DOE–EM/GJRAC2040-D

Office of Environmental Management – Grand Junction

UMTRA Project

Moab UMTRA Project
Crescent Junction Disposal Cell
Interim Completion Report
Addendum D

Revision 0

December 2014

U.S. Department of Energy

Office of Environmental Management

Prepared by the Remedial Action Contractor Contractor under contract number DE-DT0002936
for the U.S. Department of Energy Office of Environmental Management, Grand Junction, Colorado.

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Revision 0

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Date

Revision History

Revision Number	Date	Reason for Revision
0	December 2014	Initial issue.

Contents

Figures

Tables

Appendices

Attachment

Acronyms and Abbreviations

ASTM	American Society for Testing and Materials International
CAES	Computer Aided Earthmoving System
CAT	Caterpillar
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOE O	DOE Order
ft	foot/feet
GPS	global positioning system
NQA	Nuclear Quality Assurance
NRC	U.S. Nuclear Regulatory Commission
pCi/g	picocuries per gram
$pCi/m^2/s$	picocuries per square meter per second
QA	quality assurance
QAP	Quality Assurance Plan
Ra-226	radium-226
RAC	Remedial Action Contract or Contractor
RAIP	Remedial Action Inspection Plan
RAP	Remedial Action Plan
RRM	residual radioactive material
TAC	Technical Assistance Contract or Contractor
UMTRA	Uranium Mill Tailings Remedial Action
yd^3	cubic yards

Executive Summary

This Interim Completion Report Addendum D documents the construction of a portion of the disposal cell near Crescent Junction, Utah. The disposal cell is being constructed under the U.S. Department of Energy (DOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) Project. The purpose of the disposal cell is to isolate and stabilize uranium mill tailings and other contaminated materials, known as residual radioactive material (RRM), removed from the former millsite in Moab, Utah. The disposal cell is designed to be effective for 1,000 years to the extent reasonably achievable, with a minimum performance period of 200 years.

The Crescent Junction disposal cell will require many years to construct. Multiple Interim Completion Reports will be prepared to compile and document data collected during the ongoing construction process. These Interim Completion Reports will be written in the format of sequential addenda that are referenced in a Final Completion Report that will be prepared to address the entire cell construction.

This Addendum D addresses activities performed by Portage, Inc., the DOE Remedial Action Contractor (RAC) for the Moab Project, from October 1, 2013, through September 30, 2014, and includes placement of 534,400 cubic yards (yd^3) of RRM and 117,054 yd^3 of final cover materials.

This Addendum D also demonstrates that the referenced portion of the disposal cell was constructed in accordance with the *Moab UMTRA Project Final Remedial Action Plan and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at the Crescent Junction, Utah, Disposal Site* (DOE-EM/GJ1547). The *Final Remedial Action Plan* (RAP) received conditional concurrence from the U.S. Nuclear Regulatory Commission (NRC). Included in this report are a critical review, design assessment, and remedial action assessment of activities performed during this reporting period. Also provided are associated data tables, photographs, laboratory results, and other supporting documentation.

The Moab Project follows the Nuclear Quality Assurance-1 (NQA-1) requirements for quality assurance, including conducting audits and surveillances during the design and construction of the cell.

1.0 Introduction

The scope of the Moab UMTRA Project is to relocate RRM from the former uranium ore-processing facility and from off-site properties known as vicinity properties in Moab, Utah, to an engineered disposal cell constructed near Crescent Junction, Utah. Most of the processing buildings at the Moab site were demolished and placed in the southeastern corner of the tailings pile. An interim cover was placed over the tailings pile as part of decommissioning activities between 1988 and 1995. The estimated volume of the tailings pile is 12 million yd^3 (16 million tons). The RRM is being transported to Crescent Junction primarily by rail.

The Moab site is located about 3 miles northwest of the city of Moab in Grand County. The Crescent Junction site is located northeast of the junction of Interstate 70 and U.S. Highway 191, approximately 30 miles north of the Moab site, also in Grand County (see Figure 1). The completed disposal cell will be generally rectangular and will encompass approximately 230 acres. Figure 2 shows general features of the Crescent Junction site.

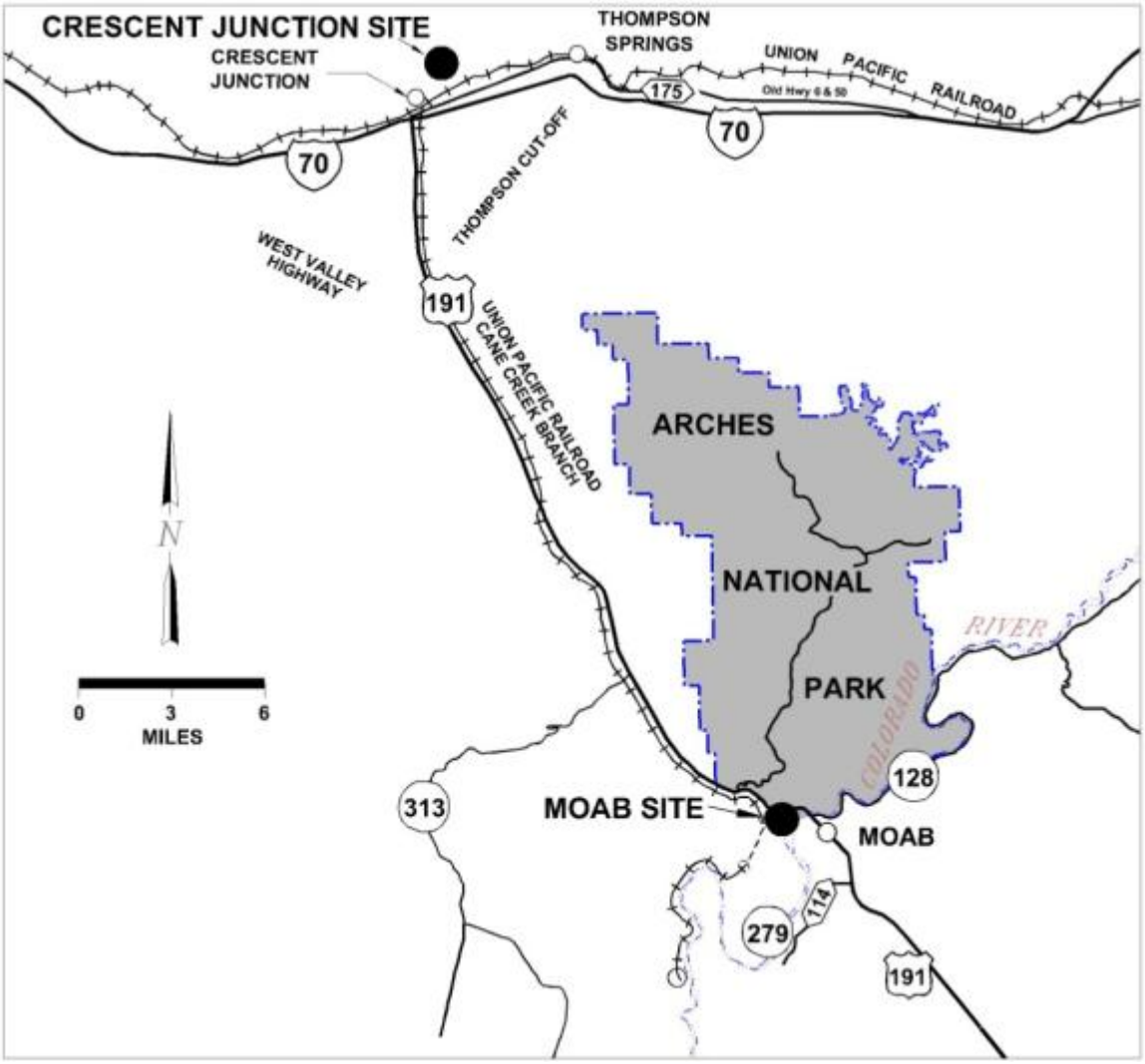

Figure 1. Location of Moab and Crescent Junction Sites

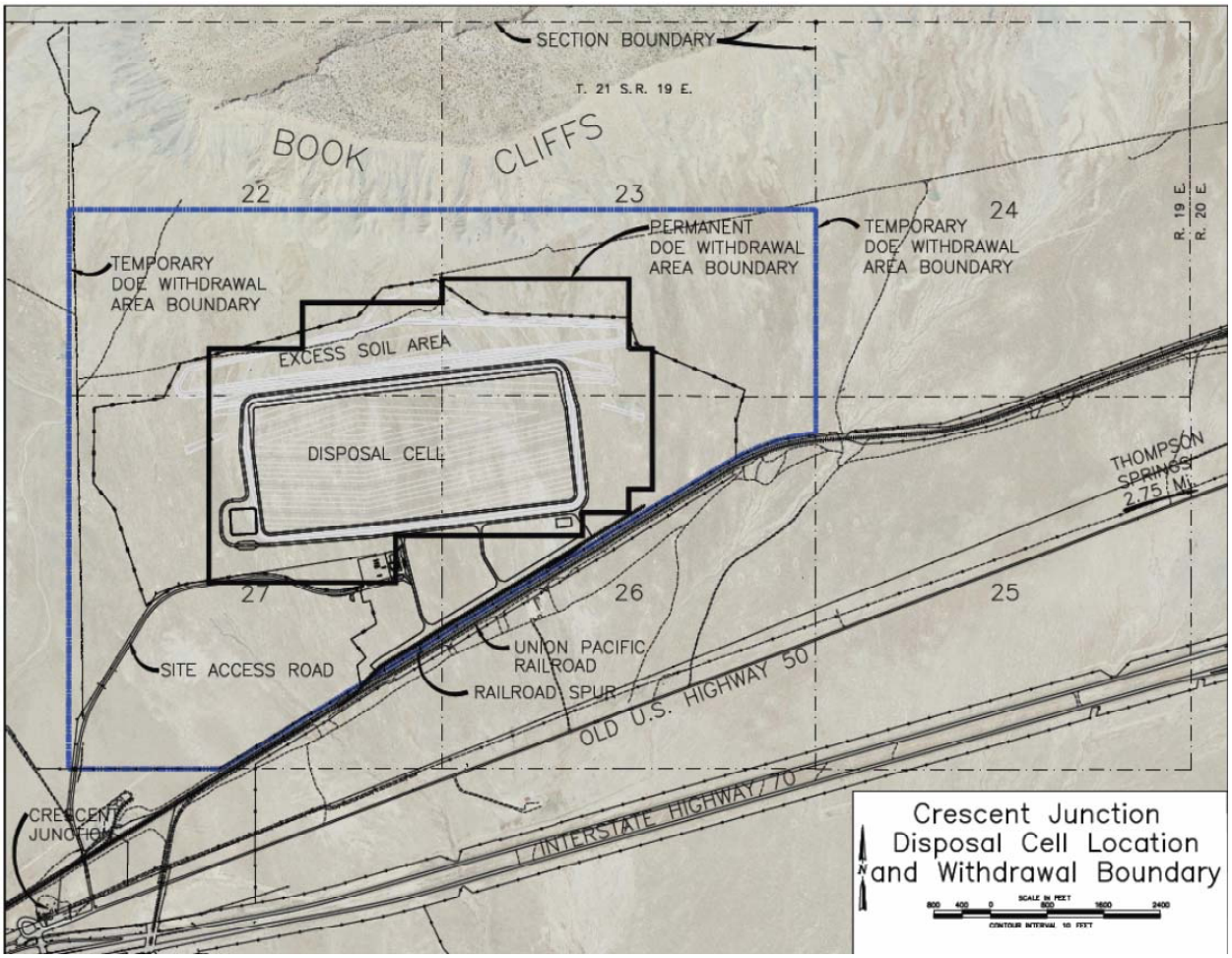

Figure 2. Crescent Junction Site Features

This Interim Completion Report Addendum D documents activities performed by the RAC for the Project from October 1, 2013, through September 30, 2014.

Addendum D sections are outlined below.

- Section 2.0 summarizes the results of critical aspects of the disposal cell construction and provides tables and figures summarizing data found in Appendix A.
- Section 3.0 describes any differences in the completed design to the design requirements in the RAP.
- Section 4.0 provides verification that placement of RRM and cell cover materials were conducted according to RAP requirements.
- Section 5.0 is a list of references for this document.
- Appendix A includes test results to demonstrate compliance with compaction requirements.
- Appendix B contains photographs of the various stages of cell construction.
- Attachment 1 contains revised procedures associated with constructing the cell.

2.0 Critical Review

The Critical Review provides key technical information about the disposal cell construction. This section contains tables summarizing inspections or tests for cell excavation, embankment construction, RRM placement, and cell cover material placement as appropriate for the report period. The tables reference the criteria and material testing procedures used to verify that the cell excavation and placement of each type of material was performed in accordance with design specifications or drawings and with Addendum E, "Remedial Action Inspection Plan" (RAIP), of the RAP. The distribution survey associated with each material type is also included in this section, as appropriate.

Information regarding total lifts of compacted material, tests performed, and geotechnical data is outlined in Table 1. Additional geotechnical data are located in Appendix A.

Table 1. Lifts/Testing Totals

Area/Material	Total Volume Placed (yd^3)	Total Number of Lifts Approved	Lifts Approved Using CAES	Lifts Approved Not Using CAES	Total Number of Standard Proctor Tests	Total Number of In-place Density/ Moisture Tests	Total Average for All In-place Density Tests Performed (%)	Total Average CAES Passes that Meet Compaction Criteria (%)	Total Number of Soil Classifications	Total Number of Durability Tests	Total Number of Gradation Tests
Cell Perimeter Embankment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RRM	534,400	487	487	0	42	2	91.5	98.6	NA	NA	NA
Interim Cover	17,261	6	NA	6	1	14	93.1	NA	NA	NA	NA
Radon Barrier	78,815	23	NA	23	9	48	99.8	NA	9	NA	NA
Infiltration and Biointrusion Barrier	6,589	1	NA	1	NA	NA	NA	NA	NA	2	2
Frost Protection Layer	14,389	4	NA	4	3	8	93.8	NA	NA	NA	NA
2-in. Cap Rock	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

CAES = Computer Aided Earthmoving System; in. = inch

2.1 Cell Excavation

Limited excavation of material east of the Phase 2 cell boundary was conducted to facilitate relocation of the existing ramp used for end dumping the containers. The excavated material was used as interim cover, radon barrier, and frost protection. Material excess to the needs of these layers was added to the spoils embankment. No inspection or testing of this excavation was needed because of the limited nature.

2.2 Perimeter Embankment

No activities associated the with perimeter embankment were conducted during this period.

2.3 RRM

2.3.1 Computer Aided Earthmoving System Performance Verification Testing

The Project utilized machines equipped with a Computer Aided Earthmoving System (CAES) to meet RRM compaction requirements as specified in Section 6.4.3 of the RAIP. Additional information about the CAES verification testing is provided in Section 4.3 of this Addendum. The RAIP also requires periodic verification of the CAES compaction by comparing the results to in-place, nuclear density gauge test results. Table 2 shows the results of the comparison tests performed during this report period.

Table 2. CAES Performance Verification Testing

Lift ID Number	Test Performance Date	In-place Density Compaction (%)	Lift Area Meeting CAES Compaction Criteria (%)
UW1E01131118-00	11/19/2013	92.6	98.4
UW1E01140506-00	05/07/2014	90.4	99.1

2.3.2 RRM Placement

RRM inspections and tests are shown in Table 3. The distribution of survey points is shown in Figure 3. The standard proctor test results summary, lift approval summaries, one lift approval package, and the top-of-waste buyoff survey for the RRM are provided in Appendix A2.

2.4 Interim Cover

The inspection and testing for the interim cover is shown in Table 4. The CAES was not used for compaction of interim cover lifts; therefore, inspections and associated criteria for the CAES are not included in the table. The distribution of survey points is shown in Figure 4. The standard proctor test results summary, lift approval summary, one lift approval package, and buyoff surveys for the interim cover are provided in Appendix A3.

Table 3. RRM Inspection and Testing

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
Visual Observation	At a minimum, scarify the top 1 in. of subsoil or preceding RRM lift, using a footed roller or a dozer, before placement of subsequent RRM layers. Fill material is placed in continuous and planar lifts. The method of dumping and spreading RRM shall result in loose lifts. Average thickness of fill area is not to exceed 12 in. Dozers shall have a minimum ground pressure of 1,650 lb/ft^2. Compaction equipment shall be footed rollers or dozers. Footed rollers shall have a minimum weight of 45,000 lb and at least one tamping foot provided for each 110 in^2 of drum surface. The length of each tamping foot from the outside surface of the drum shall be at least 6 in. After lift placement, moisture content shall be maintained until the next lift is placed. Erosion that occurs in the RRM layers shall be repaired and grades re-established. If freezing or desiccation occurs, the affected soil shall be reconditioned, as directed.	Specification 31-00-20 Sections 1.3.2, 3.2.1, and 3.2.4	6.4.2	Visually verified throughout material preparation, ground preparation, and RRM placement. Documented in lift approval packages.
Laboratory Compaction Characteristics	Assessment tests shall be performed on RRM to ensure compliance with specified requirements and to develop compaction requirements for placement. Perform tests (standard proctor) in accordance with the following standards, as applicable: *ASTM D698 and D2216.	Specification 31-00-20 Section 3.1.1	6.4.3	42 tests were performed to determine compaction characteristics.
Moisture Test	Fill material is properly moisture conditioned. Optimum moisture content is ±3%. Perform in accordance with the following standards, as applicable: *ASTM D4643, D4944, and D4959.	Specification 31-00-20 Section 3.4.2	6.4.3	Moisture tests performed daily and documented in lift approval packages.

Table 3. RRM Inspection and Testing (continued)

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
In-place Density/ Moisture Test	Must meet 90% of maximum dry density standard proctor. Optimum moisture content is ±3%. Perform in accordance with the following standards, as applicable: *ASTM D1556, D2216, D4643, and D6938.	Specification 31-00-20 Section 3.2.2	6.4.3	Two tests were performed with average in-place density of 91.5% of the laboratory-determined maximum dry density. Both moisture tests were within ±3% of optimum.
Compaction by CAES	QC shall monitor CAES compaction by visually inspecting the process and reviewing the computer records for each layer of soil placed.	Specification 31-00-20 Section 3.4.1	6.4.3	487 lifts were approved using CAES.
High Accuracy GPS	The top surface of the RRM shall be no greater than 2 in. above the lines and grades shown on the drawings and verified by survey or the use of the CAES. No minus tolerance is permitted.	Specification 31-00-20 Section 3.3	6.4.5	Completed using high accuracy GPS. See Appendix A2 for top-of-waste survey.

ASTM = ASTM International; ft^2 = square feet; GPS = global positioning system; in. = inches; in^2 = square inches; lb = pounds; lb/ft^2 = pounds per square foot; QC = quality control
*ASTM Standard titles are included in the References Section 5.0.

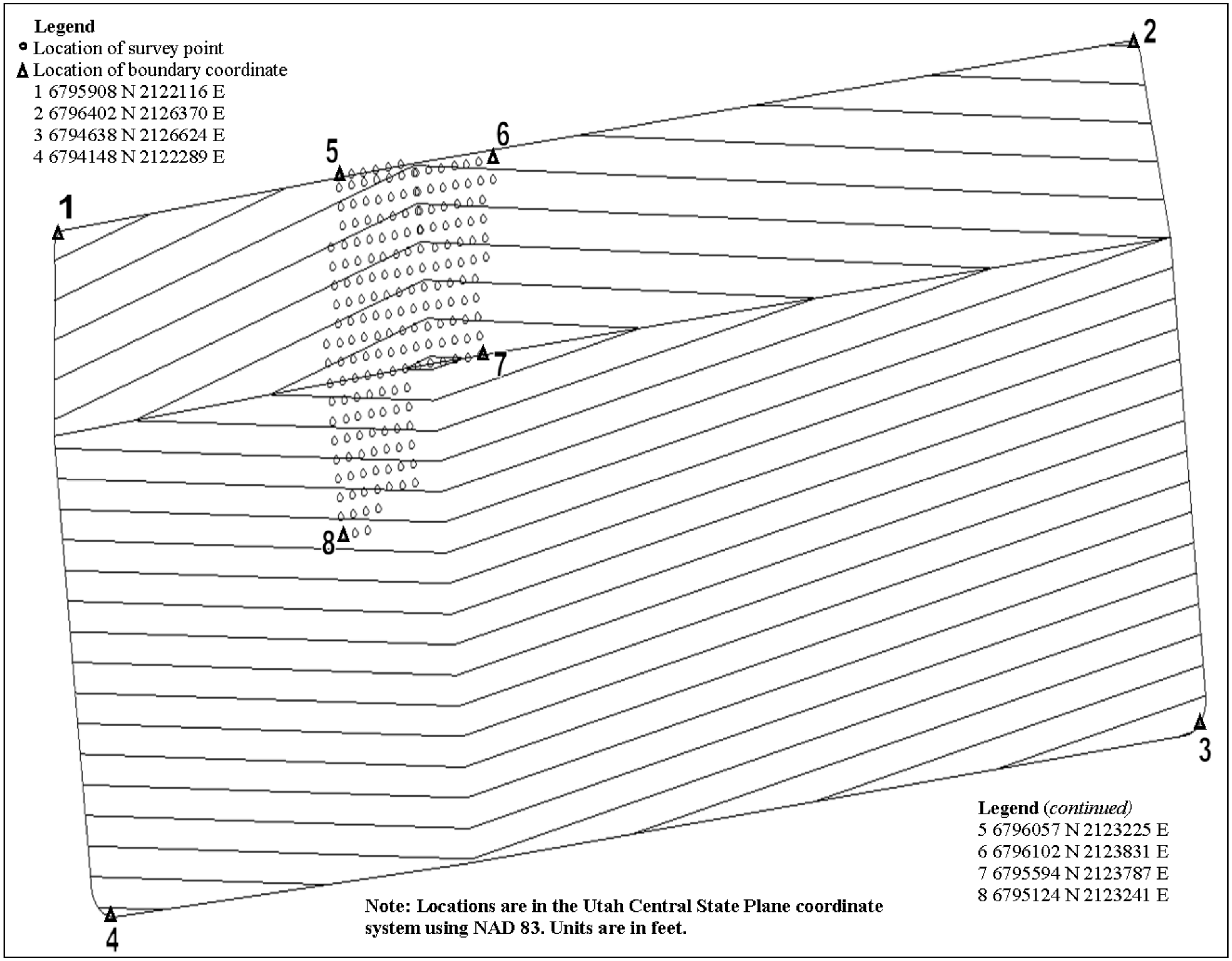

Figure 3. Distribution of Survey Points to Verify Compliance with RRM Placement Specifications

Table 4. Interim Cover Inspection and Testing

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
Visual Observation	Common fill (1 ft clean compacted): loose lifts with an average thickness not to exceed 12 in. Interim cover is placed in continuous and approximately horizontal lifts. Soil shall be free of roots, debris, and organic or frozen material. After lift placement, moisture content shall be maintained until the next lift is placed. Erosion that occurs in the RRM layers shall be repaired and grades re-established. Freezing and desiccation of the RRM shall be prevented. If freezing or desiccation occurs, the affected soil shall be reconditioned, as directed.	Specification 31-00-20 Section 3.2.1	6.5.4	Visually verified throughout material preparation, ground preparation, and interim cover placement. Documented in lift approval packages.
High Accuracy GPS Survey	The top surface of the interim cover shall be no greater than 2 in. above the lines and grades shown on the drawings. No minus tolerance is permitted.	Specification 31-00-20 Section 3.3	6.5.5	Completed using high accuracy GPS.
In-place Density/ Moisture Test	Common fill: 90% of maximum dry density standard proctor test. Optimum ±5%. Perform in accordance with the following standards, as applicable: *ASTM D1556, D2216, D4643, and D6938.	Specification 31-00-20 Section 3.4.1	6.5.4	The soils used were of the same character as materials previously tested; therefore, previous standard proctor test results were used. Six lifts were approved using in-place density/ moisture testing. Fourteen in-place tests were performed with an average density 93.1% of laboratory determined maximum dry density. All moisture tests were with ±5% of optimum.

Table 4. Interim Cover Inspection and Testing (continued)

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
Sand Cone and Moisture Correlation Test	Companion sand cone tests and moisture tests must be performed with nuclear tests until a sufficient number have been performed to demonstrate a clear correlation. Perform in accordance with the following standards, as applicable: *ASTM D1556, D2216, and D4643.	Specification 31-00-20 Section 3.4.1	6.5.4	One sand cone and moisture correlation test was performed and met requirements.
Visual Observation	A smooth, non-vibratory, steel-wheeled roller shall be used to produce a smooth, compacted surface on the top of the completed interim cover layer such that direct rainfall causes minimal erosion. Steel-wheeled rollers shall weigh a minimum of 20,000 lb. The final lift shall be rolled smooth with at least three passes of the steel-wheeled roller or proof rolled with rubber-tired construction equipment, such as a loaded dump truck or loaded scraper with a minimum weight of 45,000 lb.	Specification 31-00-20 Section 1.3.3 and 3.2.4	6.5.5	Visually observed compaction using rubber-tired construction equipment performed on the final lift.

ASTM = ASTM International; ft = foot; GPS = global positioning system; in. = inches; lb = pounds;
*ASTM Standard titles are included in the References Section 5.0.

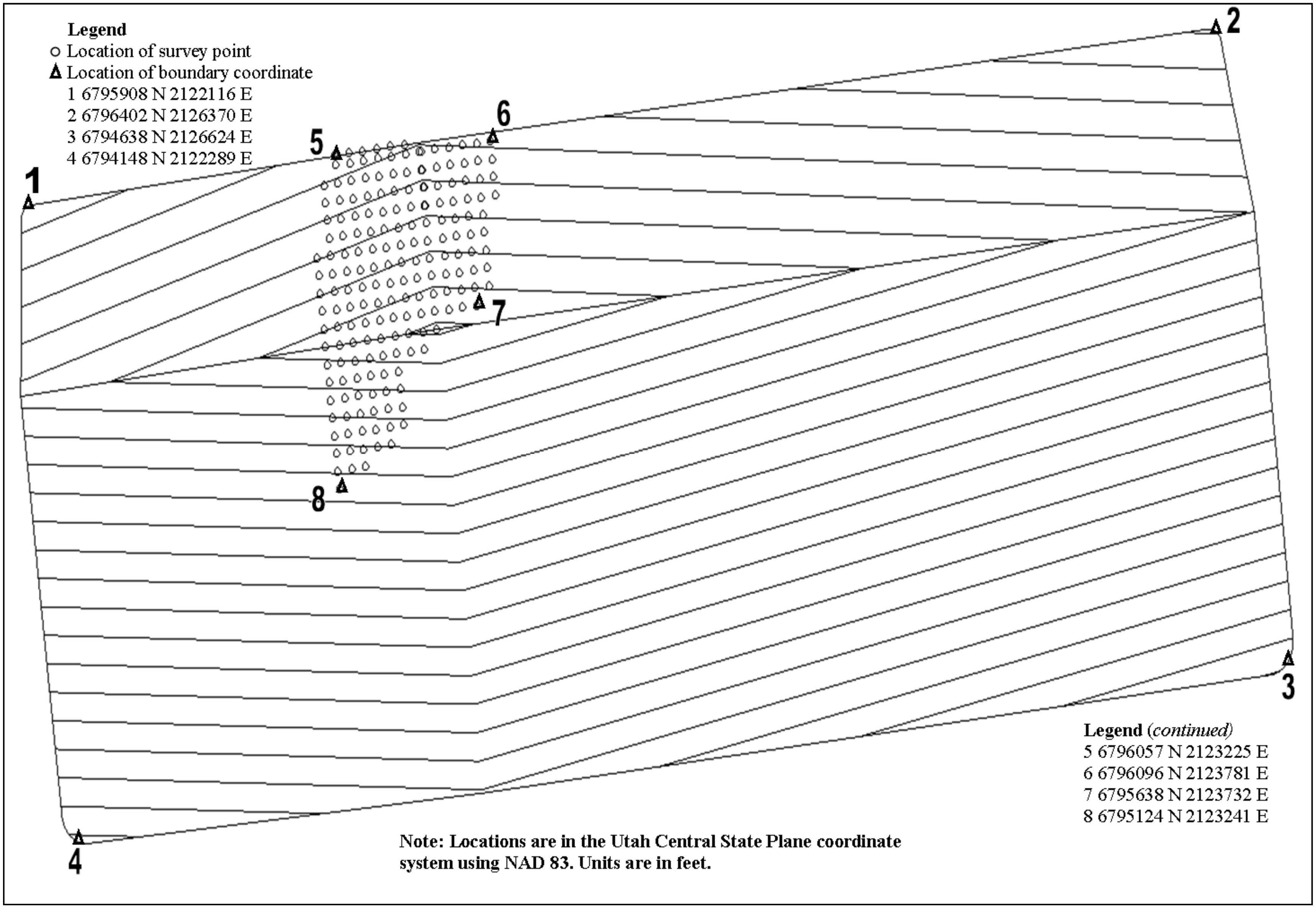

Figure 4. Distribution of Survey Points to Verify Compliance with Interim Cover Specifications

2.5 Radon Barrier

2.5.1 Radon Barrier Placement

The inspection and testing for the radon barrier can be found in Table 5. The CAES was not used for compaction of radon barrier lifts; therefore, inspections and associated criteria for the CAES are not included in the table. The distribution of survey points is shown in Figure 5. The standard proctor test results summary, lift approval summary, one lift approval package, and a buyoff survey for the radon barrier are provided in Appendix A4.

Table 5. Radon Barrier Inspection and Testing

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
Visual Observation	Processed Mancos Shale bedrock. Loose lifts not to exceed 12 in. Compacted with rubber-tired or footed roller compaction equipment. Maximum particle size in the fill material shall be 4 in. No locations where rock type particles accumulate in a concentrated location. Scarification shall be performed on all areas of the upper surface of each underlying soil layer, prior to placement of the next lift The final lift shall not be scarified. It shall be smooth rolled with a minimum of three passes of an approved steel smooth drum roller.	Specification 31-00-30 Sections 2.1, 3.2.2, and 3.2.4	6.7.4	Radon barrier processing, ground preparation, and placement were visually verified, surveyed, and documented on lift approval packages.
Laboratory Compaction Characteristics	Processed Mancos Shale. Perform in accordance with the following as applicable: ASTM D698 and D2216.	Specification 31-00-30 Section 3.2.1	6.7.4	Nine tests performed to determine compaction characteristics.
In-place Density/ Moisture Test	Processed Mancos Shale. Must meet 95% of maximum dry density standard proctor. Optimum moisture content is ±3%. Perform in accordance with the following as applicable: *ASTM D1556, D2216, D4643, and D6938.	Specification 31-00-30 Sections 3.2.1 and 3.2.3	6.7.4	48 in-place density/moisture tests performed with average density of 99.8% of the laboratory-determined maximum dry density. All moisture tests were within ±3% of optimum.
Soil Classification	Processed Mancos Shale. Perform in accordance with the following as applicable: *ASTM D422, D698, D1140, D2216, D4318, or D4643.	Specification 31-00-30 Section 3.2.1, Table 1	6.7.1	Nine soil classification tests were performed and met specifications.
Moisture Test	Processed Mancos Shale. Optimum ±3%. Perform in accordance with the following as applicable: *ASTM D4643 and D4944, or D4959.	Specification 31-00-30 Section 3.2.3	6.7.4	Tests performed to ensure moisture is within acceptable range.

Table 5. Radon Barrier Inspection and Testing (continued)

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
High Accuracy GPS Survey	Processed Mancos Shale. Confirm the total fill thickness of the radon barrier is in accordance with plans and specifications.	Specification 31-00-30 Section 3.5.2	6.7.5	Completed using high accuracy GPS.
Sand Cone and Moisture Correlation Test	Processed Mancos Shale. With nuclear tests. Perform in accordance with the following as applicable: *ASTM D1556, D2216, and D4643.	Specification 31-00-30 Section 3.6.1	6.7.4	Three sand cone and moisture correlation tests performed and met requirements.

ASTM = ASTM International; GPS = global positioning system; in. = inches
*ASTM Standard titles are included in the References Section 5.0.

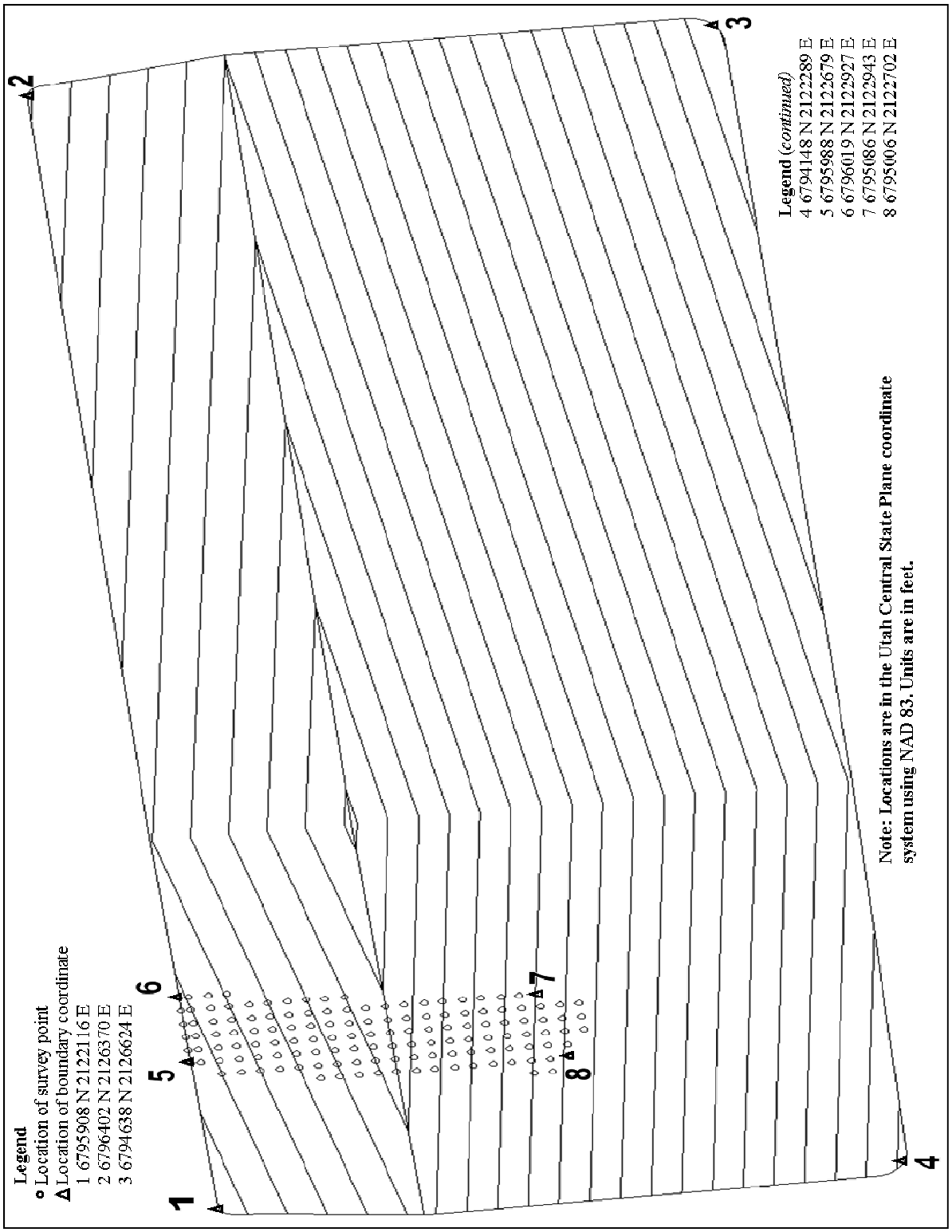

Figure 5. Distribution of Survey Points to Verify Compliance with Radon Barrier Specifications

2.5.2 Verification Measurements for Radon Flux

Table 6 shows how the radon flux measurements met the performance criteria. The grid locations referenced in the table are shown in Figure 6, which contains all radon flux grid locations for the entire disposal cell. Further data can be found in Section 4.6 of this Addendum. Lifts were placed and approved during September. Several radon flux tests were completed in early October and are included for completeness.

Table 6. Radon Flux Measurements

Grid Location	Location	Date Counted	Flux* ($pCi/m^2/s$)
15	N6795750 E2122750	09/12/14	0.1297
16	N6795500 E2122750	09/12/14	0.2263
17	N6795250 E2122750	09/12/14	0.1872
18	N6795000 E2122750	09/12/14	0.1807
22	N6796000 E2123000	10/03/14	0.1749
23	N6795750 E2123000	10/03/14	0.2189
24	N6795500 E2123000	10/03/14	0.2322
25	N6795250 E2123000	10/03/14	0.1698
26	N6795000 E2123000	10/03/14	0.1611

E = Easting; N = Northing; $pCi/m^2/s$ = picocuries per square meter per second
*Average activity measurement is 0.1868 $pCi/m^2/s$.

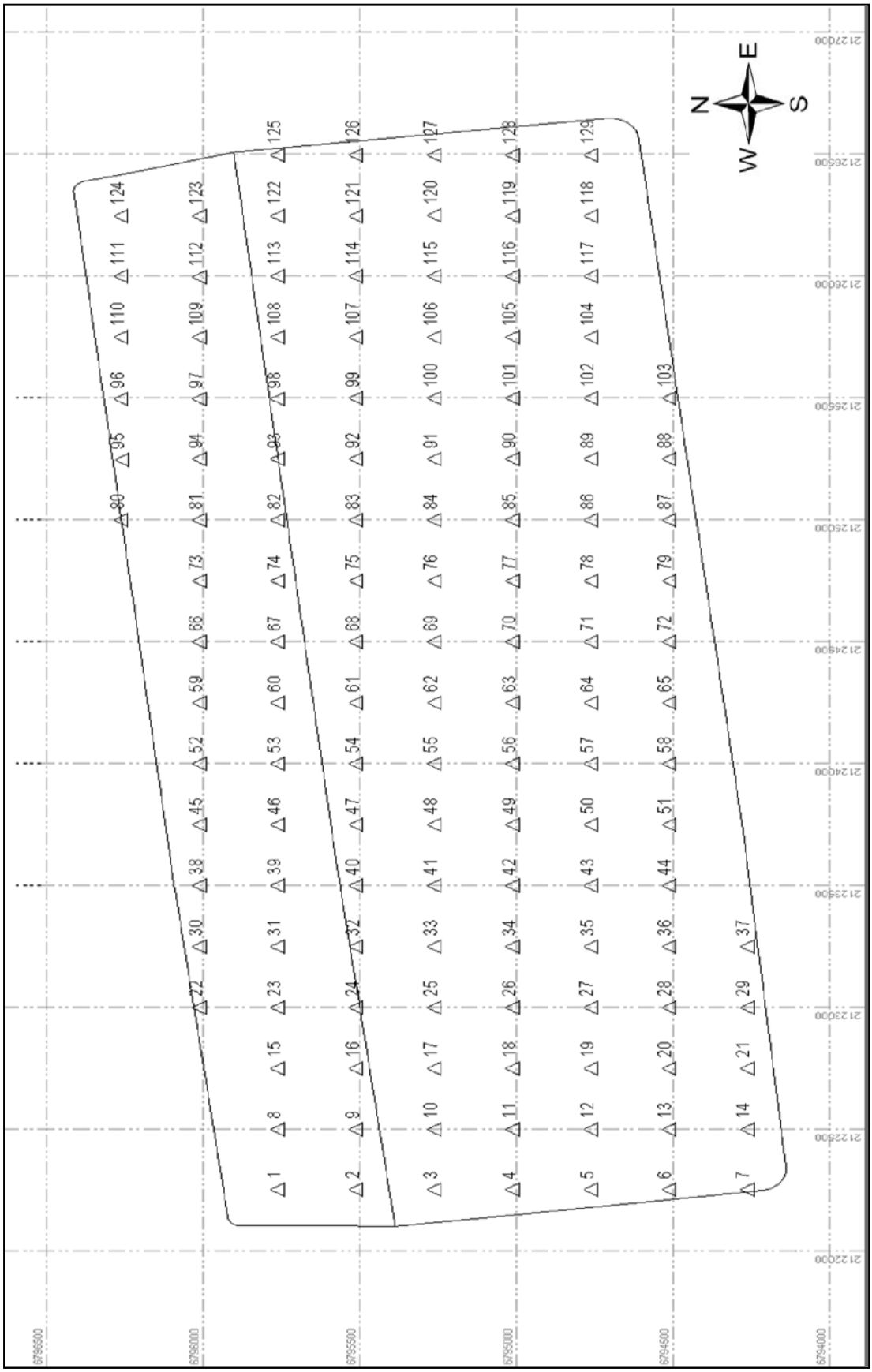

Figure 6. Radon Flux Measurement Grid Numbers and Locations

2.6 Infiltration and Biointrusion Barrier

The inspection and testing for the infiltration and biointrusion barrier can be found in Table 7. The distribution of survey points is shown in Figure 7. The lift approval summary, one lift approval package, a buyoff survey, and durability and gradation test results for the infiltration and biointrusion barrier are provided in Appendix A5.

Table 7. Infiltration and Biointrusion Barrier Inspection and Testing

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
Visual Observation	Gravel material is placed and compacted to produce a continuous, uniform thickness of at least 6 in. Compaction is performed by a vibratory steel-drum roller, and the roller makes a minimum of two passes over the placed gravel fill.	Specification 31-00-30 Section 3.4.1	6.8.2	Material placement was visually observed and surveyed throughout placement and documented in lift approval packages. Compaction was performed by a vibratory steel-drum roller, and the roller made a minimum of two passes over the placed gravel fill.
Durability	Perform in accordance with the following as applicable: *ASTM C88, C127, and C131; Schmidt rebound hardness ISRM Method and Splitting Tensile Strength ISRM Method.	Specification 32-11-23 Table 2	6.8.1	Two durability tests performed.
Gradation	Perform in accordance with the following as applicable: *ASTM C117 and C136.	Specification 32-11-23 Table 3	6.8.2	Two gradation tests performed.

ASTM = ASTM International; in. = inches; ISRM = International Society for Rock Mechanics
*ASTM Standard titles are included in the References Section 5.0.

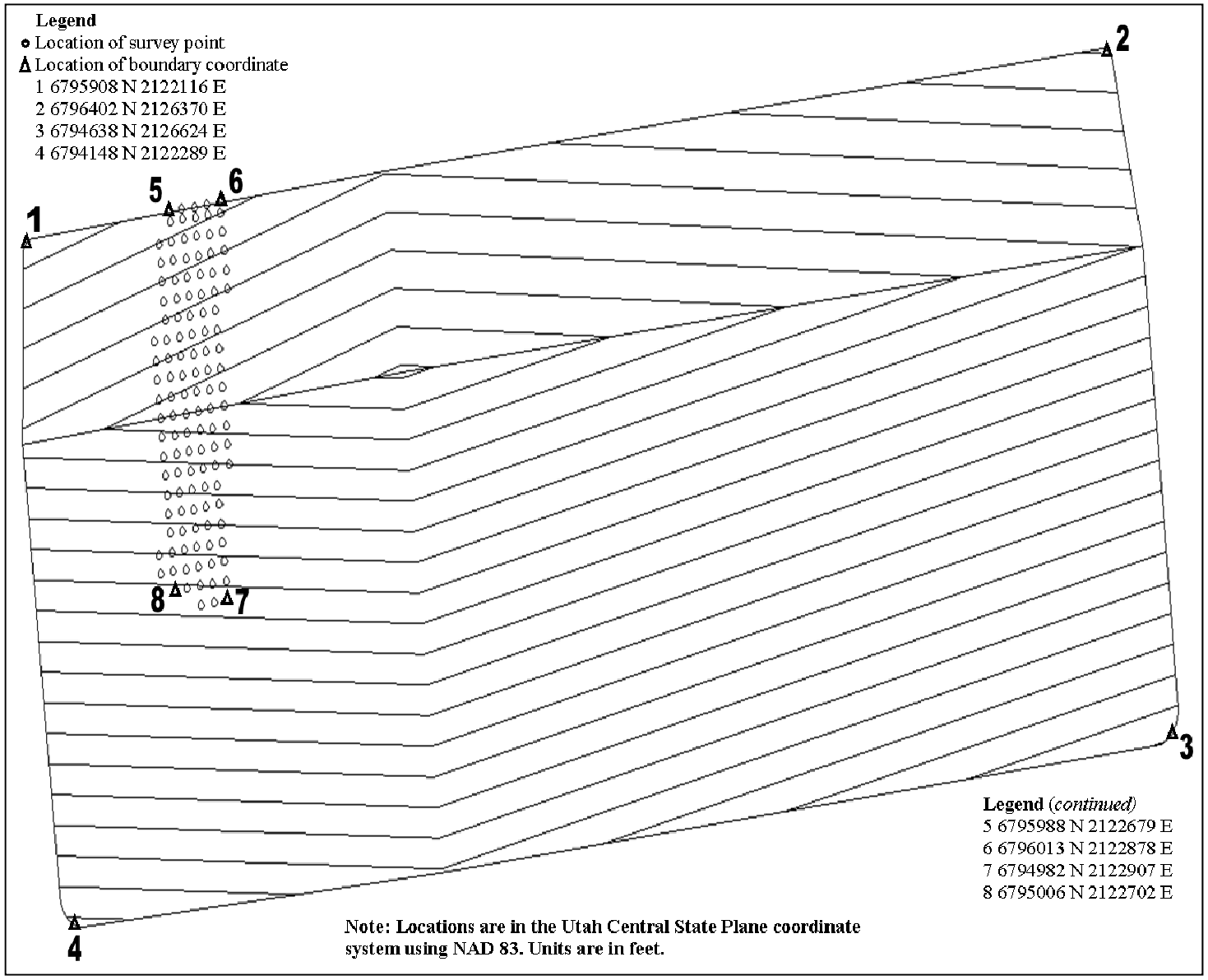

Figure 7. Distribution of Survey Points to Verify Compliance with Infiltration and Biointrusion Barrier Specifications

2.7 Frost Protection Layer

The inspection and testing for the frost protection layer can be found in Table 8. The CAES was not used for compaction of frost protection lifts; therefore, inspections and associated criteria for the CAES are not included in the table. The standard proctor test results summary, lift approval summary, and one lift approval package for the frost protection layer are provided in Appendix A6.

Table 8. Frost Protection Layer Inspection and Testing

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
Visual Observation	Common fill: 3 ft of clean, compacted soil. Loose lifts average thickness not to exceed 12 in. compacted with rubber-tired or -footed roller compaction equipment. Scarification of the upper surface of each underlying soil layer before placement of the next lift. Final lift of soil shall not be scarified. Final lift shall be smooth rolled with at least three passes of the approved, smooth steel-wheeled roller weighing a minimum of 20,000 lb.	Specification 31-00-30 Sections 3.3.2 and 3.3.4	6.9.3	Material preparation, ground preparation, and fill placement operations were visually verified throughout placement. Smooth drum rolling was also observed on final grade of frost protection. Documentation is provided in lift approval packages.
High Accuracy GPS Survey	Document the pre-cap geometry of the site.	Specification 31-00-30 Section 3.3.2	6.9.5	Pre-installation survey performed using high accuracy GPS.
High Accuracy GPS Survey	Confirm that the total fill thickness is in accordance with plans and specifications.	Specification 31-00-30 Section 3.2.2	6.9.5	Completed using high accuracy GPS.
In-place Density/ Moisture Test	Common fill: 90% standard proctor. Optimum ±5%. Perform in accordance with the following as applicable: *ASTM D1556, D2216, D4643, and D6938.	Specification 31-00-30 Section 3.3.3	6.9.4	Four lifts approved; eight in-place density/moisture tests performed with an average density of 93.8% of the laboratory-determined maximum dry density. All moisture tests were within ±5% of optimum.
Laboratory Compaction Characteristics	Tests have been performed on the common fill to determine its maximum dry density and optimum moisture content per *ASTM D 698. Perform in accordance with the following as applicable: *ASTM D698 and D2216.	Specification 31-00-30 Section 3.3.5	6.9.4	Three tests performed to determine compaction characteristics.

ASTM = ASTM International; ft = feet; GPS = global positioning system; in. = inches; lb = pounds
*ASTM Standard titles are included in the References Section 5.0.

2.8 Cap Rock and Armoring

No activities associated with cap rock and armoring were conducted during this period.

3.0 Design Assessment

The disposal cell design incorporates established design criteria, drawings and specifications, and calculations, all of which are included in the RAP. This section discusses design criteria changes, changes to the design of the disposal cell and associated erosion control features, fulfillment of quality assurance (QA) requirements, and compliance with permit requirements.

3.1 Design Criteria Changes

No changes to the design criteria were made during the period.

3.2 Design Changes

No changes to the design were made during the period.

3.3 QA Requirements

There were no QA requirements for design changes during this period.

QA activities were conducted in accordance with the *Moab UMTRA Project Quality Assurance Plan for the Remedial Action Contractor* (DOE-EM/GJRAC1766) (QAP), which complies with:

- American Society of Mechanical Engineers NQA-1 2004 and addenda through 2007 consensus standard, "Quality Assurance Requirements for Nuclear Facility Applications."
- DOE Order (O) 226.1B, "Implementation of Department of Energy Oversight Policy."
- Title 10 Code of Federal Regulations Part 830 Subpart A (10 CFR 830A), "Nuclear Safety Management, Quality Assurance Requirements."
- DOE Office of Environmental Management EM-QA-001, "EM Quality Assurance Program."
- DOE O 414.1D, Admin Chg 1, "Quality Assurance."

3.4 Permits and Agreements

The Project is in compliance with permits and agreements applicable to the Crescent Junction site. These are summarized in Table 9.

Table 9. Crescent Junction Site Permits and Agreements

Agreement Number	Document Name or Description	Issuing Agency	Purpose
Resolution 2006-2741	Grand County Council Resolution	Grand County	Approves conditional use permit for the Project.
DE-RO01-05GJ68003	Access Agreement	DOE EMCBC	For installation and maintenance of air monitoring equipment and collection of air quality data for monitoring station MPS-0306.
DE-RO01-05GJ68004	Access Agreement	DOE EMCBC	For installation and maintenance of air monitoring equipment and collection of air quality data for monitoring station MPS-0307.
Public Land Order 7697	Permanent Land Transfer	BLM	Order permanently transferred 500 acres of BLM public domain land to DOE for disposal cell.
Public Land Order 7734	Public Land Withdrawal	BLM	Order withdrew 936 acres of public land for activities to support disposal of mill tailings at the Crescent Junction disposal site. The withdrawal is for 20 years to support Public Land Order 7697.
Not assigned	Water Use Agreement	Thompson Special Service District	Water use agreement among Thompson Special Service District in Grand County, Crescent Junction Properties, Inc., and DOE to install potable waterline from Thompson Springs, Utah, to the disposal site.
UTU-83353	ROW	BLM, Moab Field Office	ROW for 3-in. service culinary waterline and a 2-in. delivery culinary waterline to the disposal site.
UTU-83450	ROW	BLM, Moab Field Office	ROW for power line to the disposal site.
Case No. 11-0028	Memorandum of Agreement	BLM, Utah State Preservation Office	Among DOE, BLM, and Utah State Historic Preservation Office regarding cultural resource issues related to development of disposal site.
Not assigned	Memorandum of Agreement	BLM, Moab Field Office	Between DOE and BLM for management of existing uses on lands withdrawn in conjunction with the Project.
UTR359187	Storm Water Permit	Utah Division of Water Quality	For the disposal site.
UTU-83396	ROW	BLM, Moab Field Office	For buried telephone line at the disposal site.
Folder No. 02399-44	Pipeline Crossing Agreement	Union Pacific Railroad	Agreement grants right to construct, maintain, and operate one underground waterline and access for phone line and 1.25-in. conduit at mile post 0.25, Cane Creek Subdivision, Thompson Springs, for the disposal site.
Folder No. 02392-96	Pipeline Crossing Agreement	Union Pacific Railroad	Agreement grants right to construct, maintain, and operate one underground waterline and access for phone line and 1.5-in. conduit across Union Pacific Railroad's property at mile post 533.2, Green River Subdivision.
U.S. DOT-SP 14283	Special Permit Authorization	U.S. DOT	Permit to transport mill tailings from Moab site to the disposal site.

Table 9. Crescent Junction Site Permits and Agreements (continued)

Agreement Number	Document Name or Description	Issuing Agency	Purpose
U.S. DOT No. 041012550006TV	U.S. DOT Hazardous Materials Certificate of Registration	U.S. DOT	For shippers of hazardous materials through 6/2017.
UTU-83354	Waterline ROW	BLM, Moab Field Office	For construction of 14.5 miles of waterline on BLM land from Green River to disposal site.
REECBCDOE-6-08-0302	Waterline Easement	Grand County	Easement within CR-175 or old Highway 6&50 and Hastings Lane ROWs to construct waterline within 60-ft ROW and operate within 20-ft ROW.
REECBCDOE-6-08-0304	Waterline Easement	Private Owner	Easement across private land near the Green River to construct waterline within 60-ft ROW and operate within 20-ft ROW and pump station.
REECBCDOE-6-08-0301-1	Waterline Easement	Private Owner	Permanent easement across private land near Crescent Junction to construct waterline within 60-ft ROW and operate within 20-ft ROW.
REECBCDOE-6-08-0309	Waterline Easement	City of Green River	Easement to construct waterline within 60 ft of CR-175 or old Highway 6&50 ROWs within Green River city limits and operate within 20-ft ROWs.
REECBCDOE-6-08-0308, SITLA No. 1345	Waterline Easement	SITLA	Easement to construct waterline within 60-ft ROW and operate within 20-ft ROW on three parcels of SITLA land near Green River and Crescent Junction.
ESMT 463	Waterline Easement	SITLA	Easement across state land for potable waterline.
400 00177	Waterline Easement	Utah Division of Forestry, Fire, and State Lands	ROW easement to construct and operate waterline in the Green River.
Statewide Utility License Agreement No. 8439	UDOT Utility License	Permits Officer	License with state of Utah to construct waterline across UDOT property.
Property No. 70-4;189A: AEQ	UDOT Easement	Permits Officer	Easement for waterline across UDOT property near Floy Wash that allows 60-ft construction ROW and 20-ft permanent ROW.
4P-082341-1	UDOT Encroachment Permit	UDOT	To construct waterline within UDOT 60-ft ROW and operate within 20-ft ROW near Floy Wash.
4P-082364-0	UDOT Encroachment Permit	UDOT	To construct waterline within UDOT 60-ft ROW and operate within 20-ft ROW for State Route 19 near City of Green River.
SPK-2007-632	U.S. Army Corps of Engineers 404 Permit	U.S. Army Corps of Engineers	To construct pump station on the Green River.
08-92-01SA	Stream Channel Alteration Permit	Utah Division of Water Rights	To construct pump station on the Green River.
Folder No. 2537-02	Industrial Track Contract	Union Pacific Railroad	Covers construction, maintenance, and operation of 5,209-ft Track A, 3,524-ft Track B, and 617-ft Track C at mile post 533.21, Green River Subdivision line.
DE-RO01-06GJ68009	Access Roadway Contract and Grant of Easement	Private Owner	Perpetual easement and ROW for construction of an access roadway and related utilities at the disposal site.

Table 9. Crescent Junction Site Permits and Agreements (continued)

Agreement Number	Document Name or Description	Issuing Agency	Purpose
DAQC-1110-2006	Fugitive Dust Control Plan (08/07/06) UAC R307-309-6, "Fugitive Dust Control Plan"	Utah Division of Air Quality	Approval letter from the state of Utah for the Fugitive Dust Control Plan for the Crescent Junction disposal cell.

BLM = Bureau of Land Management; CR = County Road; EMCBC = Office of Environmental Management Consolidated Business Center; ft = feet; in. = inches; ROW = right-of-way; SITLA = School and Institutional Trust Lands Administration; UAC = Utah Administrative Code; UDOT = Utah Department of Transportation; U.S. DOT = U.S. Department of Transportation

4.0 Remedial Action Assessment

A description of the pre-excavation site conditions, construction activities, and verification performed at the Crescent Junction disposal site is provided in this section.

4.1 Pre-excavation Site Conditions

Pre-excavation site conditions were discussed in the *Moab UMTRA Project Crescent Junction Disposal Cell Interim Completion Report Addendum A* (DOE-EM/GJRAC2040-A).

4.2 Cell Construction

Cell construction during this period included four major activities:

- Excavation of soils within the cell design boundary to facilitate construction of a new tailings dump ramp
- Placement of RRM to the design thickness, and ensuring the radium-226 (Ra-226) activity in the upper 7 feet (ft) of placed material does not exceed design criteria
- Placement of cover materials
- Construction of the spoils embankment

The *Moab UMTRA Project Lift Approval Procedure* (DOE-EM/GJRAC1803) was used to ensure the material placed met the compaction criteria. Descriptions of compaction equipment used during the above cell construction activities are provided in Table 10.

Each activity performed as part of this Addendum is further described in the following subsections. Photographs representative of the cell construction activities are included in Appendix B.

Table 10. Descriptions of Compaction Equipment Used during Cell Construction

Compaction Equipment	Machine Weight (lb)	Equipped with CAES	Material Layer Equipment Used On					
			RRM	Interim Cover	Radon Barrier	Infiltration and Biointrusion Barrier	Frost Protection	Spoils Embankment
CAT 825H Soils Compactor	69,000	X	X	X	X		X	X
CAT D8 Bulldozer	84,850	X	X					
Komatsu 275X Bulldozer	112,466	X	X					
CAT 637G Scraper	118,084			X	X		X	X
CAT CS563 Vibratory Roller	24,537				X	X	X	

CAT = Caterpillar, Inc., lb = pounds

4.2.1 Excavation

Limited excavation of material east of the Phase 2 cell boundary was conducted to begin construction of a new platform to facilitate emptying and decontaminating RRM containers. The excavation of Phase 3 of the cell to the design depth is not planned to begin until fiscal year 2017.

4.2.2 Perimeter Embankment Construction

There were no perimeter embankment construction activities during this period.

4.2.3 RRM Placement

Placement of RRM in the disposal cell continued east from where it ended, as shown in *Moab UMTRA Project Crescent Junction Disposal Cell Interim Completion Report Addendum C* (DOE-EM/GJ2040-C). The RRM was loaded into dump trucks and driven to the disposal area, where it was spread for compaction using a bulldozer. A Caterpillar (CAT) 825H Soils Compactor, CAT D8 Bulldozer, and Komatsu 275X Bulldozer were used to compact the RRM in place.

4.2.4 Cover and Rock Armoring Placement

The cover on the disposal cell consists of multiple layers of soil and rock as illustrated in Figure 5-1 of the Remedial Action Selection Report of the RAP. Once the RRM placed in the cell has reached the design thickness, a minimum of 1 ft of interim cover is placed over the RRM. The interim cover material comes from soils excavated on site (processed Mancos Shale bedrock). Three additional cover layers are placed over the interim cover. Material for the radon barrier and frost protection layers also come from materials excavated on site. Rock for the infiltration and biointrusion barrier and the uppermost cover layer is transported from a quarry at Fremont Junction, Utah, and stockpiled at the Crescent Junction site. During this Addendum reporting period, there were 117,054 yd^3 of final cover placed.

4.2.5 Spoils Embankment Construction

Material excavated on site was used to create a spoils embankment, or wedge, between the northern side of the cell and the Book Cliffs mountain range. The spoils embankment helps control drainage of storm water around the cell perimeter. The inspection and testing for the spoils embankment can be found in Table 11. The standard proctor test results summary, lift approval summary, and one lift approval package for the spoils embankment are provided in Appendix A8.

Table 11. Spoils Embankment Inspection and Testing

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
Visual Observation	Common fill: fill material is placed in continuous and approximately horizontal lifts. The method of dumping and spreading material shall result in loose lifts of nearly uniform thickness, not to exceed 12 in. Compaction: embankment fill shall be compacted with rollers, equipment tracks, or successive passes of scrapers with a minimum 45,000-lb static weight. Fill material shall be properly moisture conditioned near optimum moisture content levels.	Specification 31-00-00 Section 3.11.1.3	6.3.5	Visual inspection performed throughout placement to verify compaction and lift thickness. Compaction performed using CAT 825H compactor and CAT 637G Scraper. Thickness was visually verified. Each lift is documented.
Hig Accuracy GPS Survey	Exterior slopes are 3:1.	Drawing C-02-C-501	6.3.5	Survey performed. See drawings C-02-C-102 and C-02-C-501.
Laboratory Compaction Characteristics	Common fill: spoil material shall be tested to determine maximum dry density and the moisture content shall be modified to bring fill to near optimum for compaction. Perform in accordance with the following as applicable: *ASTM D698.	Specification 31-00-00 Section 3.11.1.3	6.3.5	One test performed to determine compaction characteristics.
In-place Density/ Moisture Test	One test per 100,000 ft^2 or 3,700 yd^3 of material placed for material compacted by other than hand-operated machines. One test per 500 ft^2, or fraction thereof, of each lift of fill or backfill areas for material compacted by hand-operated machines.Common fill: 90% of a standard proctor optimum ± 5%. Perform in accordance with the following as applicable: *ASTM D1556, D2216, D4643, and D6938	Specification 31-00-00 Section 3.14.1.2	6.3.5	Five in-place density/moisture tests performed with an average density of >90% of the laboratory-determined maximum dry density. All moisture tests were within ± 5% of optimum.

Table 11. Spoils Embankment Inspection and Testing (continued)

Inspection or Test Type	Criteria and Method Number	RAP Specification Section or Drawing Number	RAIP Section Number	Verification Results
Sand Cone Correlation	One check test for every 20 tests per *ASTM D6938, of fill or backfill compacted by other than hand-operated machines. One check test for every 20 tests per ASTM D6938, of fill or backfill compacted by hand-operated machines. Perform in accordance with the following as applicable: *ASTM D1556.	Specification 31-00-00 Section 3.14.2	6.3.5	One sand cone correlation performed, meeting requirements.
Moisture Correlation Test	One correlation test for moistures every 10 tests per ASTM D6938 will be performed in accordance to *ASTM D4643 or D2216.	Specification 31-00-00 Section 3.14.2	6.3.5	One moisture correlation test performed, meeting requirements.
Laboratory Compaction Characteristics	Perform laboratory density and moisture content tests for each type of fill material to determine the optimum moisture (optimum moisture content ±5%) and laboratory maximum density values. One representative density test per material type and every 20,000 yd^3, thereafter, or when any change in material occurs, which may affect the optimum moisture content or laboratory maximum dry density. Perform in accordance with the following as applicable: *ASTM D698 and D2216.	Specification 31-00-00 Section 3.14.3	6.3.5	One test performed to determine compaction characteristics.

ASTM = ASTM International; ft^2 = square feet, GPS = global positioning system; in. = inches; lb = pounds

4.3 Soil Compaction and Testing

Initial CAES compaction setup and verification is documented in *Interim Completion Report Addendum A*. The CAES compaction is periodically verified by performing in-place tests using a nuclear density gauge manufactured by Troxler Electronic Laboratories, Inc., following ASTM International (ASTM) methods and in compliance with the RAIP. The individual nuclear density tests verify that the compaction achieved with the CAES is greater than the required 90 percent. The CAES compaction results compared to the nuclear density gauge are provided in Table 2 of Section 2.3.1.

4.4 Lift Approval

The *Lift Approval Procedure* and Addenda B and E of the RAP were followed to verify that each lift met established criteria. The procedure was modified during this Addendum period and the revised procedure is provided in Attachment 1. Results of lifts are documented in lift approval packages. A sample lift approval package for RRM and each cell cover layer is provided in Appendix A.

4.5 Geotechnical Testing

The following procedures were used to ensure cell construction was performed in compliance with the RAP.

- The *Moab UMTRA Project Moisture/Density Testing Procedure* (DOE-EM/GJRAC1783) provides requirements and methods for the proper moisture/density testing of soils placed in the cell. This procedure was modified during this Addendum period and the revised version is provided in Attachment 1.
- The *Moab UMTRA Project Standard Practice for Sampling Aggregates Procedure* (DOE-EM/GJRAC1933) provides a consistent method for sampling aggregates for the cell cover.

The RAIP describes the methods and frequencies for performing tests to verify that the material placed in the cell meets the requirements. Geotechnical tests performed fell within two general categories: soils testing and aggregate testing. The following subsections contain descriptions of these categories.

4.5.1 Soils Testing

Laboratory and/or field soils geotechnical tests were conducted on every lift of each material layer placed to support verification that specified compaction requirements were met. Test requirements varied depending on whether the CAES was used for demonstrating compaction. Because the soils in the RRM can vary in composition, multiple compaction curves were prepared to determine the optimum moisture content for that material to achieve compaction. Results of the tests conducted are shown in the standard proctor test results summary tables included in Appendix A. When multiple standard proctor tests, or "sets," were performed, the test selected to represent that soil type appears in red in the table. Over time, the interim cover, radon barrier, and frost protection layers were found to have a consistent soil type, so the need for sets of standard proctor tests was eliminated and standard proctors were completed in the frequency required by the RAIP. The tables also summarize the tests performed to determine soil type and geotechnical properties.

Moisture content testing was performed daily for each soil layer placed to verify that the moisture content met the requirements before the lifts were approved. The thickness of each lift was surveyed and verified using a high accuracy global positioning system (GPS), when practical; otherwise, manual measurements were taken. Liquid limit and plastic limit tests were performed, and the plasticity index was calculated to further differentiate each soil type used for the radon barrier.

4.5.2 Aggregate Testing

The following tests were performed on each aggregate layer placed.

- Gradation tests to verify that the rock was appropriately sized
- Durability tests to verify the hardness and mineral composition
- Visual inspections to verify there was no nesting of fines and that the aggregate was uniformly placed

Compaction processes were visually observed for the infiltration and biointrusion barrier. The thickness of each aggregate layer placed was surveyed and verified using a high accuracy GPS. These measurements are depicted on the distribution of survey point figure (see Figure 7).

Testing of one sample per the RAIP for rock durability was performed and the results are summarized in Table 12, including the calculated NRC rock quality score. The sample met the durability requirements and scored above the acceptable NRC criteria of 80 percent.

Table 12. Rock Durability Test Results and NRC Rock Quality Scores

Laboratory Sample* ID Number	Rock Durability Test Results					NRC Rock Quality Score		
	Specific Gravity	Absorption (%)	Sodium Sulfate (%)	L.A. Abrasion	Schmidt Hammer	Total	Maximum	Final (%)
Infiltration and Biointrusion Barrier								
UBL01	2.664	0.70	0.73	7.1	68	233.8	260	89.9

L.A. = Los Angeles
* All samples are of gray basalt.

4.6 Radiological Verification

Section 5 of the Remedial Action Selection Report of the RAP identifies two primary verification criteria associated with construction of the disposal cell: Ra-226 measurements in RRM placed in the upper 7 ft and radon flux measurements to verify the integrity of the radon barrier. The *Interim Completion Report Addendum A* provides an explanation of this verification process.

During this Addendum period, 271 samples of RRM were taken prior to placement of the RRM in 10 lifts in the upper 7 ft of the disposal cell to verify the material met the Ra-226 requirement. The Ra-226 activity of the material ranged from 226 to 576 picocuries per gram (pCi/g). These values are below the 707 pCi/g limit specified in the RAP. Table 13 shows the average result for material placed in each lift tested.

Table 13. Results of Ra-226 Activity in Upper 7 Feet of Placed RRM

Lift ID #	Quantity of Samples Taken	Average Ra-226 Activity (pCi/g)	Lift Area (m^2)
UWZ06	27	576	10,177
UW1A12	27	529	4946
UW1C08*	21	522	4778
UWY01	28	483	6160
UW1D19	28	545	2358
UW1E01	28	226	5480
UW1E08	28	229	3181
UW1G01	28	266	4288
UW1H08	28	262	3034
UW1I01	28	419	1161

*Lift area was combined with UWZ06.

Radon flux measurements were taken using *Moab UMTRA Project Radon Flux Procedure* (DOE-EM/GJRAC1939) and are used to validate that the cell design criteria have been met. Radon flux measurement results are presented in the Section 25.2 and ranged from 0.1297 to 0.2322 picocuries per square meter per second (pCi/m^2/s), with an average flux of 0.1868 pCi/m^2/s, which is well below the 20 pCi/m^2/s limit.

4.7 QA Requirements

QA activities were conducted in accordance with documents identified in Section 3.3. All personnel who performed work addressed in this Addendum were qualified in accordance with the requirements of the QAP.

During construction activities, audits, surveillances, and management assessments were performed by the RAC to verify and provide assurance that these activities were performed in accordance with established plans, drawings, instructions, procedures, specifications, and other applicable documents. In addition, DOE and the Technical Assistance Contractor (TAC) performed audits and surveillances of these activities. During the period of this Addendum, nine surveillances and two management assessments were performed (see Table 14). Any issues identified during these surveillances and management assessments have been addressed.

Table 14. Surveillances and Assessments Conducted during Construction

Date	Conducted By	Type	Assessment Number	Scope
10/19/13 through 12/16/13	RAC	Management Assessment	MA-14-003	Evaluate the impacts to the Project of a revised security schedule.
11/13/13	TAC	Surveillance	DOE-14-SUR-001	Evaluate placement of RRM at the junction with the perimeter berm.
06/19/14	TAC	Surveillance	DOE-14-SUR-019	Evaluate the QC laboratory and QA program of a prospective geotechnical subcontractor laboratory.
06/29/14-06/30/14	TAC	Surveillance	DOE-14-SUR-027	Evaluate interim cover placement activities and a sampling of RAC QC activities to verify compliance to the RAP, Addendum B, “Final Design Specifications,” and the RAIP.
08/05/14	TAC	Surveillance	DOE-14-SUR-028	Evaluate interim cover placement and a sampling of RAC QC activities to verify compliance with the RAP, Addendum B, “Final Design Specifications,” and the RAIP.
08/20/14	TAC	Surveillance	DOE-14-SUR-032	Evaluate radon barrier placement and a sampling of RAC QC activities to verify compliance with the RAP, Addendum B, “Final Design Specifications,” and the RAIP.
09/02/14	RAC	Management Assessment	MA-14-019	Evaluate compliance to the RAC QA Program.
09/03/14	TAC	Surveillance	DOE-14-SUR-033	Evaluate radon barrier placement and a sampling of RAC QC activities to verify compliance with the RAP, Addendum B, “Final Design Specifications,” and the RAIP.
09/09/14	TAC	Surveillance	DOE-14-SUR-034	Evaluate radon barrier placement and a sampling of RAC QC activities to verify compliance with the RAP, Addendum B, “Final Design Specifications,” and the RAIP.

Table 14.Surveillances and Assessments Conducted during Construction (continued)

Date	Conducted By	Type	Assessment Number	Scope
09/16/14	TAC	Surveillance	DOE-14-SUR-037	Evaluate radon barrier placement and a sampling of the infiltration/biointrusion layer to verify compliance with the RAP, Addendum B, "Final Design Specifications," and the RAIP.
09/30/14-10/01/14	TAC	Surveillance	DOE-14-SUR-038	Evaluate RAC cell cover placement to verify compliance to the RAP, Addendum B, "Final Design Specifications," and the RAIP.

QC = quality control

4.8 Monitoring for Presence of Free Liquids

The results of monitoring during this period the one existing standpipe (see Figure 8) for the presence of free liquids in the disposal cell are shown in Table 15. No additional standpipes were installed during this period.

Table 15. Results of Monitoring for the Presence of Fluids in Standpipe 01

Date Monitored	Presence or Level of Fluids (ft)
12/12/13	Dry
03/13/14	Dry
06/26/14	Dry
08/27/14	Dry

Dry = no fluids present.

4.9 Monitoring for Presence of Ground Water

Four wells were monitored for the presence of ground water outside of the disposal cell footprint (see Figure 8). Results of the monitoring are shown in Table 16.

Table 16. Results of Monitoring for Presence of Ground Water

Date Monitored	Monitor Well Number			
	202	203	205	210
12/12/13	Dry	Dry	Dry	Dry
03/13/14	Dry	Dry	Dry	Dry
06/26/14	Dry	Dry	Dry	Dry
08/27/14	Dry	Dry	Dry	Dry

Dry = no fluids present

Figure 8. Locations of Monitoring Wells and Standpipe

5.0 References

10 CFR 830 Subpart A (Code of Federal Regulations), “Nuclear Safety Management, Quality Assurance Requirements.”

ASME (American Society of Mechanical Engineers), Nuclear Quality Assurance (NQA)-1 2004 and addenda through 2007 consensus standard, “Quality Assurance Requirements for Nuclear Facility Applications (QA).”

ASTM (ASTM International) Standard C88, “Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.”

ASTM (ASTM International) Standard C117, “Standard Test Method for Materials Finer than 75-µ (No. 200) Sieve in Minerals Aggregates by Washing.”

ASTM (ASTM International) Standard C127, “Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.”

ASTM (ASTM International) Standard C131, “Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.”

ASTM (ASTM International) Standard C136, “Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate.”

ASTM (ASTM International) Standard D698, “Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.”

ASTM (ASTM International) Standard D1556, “Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.”

ASTM (ASTM International) Standard D2216, “Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.”

ASTM (ASTM International) Standard D4643, “Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating.”

ASTM (ASTM International) Standard D4944, “Standard Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester.”

ASTM (ASTM International) Standard D4959, “Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.”

ASTM (ASTM International) Standard D6938, “Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).”

DOE (U.S. Department of Energy), *Moab UMTRA Project Crescent Junction Disposal Cell Interim Completion Report Addendum A* (DOE-EM/GJRAC2040-A).

DOE (U.S. Department of Energy), *Moab UMTRA Project Crescent Junction Disposal Cell Interim Completion Report Addendum C* (DOE-EM/GJRAC2040-C).

DOE (U.S. Department of Energy), *Moab UMTRA Project Final Remedial Action Plan and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at the Crescent Junction, Utah, Disposal Site* (DOE-EM/GJ1547).

DOE (U.S. Department of Energy), *Moab UMTRA Project Lift Approval Procedure* (DOE-EM/GJRAC1803).

DOE (U.S. Department of Energy), *Moab UMTRA Project Moisture/Density Testing Procedure* (DOE-EM/GJRAC1783).

DOE (U.S. Department of Energy), *Moab UMTRA Project Quality Assurance Plan for the Remedial Action Contractor* (DOE-EM/GJRAC1766).

DOE (U.S. Department of Energy), *Moab UMTRA Project Radon Flux Procedure* (DOE-EM/GJRAC1939)

DOE (U.S. Department of Energy), *Moab UMTRA Project Standard Practice for Sampling Aggregates Procedure* (DOE-EM/GJRAC1933).

DOE (U.S. Department of Energy) Office of Environmental Management EM-QA-001, "EM Quality Assurance Program" (EM-QA-001).

DOE (U.S. Department of Energy), Order 226.1B, "Implementation of Department of Energy Oversight Policy."

DOE (U.S. Department of Energy), Order 414.1D, Admin Chg 1, "Quality Assurance."

UAC (Utah Administrative Code), Rule R307-309-6, "Fugitive Dust Control Plan."

Appendix A.
Construction Verification Data

Appendix A. Construction Verification Data

Contents

NOTE: Appendices A1 and A7 are not included as they are not relevant to the period covered in this Addendum.