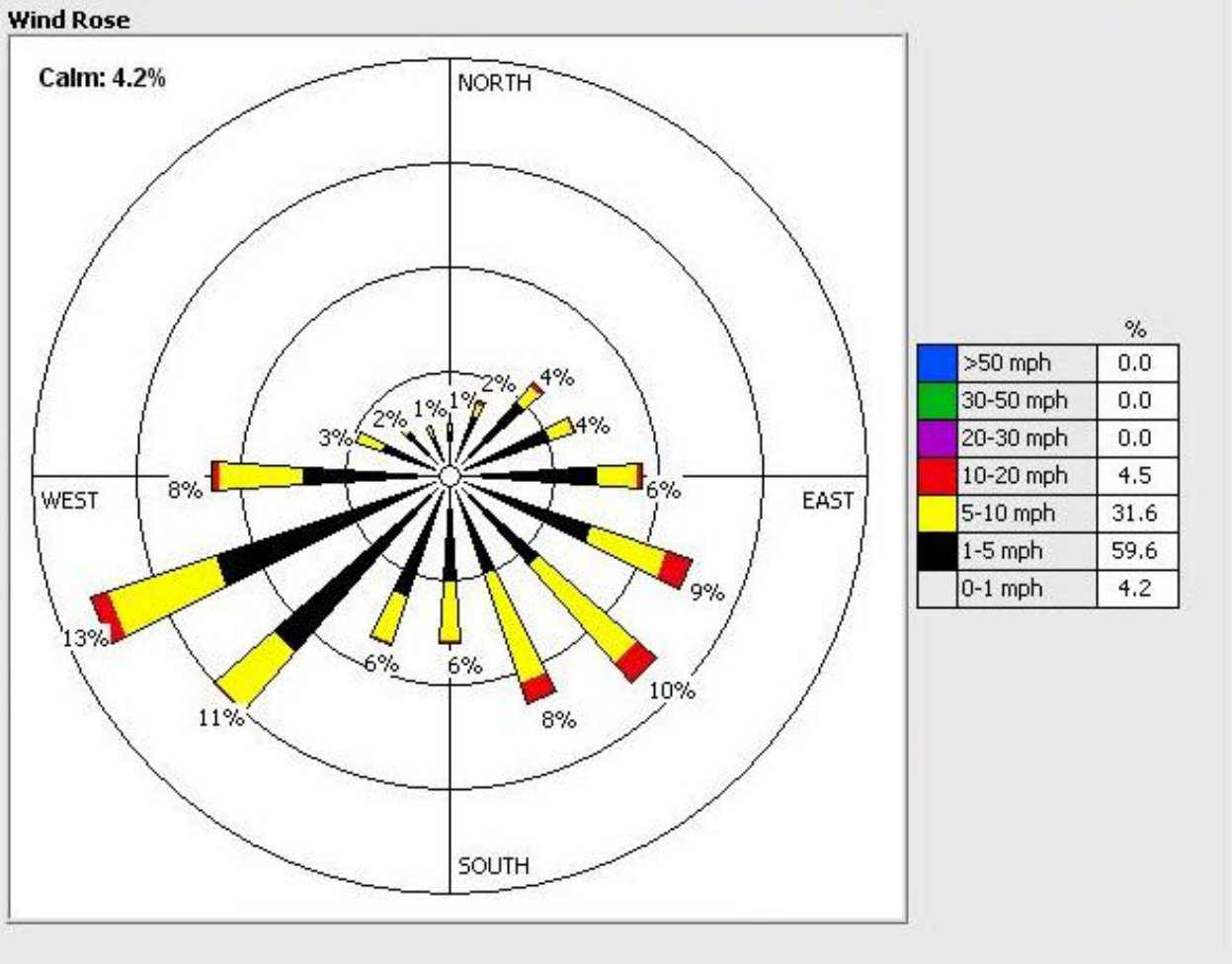

Diagram shows direction from which wind blew.

Figure 1–4. Wind Rose Plot for 2006, Moab Project Site

In June 2005, DOE installed a meteorological monitoring station (0300–MET) at the rest area near Crescent Junction to obtain more area-specific meteorological and climatological data. The location of meteorological station 0300–MET is shown on Figure 4–3.

A wind rose diagram was plotted (Figure 1–5) using data obtained at the Crescent Junction Site meteorological monitoring station between January 1 and December 31, 2006, to identify the prevailing wind directions and velocity near the Crescent Junction Site. As indicated in Figure 1–5, the prevailing wind directions at the Crescent Junction Site area are generally from the east and west-southwest. As additional data are collected, the interpretation of prevailing wind direction may be updated.

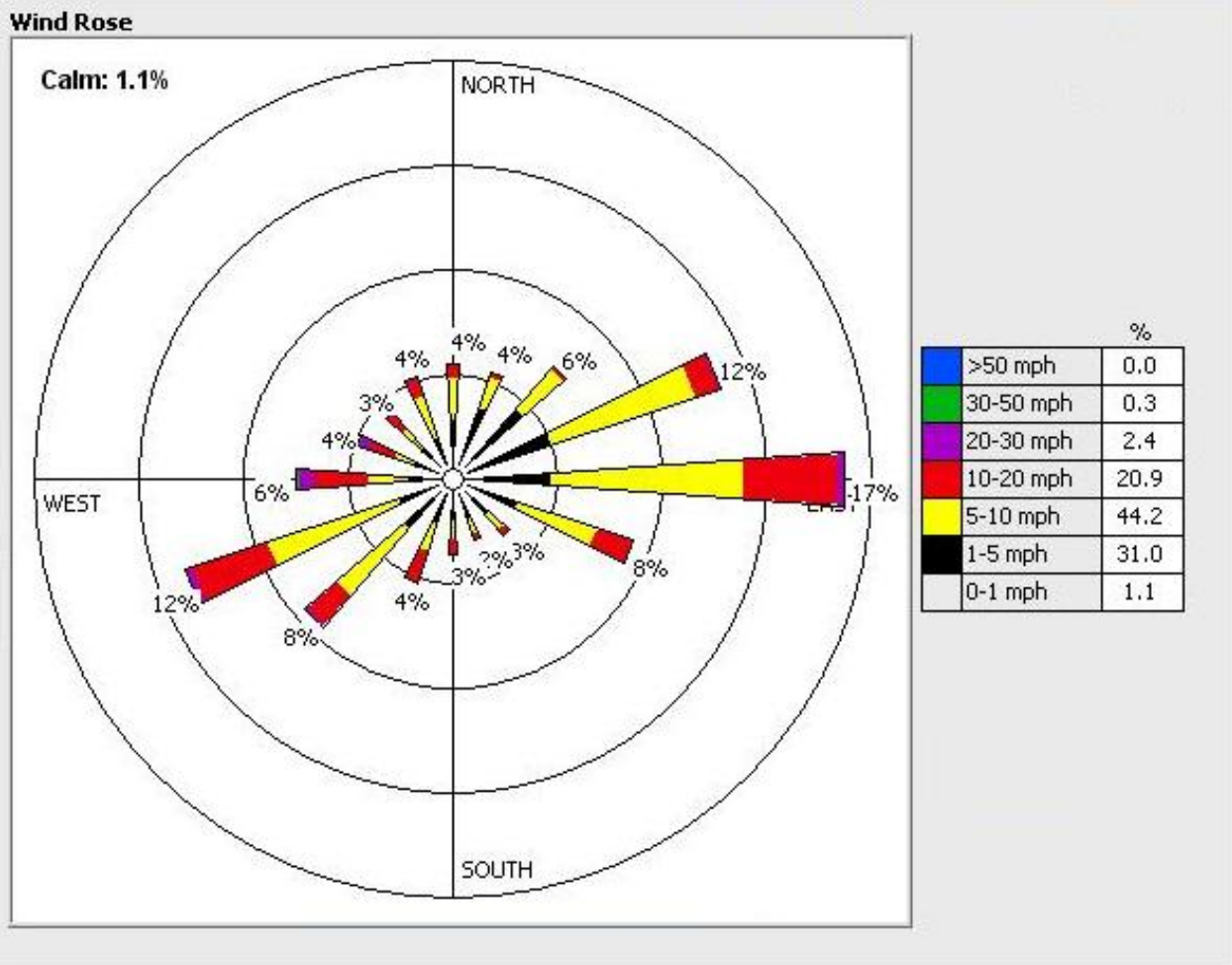

Diagram shows direction from which wind blew.

Figure 1–5. Wind Rose Plot for 2006, Crescent Junction Disposal Site

1.4 Previous Site Investigations

1.4.1 Radioparticulates

Radioparticulate air monitoring has been conducted at the Moab Site since approximately 1979. Historically, Atlas personnel operated five low-volume continuous air samplers. Three of the air samplers were located on site, and two samplers were located off site (i.e., background sampling locations). Samples were analyzed for thorium-230, radium-226, polonium-210, and total uranium. Analytical data were used to compile semiannual effluent monitoring reports as required by 10 CFR 40.65, "Effluent Monitoring Reporting Requirements."

DOE initiated radioparticulate air monitoring at the Crescent Junction Site in late 2005.

1.4.2 Radon and Direct Gamma

Radon monitoring has been conducted at the Moab Site since approximately 1979. Radon detectors (similar to alpha-sensitive Radtrack detectors) were co-located at the five air particulate monitoring stations (both on- and off-site locations) as well as just east of the eastern fence line (near the northeastern corner of the site property) where the maximally exposed individual (MEI) resides (on the McClatchy property). The resulting data were used to determine radon exposures to the MEI. The MEI represents the closest location to the site boundary that is continually occupied by a member of the public. Typically, the MEI location also represents a worst-case exposure scenario. Analytical data is published in Quarterly Data Reports and are reported in the 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.

Environmental gamma radiation monitoring also has been conducted at the Moab Site since approximately 1979. Environmental gamma radiation has been monitored using thermoluminescent dosimeters (TLDs). Environmental gamma radiation monitoring locations were co-located at each of the five air particulate monitoring locations. The resulting analytical data were used to determine the cumulative radiological exposure at the site boundary.

DOE initiated radon and direct gamma monitoring at the Crescent Junction Site in late 2005.

1.4.3 Meteorology

Atlas maintained a meteorological monitoring station at the Moab Site until 1984, when the mill ceased operations. Monitoring data from the Atlas meteorological monitoring station were not available. The National Park Service (NPS) operates a limited assortment of meteorological monitoring equipment at the entrance to Arches National Park (located approximately 0.25 mile northeast of the entrance to the Moab Site off State Highway 191). Because the Arches NPS weather station was the closest source of meteorological data prior to 2002 when DOE installed a meteorological monitoring station at the site, wind speed and direction data collected at that location were used as the basis for establishing preliminary radioparticulate, radon, and direct gamma monitoring locations. As discussed in Section 1.3, DOE has since installed two meteorological monitoring stations at the Moab Site to characterize atmospheric dispersion conditions. Radioparticulate, radon, and gamma monitoring stations have been reevaluated and updated based on current site meteorology data.

The meteorological monitoring station near the Crescent Junction Site (see discussion in Section 1.3) is obtaining data needed to calculated background conditions and to help determine site-specific air quality conditions. The location of radioparticulate, radon, and gamma monitoring stations will be reevaluated and updated as additional site-specific meteorological data are obtained and when the disposal cell design is complete.

End of current text

2.0 Basis for Sampling

The radionuclides of concern at the Moab Site include those inherent in the process of extracting uranium from ore. Those radionuclides include naturally occurring uranium and its decay progeny, typically referred to as Naturally Occurring Radioactive Material. During the milling process, the uranium is selectively removed, resulting in increased concentrations of uranium decay progeny. This results in the presence of Technologically Enhanced Naturally Occurring Radioactive Material. The primary radiological hazards in uranium mill tailings like those found at the Moab Site are radium-226, and its decay progeny, including radon gas.

The potential off-site radiological hazards from work activities at the Moab Site include three distinct hazards:

- Windblown particulate tailings, which contain low concentrations of radioactive material, commonly referred to as radioparticulates;
- Radon gas and its decay progeny resulting from the release of radon gas from the site; and
- Exposure to gamma radiation from gamma-emitting isotopes present in the tailings pile.

Radioparticulates and radon can migrate off site, primarily by air movement, and can pose a hazard away from the site; exposure to gamma radiation is a hazard only near the site itself. Because of these potential hazards, DOE has implemented a comprehensive environmental air monitoring program as described in this plan to continuously monitor and measure radioparticulates, radon, and gamma radiation, both at the site boundary and at numerous locations away from the site.

An environmental air-monitoring program was initiated at the Crescent Junction Site in late 2005 to collect baseline and natural background condition information before tailings are relocated to the Crescent Junction Site. The baseline data will be used (1) to calculate background values, (2) to determine site-specific standards for radon, gamma, and radioparticulates, (3) to ensure that a comprehensive air monitoring program is developed for the site, and (4) as a basis of comparison with future data that will be obtained as the project progresses. Constituents monitored at the Crescent Junction Site are radioparticulates, radon, and gamma.

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3.0 Objectives

The primary objective of this SAP is to monitor and document current ambient air quality and radiological exposure conditions at the Moab and Crescent Junction Sites. Specific objectives of this SAP are:

- To verify compliance with applicable environmental air quality standards and public radiation dose limits (Table 3–1), and to fulfill the environmental monitoring and surveillance requirements of DOE Orders 5400.1 and 5400.5.
- To establish baseline air quality conditions at the Moab Site, the Crescent Junction Site, and various other off-site and background locations.
- To measure off-site concentrations of airborne radioparticulates and radon and to measure levels of direct gamma radiation. Off-site dose levels are monitored so that preventive measures can be initiated before the dose limits are exceeded.
- To detect and quantify any unplanned release from the site.
- To verify the effectiveness and accuracy of models used to predict the concentrations of airborne pollutants in the atmosphere.
- To monitor the effectiveness of techniques employed during work activities to prevent migration of radioactive materials off site.

These objectives may change as the level of activity (e.g., construction activity, earth moving, land disturbance) changes at the Moab and Crescent Junction Sites. With the occurrence of any major construction activity, DOE may initiate additional monitoring to comply with air quality regulations applicable to that activity. The industrial hygiene program is a separate program and is not addressed in this plan.

The public dose limits and air quality standards/guidelines applicable to the Moab and Crescent Junction Sites are summarized in Table 3–1.

Table 3–1. Applicable Public Dose Limits and Air Quality Standards/Guidelines for the Moab Site and Crescent Junction Site

Parameter	Regulatory Citation	Standard/Limit/ Guideline	Frequency of Collection/Analysis
Radioparticulates: radium-226, thorium-230, polonium-210, and total uranium	DOE Orders 5400.5	10 mrem/yr + background	Filters collected weekly; composited and submitted for analysis quarterly.
Direct gamma radiation (e.g., TLD)	DOE Order 5400.5 and U.A.C. R313–15–301	100 mrem/yr + background	TLDs collected and analyzed quarterly.
Atmospheric radon (e.g., Track Etch radon detector)	DOE Order 5400.5 (Chapter III, Figure III-3)	3.0 pCi/L + background	Radon detectors collected and analyzed quarterly.
Fugitive dust emissions/ opacity	U.A.C. R307–205	20%	Dust emissions and opacity will be monitored by EPA Method 9 and controlled as needed.

pCi/L=picocuries per liter
mrem/yr = millirem per year

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, establishes standards and requirements for operations of DOE and DOE contractors with respect to protection of members of the public and environment against undue risk from radiation. Chapter II of the order sets public dose limits for members of the public at 100 millirem per year (mrem/yr) (above natural background) from DOE radiation sources. The order excludes contributions from radon in the dose limit. Chapter III (Figure III-3) of DOE Order 5400.5 provides a concentration in air limit of 3.0 picocuries per liter (pCi/L) (above natural background) at the site boundary.

The radon standard promulgated in 40 CFR 192.02 is a design standard that is intended to be applied to radon emissions from the cover of an engineered disposal cell that provides for the long-term containment of residual radioactive material. Accordingly, that radon standard is not applicable to the Moab Site, because the residual radioactive material at the Moab Site is not currently contained within a long-term disposal cell and protected by an engineered cover (including radon barrier).

In the absence of a federal environmental radon *standard* that is directly applicable to the Moab Site in its current condition and eventually to the Crescent Junction Site, DOE's goal for atmospheric radon emissions at the site boundary and any off-site locations is that such emissions should not exceed 3.0 pCi/L plus background (annual average radon concentration). This radon goal is not an enforceable environmental standard; rather, it is a self-imposed guideline, the appropriateness of which should be periodically evaluated as additional monitoring data are collected.

The 20 percent opacity standard for fugitive dust emission, as identified in Table 3–1, is applicable to fugitive dust emissions at both the Moab Site and the Crescent Junction Site. However, DOE's goal for fugitive dust emissions at these sites is 0 percent opacity. Fugitive Dust Control Plan permits were obtained from the State of Utah Division of Air Quality for both sites. The Moab Site permit (permit number DAQC-626-2002) expires in May 2026. The Crescent Junction Site permit (permit number DAQC-1101-2006) expires in August 2026. Fugitive dust emissions are controlled through the use of dust suppression and administrative procedures, such as speed limits or work reduction, as needed.

4.0 Field Sampling Procedures

4.1 Airborne Radioparticulates

Moab Site meteorological data (Figure 1–4) indicate that the prevailing wind direction at the Moab Site is generally from the west-southwest and from the southeast; thus, the generally prevailing wind from the site is not toward any population centers, including the city of Moab.

For the Moab Site, the monitoring network is designed to detect and quantify airborne releases from the site, including the MEI and the closest population center, the city of Moab. The radioparticulate monitoring network consists of nine continuous air samplers: two on-site locations as shown in Figure 4–1 and seven off-site locations as shown in Figure 4–2.

The Moab Site designated background monitoring locations (0117 and 0122) comply with the siting recommendations as outlined in the DOE Regulatory Guide. The topographic and geologic characteristics of the background monitoring locations are similar to those at the Moab Site. Both background locations are sited a sufficient distance away from the Moab tailings pile that windblown contaminants transported off site are diluted by natural dispersion and will not influence background or ambient air quality measurements.

The baseline radioparticulate monitoring network for the Crescent Junction and Thompson Springs areas currently consists of two off-site continuous air sampler locations: one located at a residence southeast of the disposal cell withdrawal area and the other at a residence west of Thompson Springs. The two off-site radioparticulate sampling locations are shown in Figure 4–3.

Radioparticulate samplers are RADēCO Model AVS–28A low-volume, constant flow air samplers, or the equivalent. Each sampler runs continuously at a rate of approximately 60 liters per minute (LPM). Filters are collected and replaced on a weekly basis. To obtain average quarterly values of radioparticulate concentrations, weekly filter samples will be composited and analyzed as one sample. Filter collection will be performed in accordance with the procedure in Appendix A, “Procedure for Sampling for Airborne Radioparticulates Using a Low-Volume Continuous Air Sampler” and the DOE Regulatory Guide. Field data will be collected and maintained on the Radioparticulate Sampling Field Log (Appendix A).

4.2 Radon

As shown in Figure 4–1 and Figure 4–2, the Moab Site radon monitoring network consists of 13 on-site locations and 12 off-site locations (including the MEI). The on-site locations are placed on or near the property boundary and near the tailings pile. Radon is also monitored at the nearest occupied residential structure (the caretaker’s house for McClatchy property) closest to the millsite property. This location represents the MEI and is located immediately adjacent to the eastern property boundary (Figure 4–1).

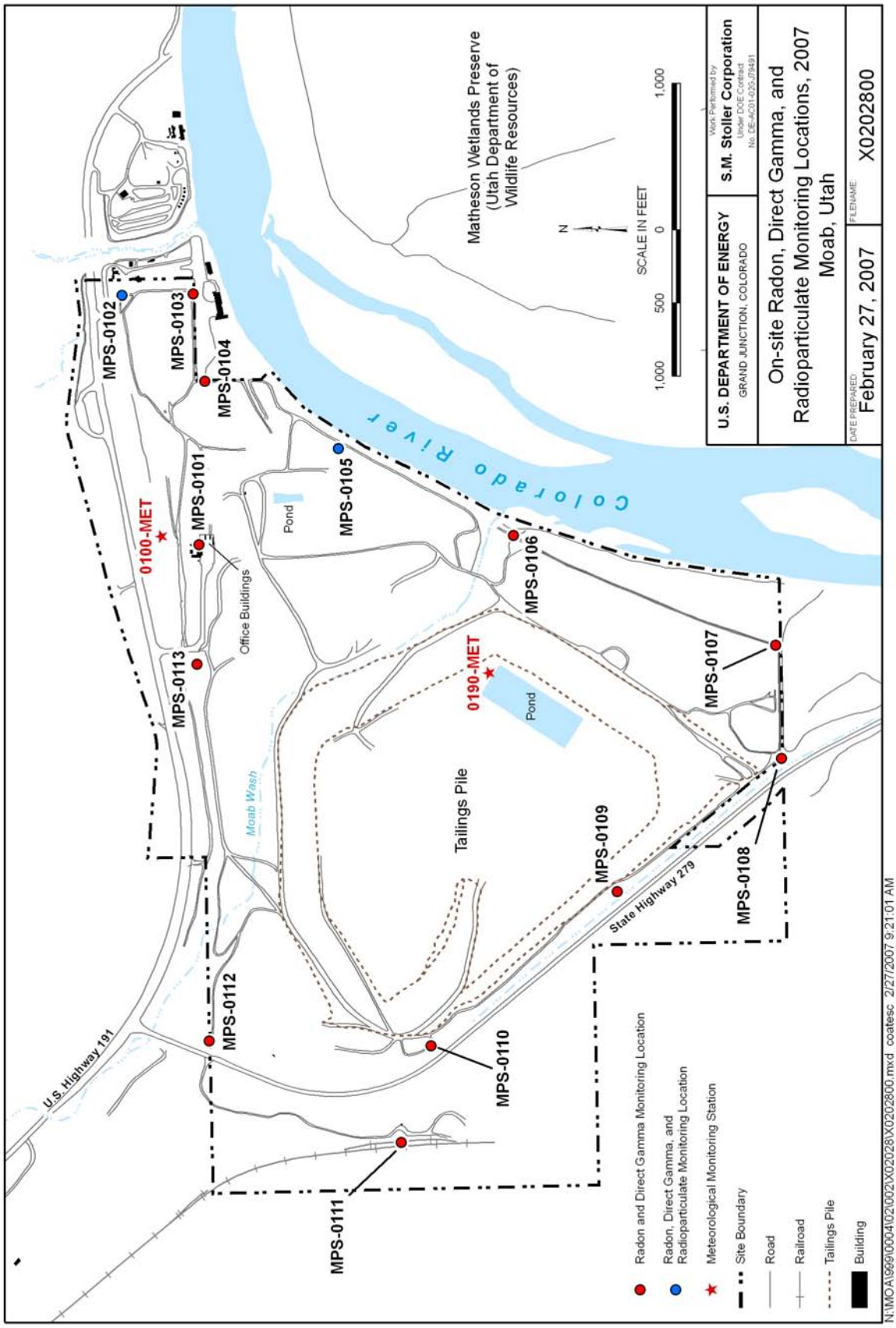

Figure 4–1. On-Site Air Quality Monitoring Locations, Moab Project Site

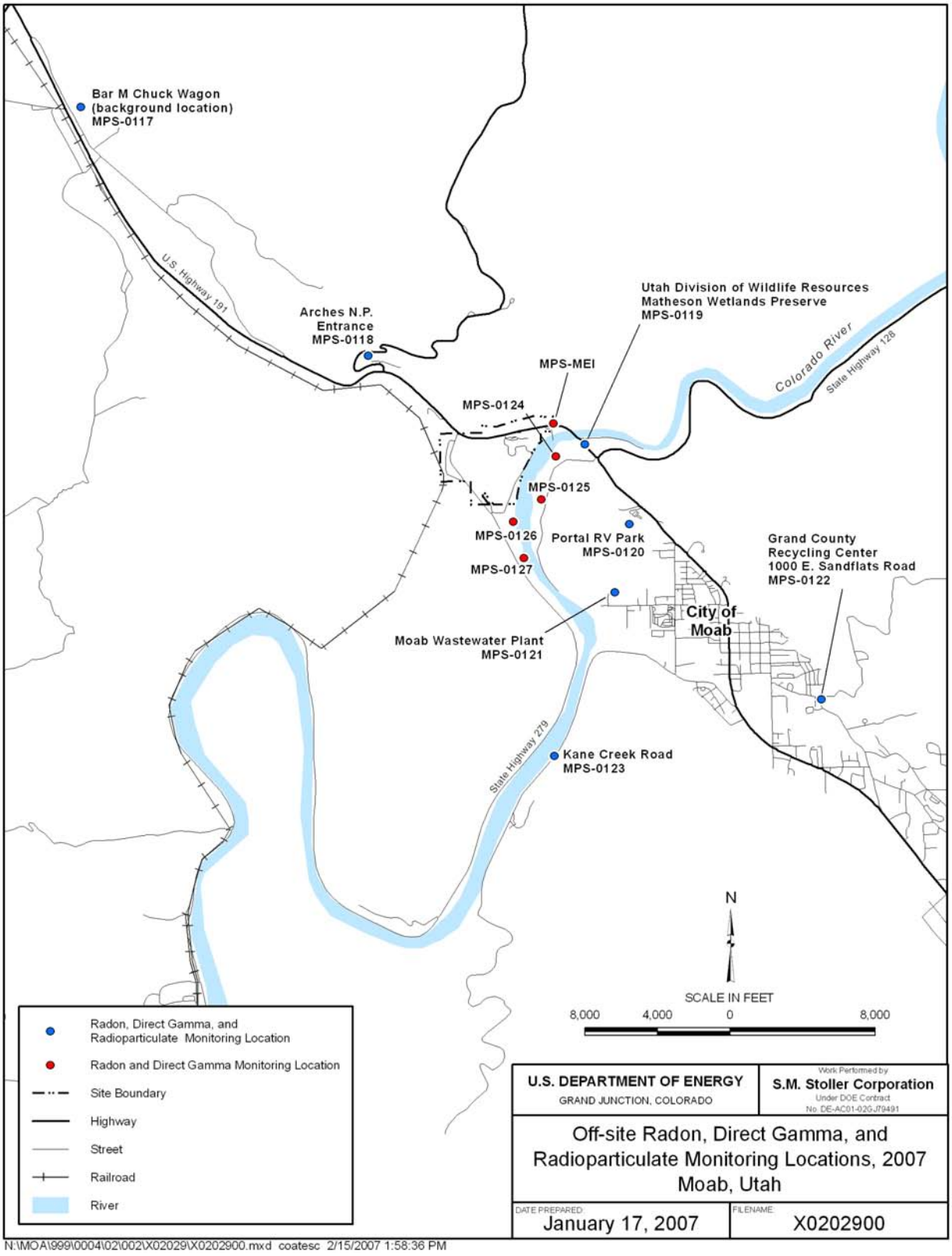

Figure 4–2. Off-Site Air Quality Monitoring Locations, Moab Project Site

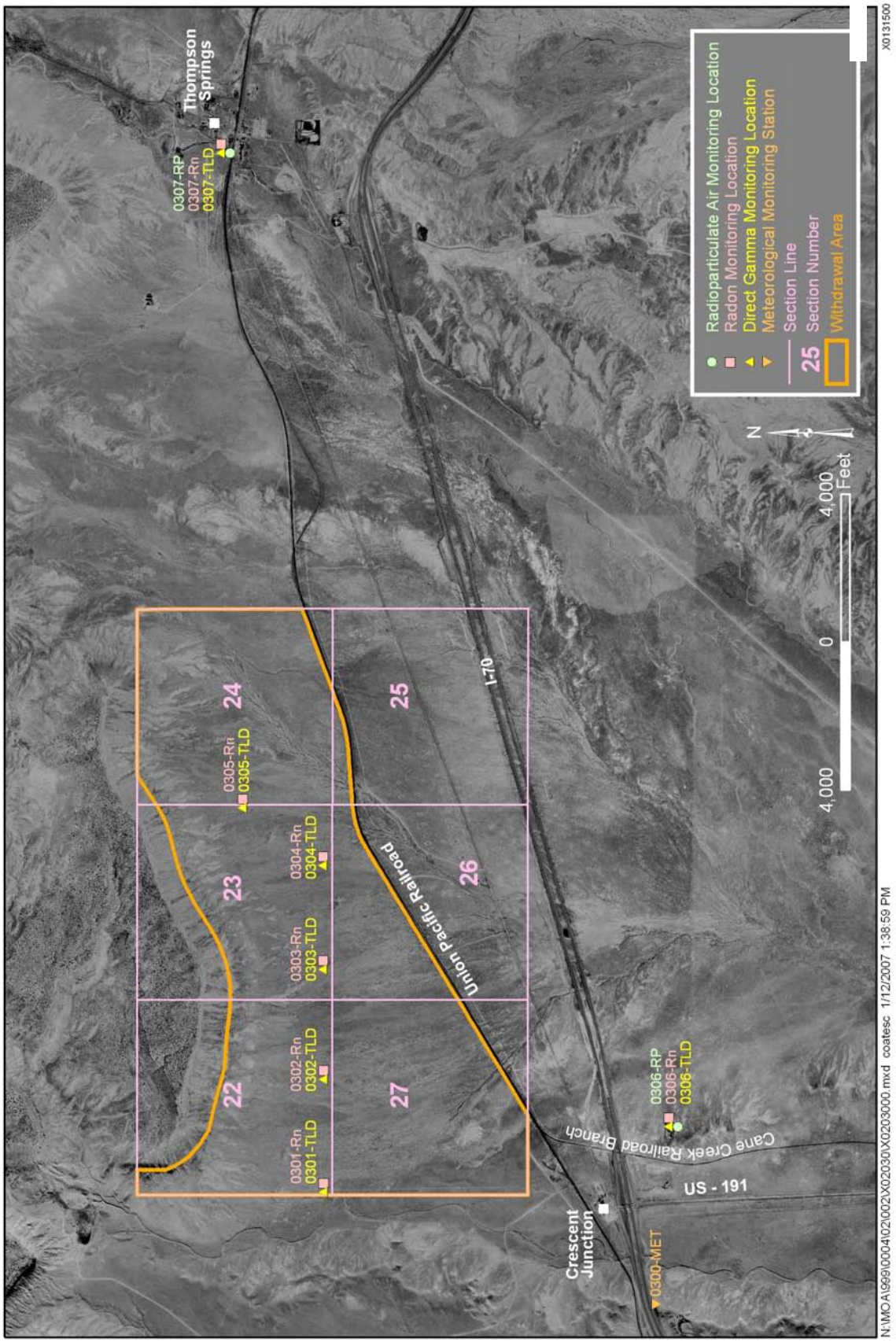

Figure 4–3. Baseline Air Monitoring Locations, Crescent Junction Disposal Site

The baseline radon monitoring network for the Crescent Junction and Thompson Springs area currently consists of seven air sampler locations: five radon monitoring stations located within the disposal cell withdrawal area and two off-site monitoring locations. Of the two off-site locations, one station is located at a residence southeast of the disposal cell withdrawal area, and the other station is located at a residence west of Thompson Springs. In addition to the exterior monitoring at the two residential locations, indoor radon monitoring is also conducted. The radon monitoring sampling locations are shown in Figure 4–3.

Radon is monitored using a single Landauer alpha-sensitive detector at each location. The radon detector is placed in a polyvinyl chloride (PVC) protective housing. The PVC housing is attached to a fence line or to a metal T-post at approximately 1 meter above the ground surface. Radon detectors were deployed at the Moab Site beginning in April 2002. Exterior radon detectors are exposed and collected in 3-month (i.e., quarterly) intervals in January, April, July, and October. Indoor radon detectors are exposed and collected annually each April. Immediately upon collection, an adhesive metal foil is placed over the open portion of the exposed detector. Sampling will be performed as specified in procedure GS-13(T), "Standard Test Method for Exterior Radon Measurements Using Alpha-Track Monitors," of the *Environmental Procedures Catalog* (STO 6). The exposed detectors are sent to Landauer, Inc. for analysis within 1 week of collection. Upon receipt from the laboratory, a copy of the analytical data reports will be provided to the Environmental Support Services organization for database management.

Field data (e.g., detector number, sample location, date of placement, date of retrieval) for individual radon monitoring locations will be collected and maintained in a field logbook.

4.3 Direct Gamma

As shown in Figure 4–1 and Figure 4–2, the Moab Site direct gamma radiation monitoring network consists of 13 on-site locations and 12 off-site background locations (including the MEI). The on-site locations are placed on or near the property boundary and near the tailings pile. All off-site direct gamma monitoring locations are co-located with each radon monitoring location (see Section 4.2).

The baseline direct gamma monitoring network for the Crescent Junction and Thompson Springs area currently consists of seven air sampler locations: five air monitoring stations located within the disposal cell withdrawal area and two off-site monitoring locations. Of the two off-site locations, one station is located at a residence southeast of the disposal cell withdrawal area, and the other station is located at a residence west of Thompson Springs. In addition to the exterior monitoring at the Thompson Springs residential location, indoor direct gamma monitoring is also conducted. The direct gamma monitoring locations are shown in Figure 4–3.

Direct gamma radiation will be measured using a single calcium sulfate dysprosium ($CaSO_4Dy$) TLD at each location. The TLD will be attached to a fence line or to a metal T-post at approximately 1 meter above the ground surface. TLDs were deployed at the Moab Site beginning in April 2002. Exposed TLDs will be collected and replaced with unexposed TLDs quarterly. Exposed TLDs will be sent to an approved laboratory for analysis within 1 week of collection. Upon receipt from the laboratory, a copy of the analytical data reports will be provided to the Environmental Support Services organization for database management.

Field data (e.g., detector number, sample location, date of placement, date of retrieval) for individual gamma monitoring locations will be collected and maintained in a field logbook.

4.4 Meteorological Monitoring

According to the DOE Regulatory Guide, "Environmental protection activities, including the assessment of impacts of planned and unplanned airborne releases on public health and safety and the demonstration of compliance with applicable Federal, State, and local laws, regulations, and Orders, require meteorological information representative of conditions at DOE facilities. This information is needed to assess the transport, diffusion, and deposition of materials released to the atmosphere by a DOE facility. It is also important in the design of environmental monitoring networks."

In addition to the above uses, meteorological monitoring data have been used extensively by DOE at environmental restoration and construction sites to document contractor/subcontractor claims for down time due to "bad weather days."

The history and locations of the meteorological monitoring stations (two at the Moab Site and one near Crescent Junction) are discussed in Section 1.3. Meteorological parameters that are measured or calculated include wind speed, wind direction, temperature, evapotranspiration potential, precipitation, solar radiation, and relative humidity. Meteorological monitoring data are collected quarterly and reported annually.

4.5 Opacity

In compliance with U.A.C. 307–205, "Emission Standards: Fugitive Emissions and Fugitive Dust," and the Fugitive Dust Control Plan permits described in Section 3.0, fugitive dust emissions from all construction activities associated with the Moab Site and the Crescent Junction Site shall not exceed 20 percent opacity. To ensure compliance with this standard, only State of Utah certified opacity readers are used to make opacity determinations. Opacity readings will be performed using EPA Method 9 on an as-needed basis when dust is visible. All opacity determinations will be documented and reported to the construction project manager.

4.6 Responsibilities

The DOE contractor has primary responsibility for implementing the following components of this environmental air-monitoring program at the Moab Site and Crescent Junction Site:

- Procurement, installation, and maintenance of equipment.
- Supplying a qualified field sampler and calibrator. The term "qualified" is defined in Section 6.3.
- Weekly particulate filter collection, replacement, and storage of filters in canister.
- Quarterly TLD and radon detector collection and replacement.
- Quarterly radioparticulate filters, radon detectors and TLDs shipment to analytical laboratories.

- Maintenance of analytical data packages and field logbooks.
- Identifying and installing new monitoring locations as needed.
- Updating procedures and SAPs as needed.
- Procurement of sampling supplies (e.g., filters, radon detectors, TLDs).
- Ensuring that site activities are in compliance with applicable federal and state regulations and DOE orders.
- Compliance reporting (e.g., preparation of an Annual Site Environmental Report, preparation of Quarterly Data Reports).
- Supplying opacity-certified personnel to support remedial activities.
- Notification of construction/program management of any noncompliant condition discovered as a result of air quality monitoring.

End of current text

5.0 Analytical Procedures

Filters collected for radioparticulate analysis will be submitted quarterly. All radioparticulate samples will be analyzed by Severn Trent Laboratories (STL)-St. Louis, Missouri, for radioparticulates (radium-226, thorium-230, polonium-210, and total uranium). Radioparticulates will be analyzed according to DOE's Consolidated Audit Program team's requirements as specified in the *Quality Systems for Analytical Services* (DOE 2006). Polonium-210 and thorium-230 are analyzed by alpha spectrometry using STL methods STL-RC-0210 and EML A-01-R MOD, respectively. Radium-226 is analyzed by gas proportional counting using STL method EML RA-06-RC MO. Total uranium is analyzed by inductively coupled plasma-mass spectrometry using EPA method SW-846 6020. Analytical reporting limits are values slightly above the instrument detection limits and are used to negate the variability associated with instrument detection limits. Reporting limits and analytical methods applicable to radioparticulate, radon, and gamma analyses are summarized in Table 5–1.

Table 5–1. Reporting Limits and Analytical Methods

Analyte		Reporting Limit	Analytical Method
Radioparticulates			
	Radium-226	2 pCi/filter[a]	EML RA-06-RC MOD
	Uranium (total)	0.5 pCi/sample	SW-846 6020
	Thorium-230	0.5 pCi/sample	EML A-01-R MOD
	Polonium-210	0.3 pCi/sample	STL-RC-0210
Radon		0.3 pCi/L	Landauer, Inc., 2002
Direct gamma radiation		1 mrem	Environmental Laboratories, Inc., Midwest Laboratory, 2001

[a]Reporting limit may vary depending on matrix interferences.

Radon detectors will be analyzed by Landauer, Inc., according to an internal procedure and in accordance with the *Quality Assurance Manual for Radon Monitoring, Revision Number 9* (Landauer, Inc. 2002). TLDs will be analyzed by Environmental Laboratories Inc., Midwest Laboratory (formerly Teledyne Brown Environmental Labs) according to *Preparation and Read-out of Teledyne Isotopes TLD Card, TIML–TLD–01, Revision 7* (Environmental Laboratories 2001).

End of current text

6.0 Quality Assurance and Quality Control

Quality assurance (QA) requirements used in association with the field and laboratory activities described in this air monitoring SAP comply with the QA requirements for environmental characterization discussed in DOE Order 231.1, *Environment, Safety, and Health Reporting*, and 10 CFR 830, and as specified in the *Quality Assurance Manual* (STO 1).

The procedures in the *Environmental Procedures Catalog* (STO 6) are intended as general guidance and require additional detail from project planning documents to be complete; the following sections fulfill that function and specify additional procedural requirements. If a discrepancy exists between a STO 6 standard operating procedure and an instruction in this SAP, then the instruction in this SAP takes precedence over the procedure.

Quality control during air sampling will be achieved by implementing and adhering to guidance in the *Quality Assurance Handbook for Air Pollution Measurement Systems Volume III* (EPA 1994). Guidance in the EPA handbook includes calibration procedures, quality control flow rate checks, independent performance audit checks, filter handling protocol, laboratory quality control, personnel chain of command, and data validation protocol.

Each low volume sampler will initially be calibrated, and recalibrated quarterly with a National Institute of Standards and Testing traceable air flow calibrator unit. The calibration unit will be calibrated by the manufacturer annually.

6.1 Sample Control

To maintain evidence of authenticity, samples will be properly identified and made discernible from other like samples. Samples will be indexed by unique sample number, site identification number, date collected, and sample period (start/end date or total hours). Chain-of-Sample-Custody records will be used to document all transfers in the possession of samples and to show that a sample was in constant custody since its collection.

6.2 Records and Document Control

When recording field data, sampling personnel will follow procedure GT–1(P), “Standard Practice for Field Documentation Process” of the *Environmental Procedures Catalog* (STO 6). All entries in the field logbook will be made with indelible ink and will be legible, accurate, complete, and traceable to the sample measurements and/or site location. Field logbook data are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the field sampling activities. Field logbooks will be stored consistent with the guidance provided in the Moab working file index, which protects them from loss or damage, and will become part of the permanent record file.

When collecting and securing samples, sampling personnel will follow procedure GT–3 (P), “Standard Practice for Chain-of Custody Control and Physical Security of Samples,” of the *Environmental Procedures Catalog* (STO 6). A copy of each Chain-of-Sample Custody form will be retained for traceability in case the sample is lost or destroyed. The copy received by the subcontracted laboratory will be included in the final analytical reports. All information/data

gathered during the course of the fieldwork will be maintained in the project record file as defined in the working file index. If an error is made when recording field data, the method of correction will be to draw a line through the error and enter the correct information. All corrections will be initialed and dated. The erroneous information will not be obliterated. When practical, any subsequently discovered error will be corrected by the person who made the entry. All corrections will be initialed and dated.

Analytical requirements for subcontracted laboratories will be established during the initial procurement of analytical services.

6.3 Sampler Calibration and Flow Checks

Qualified field personnel will check and calibrate the low-volume continuous air samplers in accordance with manufacturer specifications and procedures. For the purposes of this plan, "qualified" is defined as someone who is trained by the manufacturer and/or trained by a previously qualified field sampler. Training of qualified sampling personnel will be approved by the Environmental Procedures chairperson and documented in the project training records. The low-volume continuous air samplers will be calibrated prior to field deployment and at least quarterly thereafter. The calibration data will be recorded on the Quarterly Radioparticulate Sampler Calibration Log (Table A−2). More frequent calibration checks may be used if instrument drift exceeds 10 percent during quarterly calibration checks. If a sampler malfunctions and requires repair, the sampler will be recalibrated before being returned to service.

6.4 Analytical Laboratory QA/Quality Control

Laboratories used for the analysis of air monitoring filters and detectors will have a documented QA program and will follow all relevant laboratory procedures. QA program requirements and rights of access for verification of QA program implementation will be applied to subcontracted laboratories through the appropriate procurement documents. Analytical quality control will include, as appropriate, the analysis of blanks, duplicates, spikes, and surrogate samples as specified by the method.

7.0 Data Review and Reporting

Data collected during field sampling activities and reported by the laboratories will be entered into an Oracle database and managed by the Data Management organization. As required by DOE Order 231.1, *Environment, Safety, and Health Reporting*, data will be formally summarized and presented in the Annual Site Environmental Report. All monitoring data will be made available to and shared with other contractor organizations as needed (e.g., on-site gamma exposure data may be used by the Safety and Health organization for determining occupational exposures; project management will be notified immediately if monitoring data indicate any occurrences of noncompliance). If quarterly calibration requires greater than 10 percent flow adjustment and results are above background level, data will be flagged with a "J" qualifier as estimated values. After field and analytical data have been entered into the Oracle database, the database manager will produce a draft data report. The database manager will review the draft report to ensure that all data fields are within expected ranges. When all data are verified, the report will be finalized. The final report will undergo a comprehensive review by Compliance and Technical Support staff.

End of current text

8.0 Health and Safety

All fieldwork performed in association with this SAP must be conducted in a manner that protects workers and the public. Work will be conducted in accordance with health and safety regulations promulgated by DOE and the Occupational Safety and Health Administration. The *Moab Project Health and Safety Plan* (DOE 2005a) (1) describes required safety training for on-site personnel and visitors, (2) discusses personal protective equipment requirements, (3) describes the potential contaminants of concern at the Moab Site and their exposure limits, (4) outlines plans for emergency response and evacuation, and (5) provides guidance for spill cleanup and abatement.

End of current text

9.0 References

10 CFR 40.65. "Effluent Monitoring Reporting Requirements," *Code of Federal Regulations*.

10 CFR 830. "Nuclear Safety Management," *Code of Federal Regulations*.

40 CFR 50. "National Primary and Secondary Ambient Air Quality Standards," *Code of Federal Regulations*.

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

DOE (U.S. Department of Energy) Orders:
231.1, *Environment, Safety, and Health Reporting*.
5400.1, *General Environmental Protection Program*.
5400.5, R*adiation Protection of the Public and the Environment*.

DOE (U.S. Department of Energy), 1991. *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, DOE/EH–0173T, January.

DOE (U.S. Department of Energy), 2005a. *Moab Project Health and Safety Plan*, DOE-EM/GJ1038-2005, Rev. 6, prepared by S.M. Stoller Corporation for the U.S. Department of Energy, Grand Junction, Colorado, November.

DOE (U.S. Department of Energy), 2005b. *Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties, Utah, Final Environmental Impact Statement*, DOE/EIS-0355, July.

DOE (U.S. Department of Energy), 2006. *Quality Systems for Analytical Services*, Revision 2.2, maintained by the DOE Consolidated Audit Program Team, Unnumbered Document.

Environmental Laboratories Inc., Midwest Laboratory, 2001. *Preparation and Read-Out of Teledyne Isotopes TLD Card, TIML–TLD–01, Revision 7*, Northbrook, Illinois.

Landauer, 2002. *Quality Assurance Manual for Radon Monitoring Services, Revision Number 9*, Glenwood, Illinois.

STO 1. *Quality Assurance Manual*, continuously updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy, Grand Junction, Colorado.

STO 6. *Environmental Procedures Catalog*, continuously updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy, Grand Junction, Colorado.

EPA (U.S. Environmental Protection Agency), 1994. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III*: *Part I, Ambient Air Quality Monitoring Program Quality System Development*, EPA-454/R-98-004, August.

U.A.C. (*Utah Administrative Code*), *R307–205:* "Emission Standards: Fugitive Emissions and Fugitive Dust," Salt Lake City, Utah, July 2005.

U.A.C. (*Utah Administrative Code*), *R313–15–301:* "Standards for Protection Against Radiation, Dose Limits for Individual members of the Public," Salt Lake City, Utah, September 2001.

Appendix A

Procedure for Sampling Airborne Radioparticulates Using a Low-Volume Continuous Air Sampler

A1.0 Purpose

This procedure provides instructions for filter installation, removal, and calibration of a continuous low-volume air sampler. This procedure will follow quality assurance and quality control as established in Section 6.0 of this SAP.

A2.0 Application

This procedure applies to the use of a RADēCO Model AVS-28A low-volume, constant flow air sampler.

A3.0 Definitions

Low-Volume Continuous Air Sampler—An instrument for sampling total suspended particulates in the air for a specific time period at a specific flow rate. This instrument is used to determine compliance with ambient air quality standards and for occupational health monitoring purposes.

A4.0 Field Calibration

The samplers will be calibrated at least quarterly in accordance with manufacturer operation and maintenance manual and recorded on Table A−2. More frequent calibration checks may be used if instrument drift exceeds 10 percent during weekly field checks or quarterly calibration checks. The preset sample flow rate will be 60 LPM. Therefore, operational range (with 10 percent drift) will be 54 to 66 LPM. If flow rate is not within operational range, calibration will be performed as soon as possible and prior to quarterly calibration.

The AVS-28A may be recalibrated with any suitable flow system that is capable of measuring 14 LPM to 100 LPM with better than ±5% accuracy. A RADēCO portable calibrator, Model D-812 will be utilized for calibration. It is important that calibration points be picked that are within the range of the flow controller (ΔP paper > 1 inch of mercury). Check each index mark on the rotameter by varying the Flow Adjust until the rotameter ball aligns with the index.

If the index point in which the ball is located for a given flow rate does not correspond with the D-812 calibrator reading, an adjustment must be made. Proceed as follows:

- Check for loose fit and leaks in tygon tubing connections. Repair as required.
- Check rotameter for foreign matter within the flow tube. Also observe rotameter for cracks that may cause air leaks. Replace rotameter as required.
- Connect flow calibrator to inlet of pump or inlet of inline filter and cartridge holder with cartridge and/or filter paper used in actual sampling.
- Turn on air sampler and adjust flow to maximum and allow to run for two minutes.
- Adjust flow to the highest desired flow point. The standard range for the Model AVS-28A is 14 LPM to 100 LPM. Therefore, the calibrator should read 100 LPM.

- Locate a mark 1 inch below the top of the rotameter and adjust the needle valve until the red ball comes to rest centered with the 1 inch mark. Lock the needle valve in place making sure not to over tighten because this will cause the rotameter to crack.
- Upon verifying that the ball floats centered with the highest index mark as the calibrator reads exactly 100 LPM, decrease the flow by adjusting the knob located on the regulator valve and mark a dot at each desired flow point (calibrate from maximum flow to minimum flow).
- Turn the unit off and mark a line with permanent ink at each calibration point. Identify each line with transfer numbers.
- Spray the rotameter with spray enamel or apply transparent tape to protect the markings.

A5.0 Equipment and Materials

- RADēCO Instruments. Regulated low-volume, constant flow air sampler, Model AVS-28A (see attached product specification sheet).
- 47-millimeter (mm)-diameter glass fiber filters.
- 50-mm filter canister.
- Airborne radioparticulate sampling field log (Table A−1).
- RADēCO portable calibrator, Model D-812.

A6.0 Procedures

Filter Installation

- Ensure that the instrument is in good condition according to the manufacturer's requirements.
- Unscrew the combination filter holder at the O ring.
- Wipe away any dust with a disposable wipe inside and outside of the combination filter holder.
- Unscrew the front end of the combination filter holder and wipe away any dust around the front plate and on the plastic screen.
- Lay the plastic screen and holder on a clean, flat surface. Place one 47-mm filter on the screen and replace the front end of the combination filter.
- Replace the combination filter holder to the O ring end.
- Turn the air sampler on (switch on back of motor) and reset the timer, if necessary, by pushing the button on the timer gauge.

Filter Removal

- Turn off the sampler and unscrew the combination filter holder at the O ring.
- Lay the filter holder on a flat surface and remove the front end of the holder.
- Remove the filter and place in a 50-mm filter canister for storage during the sampling quarter. Weekly filters are securely stored in a canister at the sample location and the composite (all weekly filters) is submitted quarterly to the laboratory for analyses. No blanks will be used in the field because the laboratory QA is performed internally (Severn Trent).
- Record sample identification number, sample location number, and time period (date collected and date and period of sample) on the filter canister.
- Place filter canister in ziplock-type plastic bag for convenient storage prior to submittal to the laboratory.

A7.0 Radioparticulate Sampling Field Log

- Fill out the log for each sample collected (Table A−1).
- Complete the top of the log that identifies the month, year, and the name of the person who collected the sample.

For each sample location number:

- Record the calibration date for each sample location in the Sample Location Number block.
- Record the sampling date (i.e., mm/dd/yy).
- Record the sample flow rate in LPM.
- Check flow rate is within operational range, mark yes/no.
- If flow rate is not within operation range proceed to A4.0 for calibration.
- Record the current total hour reading.
- Calculate the total weekly volume in liters (L) (total weekly hours multiplied by flow rate).
- Mark “yes” if the sampler hour meter was reset.
- Calculate the monthly flow volume (L).
- Record comments about the air sampling pump or any unusual conditions.

End of current text

Table A−1. Radioparticulate Sampling Field Log

Month: _____ **Year:** _____ **Sampler:** _____

Sample Location Number	Date	Flow Rate (LPM)	Operational Range 54−66 LPM yes/no	Current Reading (hrs)	Calculated Weekly Volume (L)	Hour Meter Reset Yes	Monthly Volume (L)	Comments
MPS-0306-RP (Asay Crescent Junction) Calibration Date: _____								
MPS-0307-RP (Fordham Thompson) Calibration Date: _____								
MPS-0102-RP (On-site, east-side) Calibration Date: _____								
MPS-0105-RP (On-site Berm) Calibration Date: _____								
MPS-0117-RP (Bar M Chuckwagon – Background Site) Calibration Date: _____								
MPS-0118-RP (Arches National Park) Calibration Date: _____								

Table A−1 (continued). Radioparticulate Sampling Field Log

Month: _____ **Year:** _____ **Sampler:** _____

Sample Location Number	Date	Flow Rate (LPM)	Operational Range 54−66 LPM yes/no	Current Reading (hrs)	Calculated Weekly Volume (L)	Hour Meter Reset Yes	Monthly Volume (L)	Comments
MPS-119-RP (Matheson Wetlands) Calibration Date: _____								
MPS-0120-RP (Portal RV Park) Calibration Date: _____								
MPS-0121-RP (City Wastewater Treatment Plant) Calibration Date: _____								
MPS-0122-RP (County Solid Waste Recycle Center) Calibration Date: _____								
MPS-0123-RP (Kane Creek Road) Calibration Date: _____								

Table A−2. Quarterly Radioparticulate Sampler Calibration Log

Year: _____ **Calibration Unit Serial No: _____** **Unit Calibration Date: _____**

Sample Location Number	Date	As Found Rate (LPM)		New Flow Rate (LPM)	Calibrated By	Comments
		Rotameter	Calibration			
MPS-0306-RP (Asay Crescent Junction)						
MPS-0307-RP (Fordham Thompson)						
MPS-0102-RP (On-site, east-side)						
MPS-0105-RP (On-site Berm)						
MPS-0117-RP (Bar M Chuckwagon – Background Site)						
MPS-0118-RP (Arches National Park)						

Table A−2 (continued). Quarterly Radioparticulate Sampler Calibration Log

Year: _____ **Calibration Unit Serial No: _____** **Unit Calibration Date: _____**

Sample Location Number	Date	As Found Rate (LPM)		New Flow Rate (LPM)	Calibrated By	Comments
		Rotameter	Calibration			
MPS-119-RP (Matheson Wetlands)						
MPS-0120-RP (Portal RV Park)						
MPS-0121-RP (City Wastewater Treatment Plant)						
MPS-0122-RP (County Solid Waste Recycle Center)						
MPS-0123-RP (Kane Creek Road)						

Attachment A

Manufacturer’s Data Sheet for RADēCO

RADēCO
509 Norwich Avenue, Taftville, CT 06380
(860) 823-1220 FAX (860) 823-1521 www.radecoinc.com

PORTABLE CONSTANT FLOW AIR SAMPLER MODEL AVS-28A

- **CONSTANT AIRFLOW MAINTAINED WITH ΔP ACROSS THE FILTER OF UP TO 17" Hg (FLOW RATE DEPENDENT)**
- **BALANCED, EASY TO CARRY COMPACT SYSTEM**
- **FLOW RATE INDICATION ON ROTOMETER, CFM OR LPM**
- **RATED FOR CONTINUOUS DUTY**
- **LOW NOISE LEVEL**
- **MINIMUM MAINTENANCE**
- **OPTIONAL ELAPSED TIME INDICATOR**
- **ALL UNITS INDIVIDUALLY CALIBRATED AND TRACEABLE TO NIST**

Industry Workhorse Continues to Lead the Field

The Model AVS-28A Portable Constant Flow Air Sampler is a continuous duty, constant flow device. It can be used with filters and cartridges in the collection of airborne contaminates, or as a regulated, positive displacement vacuum supply for continuous air monitors and stack sampling systems.

The ability of the AVS-28A to maintain a preset sample flow rate is controlled by the unique side-mounted regulator valve. The RADēCO regulator valve is not a bypass design, and therefore the exhaust contains only sampled air. The AVS-28A has the superior ability to compensate for added ΔP across sampling media.

The sampling flow rate is read out on a side-mounted rotometer which measures the differential pressure across the in-line anodized aluminum venturi. All units are individually calibrated and traceable to NIST.

RADēCO

509 Norwich Avenue, Taftville, CT 06380
(860) 823-1220, FAX (860) 823-1521, www.radecoinc.com

PORTABLE CONSTANT FLOW AIR SAMPLER MODEL AVS-28A

Specifications

Air Flow Rate: Adjustable from 0.5 to 3.5 CFM (10 to 100 LPM).

Air Flow Regulation: ±5% of set air flow rate up to maximum capability of pump.

Dimensions/Weight: 12” Long x 14” Wide 9” High, (30.5 cm x 35.6 cm x 22.9 cm), 38 lbs (17.27 kg).

Power Requirement/Cable: 115V, 60Hz, 4.6 Amps; 230V, 50hz, 2.3 Amps. Three wire, (6) six feet (10) Ten Amp rating; British and European available.

Air Flow Indicator: Venturi mounted rotometer.

Air Mover/Motor: Self-adjusting carbon vane type. Pump is designed for continuous operation at 26” Hg vacuum. Rated at 1/4 horsepower with thermal overload protection.

Input Connection: 3/8” Female Quick Disconnect.

Re-settable Elapsed Time Meter: 99999 hours and 59 minutes, pushbutton re-

Sample Holders Available	
Model No.	**Description**
2500-04	2” diameter filter, open face
2500-42	47 mm diameter filter, open face
2500-21	2” diameter filter/RADēCO cartridge, open face
2500-46	47 mm diameter filter/RADēCO cartridge, open face
2500-45	2” diameter filter/RADēCO cartridge, in-line
2500-44	47 mm diameter filter/RADēCO cartridge, in-line
Other style holders available. Please call for selection information.