LMS/S00336

Guidance for Developing and Implementing Long-Term Surveillance Plans for UMTRCA Title I and Title II Disposal Sites

November 2012

U.S. DEPARTMENT OF ENERGY | Legacy Management

This page intentionally left blank

LMS/S00336

Guidance for Developing and Implementing Long-Term Surveillance Plans for UMTRCA Title I and Title II Disposal Sites

November 2012

This page intentionally left blank

Contents

Tables

Attachments

Abbreviations

ACL	alternate concentration limit
CFR	*Code of Federal Regulations*
COC	constituent of concern
DOE	U.S. Department of Energy
IC	institutional control
LTS&M	long-term surveillance and maintenance
LTSP	long-term surveillance plan
LTSC	long-term surveillance charge
NRC	U.S. Nuclear Regulatory Commission
POC	point of compliance
POE	point of exposure
RIS	Regulatory Issue Summary
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978
USC	*United States Code*

This page intentionally left blank

1.0 Purpose and Scope

The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA, 42 *United States Code* [USC] 7901 et seq.), as amended, established that the U.S. Department of Energy (DOE) will be the long-term custodian for sites cleaned up under Title I or Title II of that legislation.[1] A long-term surveillance plan (LTSP) explains how DOE will fulfill general license requirements of Title 10 *Code of Federal Regulations* Part 40 (10 CFR 40) at a specific UMTRCA Title I or Title II disposal site. 10 CFR 40.27 provides general license requirements for Title I disposal sites, and 10 CFR 40.28 provides general license requirements for Title II disposal sites. The LTSP also indicates how DOE, as the long-term steward of the land, will comply with other applicable federal, State, and local regulations.

This document provides guidance for the development and implementation of a site-specific LTSP for sites regulated under Title I and Title II of UMTRCA. This guidance may also be used to prepare LTSPs (or site management plans) for disposal sites remediated under other authorities and under DOE custody (e.g., sites managed under the Formerly Utilized Sites Remedial Action Program or the DOE Decontamination and Decommissioning Program). The guidance also recommends practices for conducting some of the routine aspects of long-term surveillance and maintenance (LTS&M), such as conducting inspections and responding to earthquakes.

Previous versions of this guidance, developed in 1986 and revised in 1990, 1992, 1996, and 2001, listed the elements of an LTSP. For those previous versions, DOE reviewed existing LTSPs against regulatory requirements, including applicable parts of the CFR and U.S. Nuclear Regulatory Commission (NRC) guidance in the *Standard Review Plan for the Review and Remedial Action of Inactive Mill Tailings Sites under Title I of the Uranium Mill Tailings Radiation Control Act* (NRC 1993). This revised guidance references the *Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978* (NUREG-1620, Revision 1, NRC 2003a).

This new version of the guidance seeks to ensure that all required elements are included in an LTSP and that there is compliance and consistency in future LTSPs. DOE revised this guidance to follow the format of recently accepted LTSPs. It should be noted that NUREG-1620 is applicable to Title II sites, but regulations stipulating LTSP content in 10 CFR 40.27 for Title I sites and 10 CFR 40.28 for Title II sites are almost identical (relevant sections of these regulations are cited throughout this guidance when applicable).[2] Information contained in Appendix D of NUREG-1620 may be used as a guide to ensure that all elements are included in the LTSP for NRC review. For Title II transitioning sites, information regarding the development of an LTSP is also found in the *Process for Transition of Uranium Mill Tailings Radiation Control Act Title II Sites to the U.S. Department of Energy Office of Legacy Management for Long-Term Surveillance and Maintenance* (DOE 2012).

Section 2.0 of this guidance describes the content of an acceptable LTSP. While the LTSP can include technical information by reference, the site-specific LTSP should stand alone in

[1] A host state may elect to become the long-term custodian of a reclaimed Title II site. To date, no state has exercised this option.

[2] Many Title I LTSPs were written according to the recommendation of the Title I standard review plan, which is still applicable and should be reviewed when revising an LTSP for a Title I site.

providing sufficient information to establish a baseline of site conditions and the rationale for the LTS&M program established for a site.

Requirements for long-term surveillance, monitoring, and maintenance of UMTRCA Title I and Title II sites are provided in NRC regulations at 10 CFR 40. These requirements are cited in Section 2.4 of this document. Regulatory citations used throughout this guidance citing a provision in 10 CFR 40.27 are applicable to Title I sites, and citations for 10 CFR 40.28 are applicable to Title II sites.

In accordance with NRC's Regulatory Issue Summary (RIS) 2011-11, which reiterates NRC's policy regarding determination of the long-term surveillance charge (LTSC) for transitioning UMTRCA Title II disposal sites (NRC 2011), DOE will provide a technical and regulatory basis and cost estimate for conducting LTS&M activities at transitioning sites when requirements for post-closure care are determined to exceed the minimum LTS&M activities specified in NUREG-0706, *Final Environmental Impact Statement on Uranium Milling*, Appendix R, Scenario I. The estimated costs for LTS&M activities specified in Scenario I were adopted as the minimum charge specified in 10 CFR 40, Appendix A, Criterion 10. DOE anticipates that the long-term monitoring and maintenance program for a particular UMTRCA Title II disposal site will be based on the monitoring and maintenance program in effect immediately prior to site transition and detailed in the specific license, but DOE recognizes that technically defensible modifications may be warranted. DOE also recognizes that additional land stewardship activities may be necessary to comply with other federal, State, and local regulations. Therefore, these additional land stewardship activities will be included in the LTS&M cost estimate DOE provides NRC for consideration in its determination of the LTSC (see Provision 15 of the *License Termination/Site Transfer Protocol between the U.S. Department of Energy and the U.S. Nuclear Regulatory Commission* [DOE and NRC 1998]).[3]

The scope and technical and regulatory basis for all LTS&M activities should be presented in the LTSP, including any that are considered to be in addition to the minimum requirements and that have been determined necessary to maintain protectiveness and to comply with other federal, State, and local regulations. The scope and technical and regulatory basis for these additional LTS&M activities must be provided in sufficient detail to satisfy the site-specific evaluation requirement of 10 CFR 40, Appendix A, Criterion 10. All costs to conduct LTS&M activities described in the LTSP, including the labor, equipment, and any outside services needed, along with the estimated duration of each activity deemed necessary to demonstrate continued regulatory compliance over the long term, should be considered when preparing the LTSC estimate submitted to NRC.

The RIS indicates that, in determining the LTSC, NRC will consider cost estimates (based on the approved LTS&M scope presented in the LTSP) from both the long-term custodian (i.e., DOE) and the licensee for the transitioning site (NRC 2011). The LTSC must be paid to the U.S. Treasury prior to NRC's acceptance of the LTSP and termination of the licensee's specific license. Guidance regarding the establishment of the LTSC is also presented in Appendix E, Section E3.4, of NUREG-1620 (NRC 2003a) and DOE's *Process for Transition of Uranium Mill Tailings Radiation Control Act Title II Sites to the U.S. Department of Energy Office of Legacy Management for Long-Term Surveillance and Maintenance* (DOE 2012).

[3] This protocol (DOE and NRC 1998) is being revised and will reflect the recent NRC guidance for implementing 10 CFR 40, Appendix A, Criterion 10, as addressed in RIS 2011-11.

2.0 Long-Term Surveillance Plan

NRC regulations require that each LTSP describe the disposal site and disposal cell (including a legal description of the site), final disposal site conditions, the long-term surveillance and monitoring program, reporting requirements, and the criteria for follow-up inspections, site maintenance, and emergency measures (10 CFR 40.27[b] or 10 CFR 40.28[b]).

LTSPs may reference information in documents previously submitted to NRC (10 CFR 40.27[b] or 10 CFR 40.28[b]).

LTSPs should be written using a common format to ensure that all required elements are addressed. An LTSP has four sections. Section 1.0 establishes regulatory authority for DOE to assume responsibility for custody and care of the remediated site and summarizes DOE's role in fulfilling that responsibility. Section 2.0 describes final site conditions, including a summary of the site's history, physical and legal site conditions, details of the disposal cell and associated structures, the geological and hydrogeologic regime, local groundwater conditions and surrounding land use, and institutional controls (ICs). Section 3.0 describes the LTS&M program. Section 4.0 provides references for supporting documentation, DOE orders, and regulatory oversight. A sample LTSP table of contents is shown in Attachment 1. Authors are encouraged to use the most recent LTSP accepted for an UMTRCA Title I or Title II site as a template for developing an LTSP.

LTSPs developed in the 1980s and early 1990s were organized according to the list of requirements in 10 CFR 40.27 or 10 CFR 40.28. DOE adopted a standardized organization and format in the late 1990s. A sample of earlier LTSPs was reviewed against the regulations and found to comply with them (Stoller 2009). Therefore, older LTSPs will not be revised to comply with the current organization and format until changes in site conditions or LTS&M requirements necessitate revision and acceptance by NRC.

The following sections describe the content of each section of an LTSP.

2.1 LTSP Section 1.0, "Introduction"

The language in Section 1.0 is primarily boilerplate. Section 1.0 establishes whether the site is regulated under Title I or Title II of UMTRCA and whether it is in an Agreement State. To complete this section, the LTSP author is encouraged to use wording from the most recently accepted LTSP for a Title I or Title II site.

2.1.1 Purpose and Scope of a Site-Specific LTSP

An LTSP must state its purpose and scope. Each LTSP is site-specific and must describe site conditions and the remedy selected for the site. The purpose of an LTSP is to establish the long-term care program for a disposal site, including surveillance and monitoring requirements. The LTSP explains how DOE will fulfill the general license requirements in 10 CFR 40.27 or 10 CFR 40.28 as the long-term custodian of the site. The LTSP also details historical and baseline conditions for comparisons over time.

2.1.2 Legal and Regulatory Requirements

This portion of the LTSP defines the regulatory requirements established under Title I and Title II of UMTRCA for remediation (or reclamation) and regulation of uranium mill tailings. Title I addresses former uranium mill sites that were unlicensed as of January 1, 1978. Title II addresses uranium mill sites that were under a specific license as of January 1, 1978. In both cases, the licensing agency is NRC.

DOE manages Title I and Title II sites under NRC general licenses for custody and long-term care. The long-term care program includes site surveillance and inspections, monitoring maintenance requirements, and emergency measures necessary to ensure protection of public health and the environment. DOE is responsible for all remediated Title I sites under the general license.[4] For Title II sites, the host state can elect to become the long-term custodian, but to date, all states have declined this option, and consequently, the general license has required that DOE or another appointed federal agency become the long-term custodian.

A standardized table in this section shows how the content of the LTSP demonstrates compliance with the requirements of the NRC general license for providing long-term custody and care of the licensed site. An example of this table specific to the draft LTSP for the Split Rock, Wyoming, UMTRCA Title II disposal site (submitted to NRC for review on April 13, 2012) is provided below.

Table 1. General License Requirements for the Split Rock Disposal Site

10 CFR 40.28(b) Requirements		
	Requirement	*LTSP Section*
1.	Description of final site conditions	Section 2.0
2.	Legal description of the site	Appendix A
3.	Description of the long-term surveillance program	Section 3.0
4.	Criteria for follow-up inspections	Section 3.5.1
5.	Criteria for routine site maintenance and emergency measures	Section 3.6.3
10 CFR 40.28(c) Requirements		
	Requirement	*LTSP Section*
1.	Implementation of the LTSP	Section 1.2
2.	Care for the site in accordance with provisions of the LTSP	Section 1.2
3.	Notification to NRC of any changes to the LTSP	Section 3.1
4.	Guarantee NRC permanent right-of-entry	Section 3.1
5.	Notification to NRC of significant construction, actions, or repairs at the site	Sections 3.5 and 3.6

[4] The Grand Junction, Colorado, Disposal Site will remain open to receive authorized waste until 2023 or until design capacity is reached, whichever occurs first, in accordance with UMTRCA. This site will not come under the general license until disposal operations cease and the cell is closed in accordance with NRC requirements. Until then, DOE operates the closed portion of the site under an interim LTSP.

2.1.3 Role of the U.S. Department of Energy

This portion of Section 1.0 in the LTSP defines DOE's role in providing LTS&M for closed UMTRCA disposal sites. In addition, this section supports DOE's objectives in DOE Order 450.1A, *Environmental Protection Program*; Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*; and Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, as well as DOE's ongoing obligation to implement sound environmental stewardship.

During the course of long-term stewardship, site conditions, new data, or reuse opportunities may require changes to the LTS&M program for a particular site. In such circumstances, DOE will revise the LTSP to describe these changes to site conditions or the LTS&M program for the impacted site. The revised LTSP must be submitted to NRC for acceptance (10 CFR 40.27 [c][3] or 10 CFR 40.28 [c][3]).

Language in this section incorporates this guidance by reference into the LTSP.

2.2 LTSP Section 2.0, "Final Disposal Site Conditions"

This section summarizes final disposal site conditions for use as a baseline for comparisons over time (NUREG-1620, Appendix D, D2.2.2; 10 CFR 40.27[b][2] or 10 CFR 40.28[b][2]). A summary of the site history is also typically provided in this section of the LTSP, including a brief description of the selected remedy and any groundwater corrective action performed. Site-specific documentation, including remedial action or reclamation plans, as-built drawings, completion reports, applications for alternate concentration limits (ACLs), and any other information or data that are relevant to the long-term management of the site, should be summarized in Section 2.0 of the LTSP and referenced when more in-depth detail is needed (NUREG-1620, Appendix D, D2.2.2; 10 CFR 40.27[b][2] or 10 CFR 40.28[b][2]).

The LTSP describes the physical setting, local land and groundwater use, geology, and hydrology of the site. The remedy is described, including engineered structures, groundwater conditions, and (for some Title I sites) ongoing groundwater restoration activities (10 CFR 40.27[b][2] or 10 CFR 40.28[b][2]). These descriptions in the LTSP must be detailed enough that inspectors can determine changes from baseline conditions and determine when these changes require maintenance, repairs, corrective action, or additional controls. Changes from baseline conditions that result in the need for any of these measures will require concurrence from NRC, followed by revision of the LTSP and subsequent acceptance by NRC (see Section 4.0 of this guidance).

2.2.1 General Description of Disposal Site and Vicinity

This section of the LTSP provides a general description of the site location and its relationship to a city, town, or other nearby landmark. This section should include a figure showing the location of the site in relation to a known landmark (NUREG-1620, Appendix D, D2.2.2[5]).

Information is provided on the general climate of the area, weather patterns and annual precipitation, general site elevation above sea level, and surrounding land and groundwater uses. This section of the LTSP describes surface features of the disposal site, including topography

(NUREG-1620, Appendix D, D2.2.2[4]), drainage patterns, natural or cultural resources, surface waters, and the physiographic setting.

The LTSP should also include information about nearby activities, such as active or proposed oil and gas or mineral development, which have the potential to impact the site and therefore should be monitored.

2.2.2 Site Ownership

This section of the LTSP defines DOE ownership of the site and any real property instruments that secure site access, such as easements or rights-of-way. The LTSP must document the perpetual right of access to the site (10 CFR 40.27[c][4] or 10 CFR 40.28[c][4]; see Section 2.3 of this guidance). Documentation of the ownership or custodial agreement (for tribal lands), such as deeds and Public Land Orders for acquisition of federal land and any other required real property instruments, are appended to the LTSP.

The LTSP must include a legal description of the disposal site (10 CFR 40.27[b][1] or 10 CFR 40.28[b][1]), which describes the number of acres included in the federally owned portion of the site and within the site's long-term care boundary, should they differ.[5,6] A description of these acreages is also typically provided in the acquisition, withdrawal, or IC documentation that is appended to the LTSP. A surveyor's legal description of the property, as recorded and filed in public land records, is also appended. The legal description may be expressed using the section breakdown structure (township, range, and section [nearest quarter section]) or in metes and bounds. This information may be incorporated into the deed that is transferring ownership of fee land.

A description of both surface and subsurface ownership within the site's long-term care boundary should also be included in this section of the LTSP. For Title II sites, NRC may issue a specific license, upon application, permitting the use of the site by any person, provided that, (1) the proposed action does not endanger public health, safety, or welfare, or the environment; (2) the site would be maintained or restored to meet regulatory requirements; and (3) adequate financial arrangements are in place to ensure the integrity of the materials that have been disposed of (10 CFR 40.28[d]). A figure displaying ownership of adjoining land parcels (i.e., private versus public) at the time of site transition is also useful information to include in this section.

If the land on which the site lies is part of a reservation or has trust status, the LTSP must contain documentation from the affected tribe or trustee (NUREG-1620, Appendix D, D2.2.1(3), and 10 CFR 40, Appendix A, Criterion 11[F]). In these cases, agreements typically establish that

[5] Title II sites transferring to DOE may include fee land that was owned by the licensee and federal land administered by the U.S. Bureau of Land Management (or another federal agency) that was permanently withdrawn from public entry and placed under DOE's jurisdiction. These portions of a site, collectively, are referred to as the DOE-owned land. Note that withdrawal may not be completed before transition of responsibility to DOE. Administration of a portion of a transitioning site by another federal agency satisfies the requirement that the land be owned by the federal government (10 CFR 40, Appendix A, Criterion 11[C]).

[6] At some Title II disposal sites, ICs may be required to control residual site-related contamination that is located outside the federally owned portion of the site, and in such cases, the long-term care boundary may differ from the ownership boundary.

ownership of the land remains with the tribe and that federal ownership and custody apply only to the waste materials and their containment and protection structures.

This section should include the statement that all real property correspondence and supporting documentation is filed and maintained in the real property files of the DOE Office of Legacy Management.

2.2.3 Directions to the Disposal Site

This section provides a road log (in text) of driving directions to the site. The directions should include driving distances and a description of any pertinent features, such as road names, fences, gates, and signs, that will aid in locating the site. This section of the LTSP should also provide a figure of the route to the site, which may be incorporated into the vicinity map.

2.2.4 Site History

This section of the LTSP presents a brief history of site ownership and operations and summarizes historical information related to the surface and the underlying groundwater system (e.g., years of operation, processes, volume of materials processed, remediation or reclamation activities, groundwater corrective actions performed). This section describes steps taken (1) to evaluate the surface and groundwater conditions, (2) to describe the results of previous actions to stabilize the tailings, and (3) to remediate the site surface and any remaining groundwater contamination. Historical processes should be described in sufficient detail to indicate potential constituents of concern (COCs) in groundwater and surface areas.

Section 2.2.6 of this guidance describes in greater detail how the groundwater conditions section of the LTSP is related to discussion of past operations and groundwater compliance history.

2.2.5 Disposal Site Description

In this section, the LTSP provides a description of the surface remedy and conditions at the site, and informs stakeholders of where to locate the source documentation. This section also describes any permanent site surveillance features to be inspected.

2.2.5.1 Surface Remedy

This section of the LTSP should briefly describe the selected surface remedy, including the licensee's surface characterization and reclamation activities, with enough specificity that changes from the baseline condition can be identified (NUREG-1620, Appendix D, D2.2.2[7]). Additional supporting information in this regard is provided in the following sections of the LTSP.

2.2.5.2 Surface Conditions

This section of the LTSP includes a general description of any engineered features constructed at the site and designed as part of the remedy to achieve containment, necessary drainage, and erosion protection for materials that have been disposed of. Any fencing that is necessary for securing the disposal site is also described here (10 CFR 40, Appendix A, Criterion 10). A figure that shows all surface features pertinent to the containment and protection of the wastes that have been disposed of should be provided. Surface water hydrology and erosion protection should be

discussed. The design basis for erosion resistance (usually the probable maximum flood) should be presented; this will be in inches of precipitation over a stated period of time.

A more detailed discussion of the design and construction of the specific tailings impoundments and associated surface water diversion structures is typically provided in the following section of the LTSP, as described below.

2.2.5.3 Disposal Cell Design

The LTSP summarizes the disposal cell design (NUREG-1620, Appendix D, D2.2.2[3]) and performance expectations, and it references appropriate sections of site-specific documents for more detailed information (e.g., as-built drawings). The description should include the design-basis seismic event and address how the structures are designed to withstand design-basis events (e.g., resistance to seismic and flooding events). The cover design elements that control radon emission rates (20 picocuries per square meter per second) are typically described here (10 CFR 40, Appendix A, Criterion 6).

Title I and Title II disposal cells are designed to be effective for 1,000 years or at least 200 years, with the intent to need no more than custodial maintenance (40 CFR 192.02[a]–[d]; 10 CFR 40, Appendix A, Criteria 6 and 12). An LTSP should include the following information:

- A summary of the disposal cell's major constructed components, including their dimensions.
- A plan view and cross sections of the disposal cell, obtained from site-specific documents (e.g., as-built drawings), which include a description of the cover components (e.g., erosion protection/riprap layer, filterbed/drainage layer, frost protection layer, compacted soil layer/radon barrier), side slopes, and embankments.
- A summary of the cover system (e.g., rock or vegetative) drainage controls and other features that contribute to cell performance and long-term erosion protection, such as contouring and sloping, diversion channels, aprons, toe drains, and cover components.
- A summary of design elements necessary for groundwater protection.
- A summary of other performance features (e.g., frost protection, infiltration and percolation resistance, cover drainage, transient drainage management).

Within the disposal cell design section, the LTSP should include as many subsections as are needed to define all of the engineered disposal cell system elements that must be maintained and monitored for proper performance, such as the disposal cell cover and storm water diversion structures.

The LTSP should also include any pertinent ground and aerial photographs that could assist in conducting LTS&M and for comparing inspection results to initial post-construction conditions (NUREG-1620, Appendix D, D2.2.2[6]).

2.2.5.4 Permanent Site Surveillance Features

Permanent long-term surveillance features such as the site markers, boundary monuments, and warning signs are described in this section. The LTSP should describe the number, location, and condition of these features (NUREG-1620, Appendix D, D2.2.2[6]). These features are part of DOE's network of engineered ICs, as defined in DOE Policy 454.1, that serve to notify the

public about the contamination (e.g., monuments, site markers, signs). For a transitioning UMTRCA Title II disposal site, the licensee installs these site surveillance features prior to transition (specifications and locations are provided by DOE, via this guidance).

Any fencing determined necessary (10 CFR 40, Appendix A, Criterion 10) serves as an engineered control that is intended to limit access to the site. The site inspection map and figures provided in the LTSP should show the locations of permanent features that must be inspected annually and maintained as part of the site LTS&M program. Specifications for site surveillance features (e.g., boundary monuments, site markers, warning signs) are provided in Attachment 2 of this guidance document.

2.2.6 Geology, Hydrology, and Groundwater

2.2.6.1 Site Geology and Hydrology

This section of the LTSP describes the geological and hydrological settings for the site and the surrounding area. The descriptions should include pertinent information on the geological section, such as lithology, stratigraphy, and structure. A columnar section is often included as a figure in the LTSP. The discussion of the regional hydrogeological system should emphasize the uppermost aquifer or any underlying aquifer that has been impacted by legacy contamination from the former tailings impoundment or that could become degraded by site-related constituents if the disposal cell does not perform as designed.

Groundwater flow rates and the direction of groundwater flow, both horizontal and vertical, should be discussed for all flow regimes underlying and immediately downgradient of the disposal system, along with any discharge points to surface waters (discharge points are potential points of exposure [POEs]).

2.2.6.2 Groundwater Remedy

This section of the LTSP should briefly describe the selected groundwater remedy, including the licensee's groundwater characterization and remedial activities, with enough specificity that changes from the baseline condition can be identified (NUREG-1620, Appendix D, D2.2.2[7]). Additional supporting information in this regard is provided in the following section of the LTSP.

2.2.6.3 Groundwater Conditions

This section of the LTSP describes conditions that affect groundwater quality. NRC regulations require that each LTSP describe the appropriate site-related constituent concentration limits for groundwater (10 CFR 40.27[b][3] or 10 CFR 40.28[b][3]). In addition, the LTSP should discuss the following areas with an appropriate level of detail:[7]

- Background groundwater quality and condition (40 CFR 192.12[c][1] and NUREG-1620, Appendix D, D2.2.3).

[7] Sufficient detail allows for an understanding of the local conditions so that an assessment of monitoring data and surveillance results can determine if conditions remain protective and in compliance with applicable regulations.

- Hazardous constituents in the groundwater (40 CFR 192.02[c]; 10 CFR 40, Appendix A, Criterion 5[B][2]; NUREG-1620, Section 4.2 and Appendix D2.2.3[3]; and the *Standard Review Plan for the Review and Remedial Action of Inactive Mill Tailings Sites Under Title I of the Uranium Mill Tailings Radiation Control Act*, Section 4.3.3.1.1 [NRC 1993]).
- Groundwater protection standards (40 CFR 192.02[c][3]; 40 CFR 192.12; 40 CFR 192.32; 10 CFR 40, Appendix A, Criterion 5; and NUREG-1620, Appendix D, D2.2.3[3]).
- ACLs, if applicable (40 CFR 192.02[c][3][i][C] and 10 CFR 40, Appendix A, Criterion 5[B][6]).
- Indicator parameters (40 CFR 192.20[a][4] and NUREG-1620, Appendix D, D2.2.3[3]).
- Tailings pore fluid concentrations (40 CFR 192.02[c][1] and 10 CFR 40, Appendix A, Criterion 5).
- Maximum historical point of compliance (POC) and POE concentrations and groundwater protection standards applicable at the POC and POE.
- Historical monitoring results for COCs at all locations in the proposed long-term monitoring network.
- Predicted concentrations (or target levels) of COCs over time at the designated POC, POE, and trend well locations, if available, and contaminate plume velocities as determine by groundwater fate and transport modeling for ensuring compliance with groundwater protection standards both within and at the site boundary.
- Hydrogeologic characteristics of the uppermost aquifer beneath and downgradient of the disposal site that either has been impacted by the legacy plume or could be impacted by a continuing release of contaminants from the tailings impoundment (i.e., transient drainage) or a legacy plume.
- Use of surrounding groundwater and groundwater-use restrictions (to include any State-designated water quality classifications).

Note that some of the items that are listed in 10 CFR 40.27(b)(3) or 10 CFR 40.28(b)(3) are addressed in Section 3.0 of the LTSP with the description of the groundwater monitoring program (see Section 2.3.7.1 of this guidance).

The LTSP identifies (1) constituents with established maximum concentration limits; (2) other hazardous constituents listed in 40 CFR 192, Appendix I (for Title I sites) or 10 CFR 40, Appendix A, Criterion 13 (for Title II sites); and (3) hazardous COCs that are present in or reasonably derived from the tailings stabilized in the disposal cell.[8] A typical presentation of these constituents is shown in Table 2. The presentation should also include background groundwater quality, contamination concentrations in groundwater, tailings pore water chemistry, maximum predicted POC and POE concentrations, and groundwater protection standards applicable both onsite and at the POE.

[8] This information should be available from existing historical site documentation and should not require additional sampling and analysis, particularly with regard to a transitioning UMTRCA Title II disposal site; it is the former licensee's responsibility to gather these data and make them available to DOE.

Table 2. Maximum Concentration Limits for Groundwater Protection

Constituent	Maximum Concentration Limit[a]
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium	0.05
Lead	0.05
Mercury	0.002
Selenium	0.01
Silver	0.05
Nitrate (as N)[c]	10
Molybdenum[c]	0.1
Combined radium-226 and radium-228	5 pCi/L
Combined uranium-234 and uranium-238[b,c]	30 pCi/L
Gross alpha-particle activity (excluding radon and uranium)	15 pCi/L
Endrin (1,2,3,4,10,10-hexachloro-6,7-exposy-1,4,4a,5,6,7,8, 8a-octahydro-1,4-endo,endo-5,8-dimethanonaphthalene)	0.0002
Lindane (1,2,3,4,5,6-hexachlorocyclohexane, gamma insomer)	0.004
Methoxychlor (1,1,1-trichloro-2,2=-bis[p-methoxyphenylethane])	0.1
Toxaphene ($C_{10}H_{10}Cl_6$, technical chlorinated camphene, 67-69 percent chlorine)	0.005
2,4-D (2,4-dichlorophenoxyacetic acid)	0.1
2,4,5-TP Silvex (2,4,5-trichlorophenoxypropionic acid)	0.01

Notes:
From Table 1 of 40 CFR 192, Subpart A, and Table 5C of 10 CFR 40, Appendix A.
[a] Milligrams per liter (mg/L), unless stated otherwise.
[b] Where natural isotopic abundances obtain, this criterion will be satisfied by a concentration of 0.044 mg/L. For conditions other than natural isotopic abundances, a corresponding value may be derived and applied, based on the measured site-specific ratio of the two isotopes of uranium.
[c] Title I sites only.
Abbreviations:
pCi/L = picocuries per liter.

For most sites, potentially hazardous constituents are identified in the remedial action or reclamation plans and were determined by sampling and analyzing tailings pore water and by groundwater monitoring.

For a transitioning UMTRCA Title II disposal site, a constituent is considered hazardous when all of the following criteria are met: (1) the constituent is reasonably expected to be in or derived from the byproduct material in the disposal area; (2) the constituent has been detected in the groundwater of the uppermost aquifer; and (3) the constituent is listed in Criterion 13 of Appendix A to 10 CFR 40 (10 CFR 40, Appendix A, Criterion 5[B][1]–[2]). Hazardous constituents for a site are determined before the site is transitioned to DOE for long-term care and is based a technical assessment of the historical groundwater monitoring results.

DOE may propose eliminating some hazardous constituents or water quality indicators from the long-term monitoring program presented in the LTSP that were monitored by the licensee prior to transition (the assessment should be appended to the LTSP). Stability and a downward concentration trend typically provide the technical rationale for eliminating a hazardous constituent or water quality indicator. NRC approval is required (through acceptance of the LTSP) before any analyte that was included in the licensee's monitoring requirements can be

eliminated from the long-term monitoring program. NRC may choose to consult with the State before approval is provided.

In addition to chemical analysis of tailings pore fluids and historical groundwater monitoring results, the LTSP should summarize other factors that may result in constituents being added to or removed from the list of hazardous constituents (10 CFR 40, Appendix A, Criterion 5[B][1]–[6]). Factors that may determine a site-related hazardous constituent include, but are not limited to, the following:

- The chemical composition of the raw ore.
- Chemical agents used for uranium extraction.
- Chemical analysis data from collection ponds, subsurface soils, or contaminated groundwater at the processing site.
- The chemical properties of compounds listed in 40 CFR 192, Appendix I (for Title I sites) or compounds listed in 10 CFR 40, Appendix A, Criterion 13 (for Title II sites) when they come into contact with groundwater in the uppermost aquifer (e.g., stability, solubility).

Two of the primary factors that must be evaluated before NRC will consider excluding a site-related hazardous constituent from the monitoring program are the following:

- The potential adverse effects on groundwater quality.
- The potential adverse effects on hydraulically connected surface water quality.

The complete list of factors that NRC will consider can be found at 10 CFR 40, Appendix A, Criterion 5(B)(3).

Table 3 is an example of how historical groundwater monitoring results can be presented in an LTSP.

Table 3. Monitoring Results from 2004 to 2008 at the Bear Creek, Wyoming, Disposal Site

Constituent	Range	Detects/Total Number of Samples
Beryllium (mg/L)	<0.01–<0.001	0/10
Cadmium (mg/L)	<0.01–<0.001	0/10
Chromium (mg/L)	<0.005–0.032	5/10
Molybdenum (mg/L)	<0.01–<0.001	0/10
Selenium (mg/L)	<0.001–0.014	21/25
Nickel (mg/L)	<0.001–0.032	15/45
Uranium, total (pCi/L)	1.2–629.6	45/45
Radium-226 (pCi/L)	0.29 ± 0.12–4.4 ± 0.7	45/45
Radium-228 (pCi/L)	<1.0–9.5 ± 1.2	26/45
Thorium-230 (pCi/L)	<0.2	0/45
Chloride (mg/L)	16–886	20/20
Sulfate (mg/L)	803–2,160	20/20

mg/L = milligrams per liter
pCi/L = picocuries per liter

For Title I sites, if groundwater monitoring is required, the LTSP summarizes groundwater monitoring well data if the wells (1) are specifically referenced in the text, (2) will be used in future groundwater protection activities at the disposal site, or (3) are not planned for sampling but will remain at the disposal site under LTS&M. Monitoring well data should be included for cell performance monitoring. Monitoring that is conducted to track the legacy plume or to assess the effectiveness of ongoing groundwater treatment is typically not included because these data are captured in other site documentation. DOE maintains monitoring well construction and location data, along with monitoring results, at their Legacy Management website (http://gems.lm.doe.gov/imf/ext/gems/jsp/launch.jsp).

For Title II sites, any groundwater corrective action program (or, if appropriate, an ACL application) must be completed prior to site transfer to DOE. Therefore, groundwater monitoring well data and other related information should be summarized, with more detailed information incorporated into the LTSP by reference. In addition, the licensee's pre-transition groundwater monitoring program should be assessed to establish a technical basis for the long-term groundwater monitoring program proposed in the final draft LTSP submitted to NRC for acceptance (the assessment results should be appended to the LTSP).

If an LTSP is being revised to modify an existing groundwater monitoring program, an assessment of the existing program and the technical basis for the modification should be performed and summarized in the revised LTSP, and the assessment results should be appended to the LTSP.

For all sites, a table that lists the monitoring locations and provides relevant information for each location, such as formation of completion, depth of the screened interval, and total depth of the well, is desirable. Springs or seeps that are used for monitoring should be identified. A site map showing all locations included in the long-term monitoring program should be provided in the LTSP.

In the context of the LTSP, background groundwater quality represents the quality that would exist in the uppermost aquifer at the disposal site if neither the tailings disposal nor any previous uranium processing had occurred at the disposal site (impacts from other non-site-related uranium mining and processing activities are considered part of the background, as are impacts to groundwater quality from naturally occurring uranium sources). For UMTRCA sites, the LTSP summarizes and implements the groundwater corrective action plan or equivalent groundwater remedy decision document, and it discusses background groundwater quality in the uppermost aquifer with respect to the basic properties of background groundwater,[9] including the following:

- Naturally occurring radionuclides.
- Total dissolved solids.
- Major cations (e.g., sodium, magnesium, calcium) and anions (e.g., sulfate, chloride, bicarbonate).

[9] For Title II sites, this information may be included in the corrective action plan for sites where groundwater remediation was conducted or in the ACL application and supporting documents. Several Title II sites are listed on the National Priorities List, and groundwater remedy decisions may be documented in a record of decision.

- pH.
- Oxidation-reduction potential.
- Trace elements and site-related constituents that exceed maximum concentration limits (Table 3).
- Range or variability of the above in background water quality.
- Comparison of the above to regional data, if available.

If the groundwater protection strategy for a Title I site is based on supplemental standards (40 CFR 192.21–22) related to background groundwater quality, the LTSP summarizes the basis for that determination.

An LTSP does not discuss potential changes in water quality due to the potential for failure of the disposal cell. An LTSP does summarize anticipated or reasonably possible changes in groundwater conditions in the monitored aquifer at the disposal site. Accordingly, an LTSP may discuss changes in groundwater quality caused by the following:

- Impacts from disposal cell construction or drainage of excess water from the disposal cell.
- Natural flushing or active remediation of existing groundwater contamination at the site.
- Future land or water uses in the vicinity of the site (e.g., in situ recovery operations).
- Short-term precipitation effects, cyclical seasonal variation, or long-term climatic influence.

This section should also include a discussion of any current and anticipated uses for surrounding groundwater in affected areas.

2.2.7 Institutional Controls

Complete remediation of contaminated soil and groundwater might not have been possible or practicable at some UMTRCA Title I and Title II processing and disposal sites, and therefore, in accordance with applicable regulations, residual site-related contamination may remain in place above primary standards (40 CFR 192.21; 10 CFR 40, Appendix A, Criterion 5[B][6], and NRC 1988). In such cases where residual contamination remains, particularly where it occurs (or is expected to occur) beyond the site's ownership boundary, ICs may be part of the remedy (40 CFR 192.12[c][2][i][B]) or may have been imposed as a temporary or long-term measure to ensure protection of human health and the environment. ICs must be enforceable, durable, and legally defensible, and applied in addition to any applicable regulatory numerical limits (NUREG-1620, Section 4.3.3.2[5]).

This section of the LTSP should define the ICs required for protection of human health and the environment. ICs are designed to mitigate unacceptable human health or environmental risks resulting from residual contamination left in place. The ICs discussed in this section are administrative controls, including federal ownership or jurisdiction of the site; instruments that convey restrictive easements or zoning ordinances; or any other real property instruments with enforceable restrictions. Federal ownership is considered the most protective and durable IC. Other ICs that should be described are those that define access limitations and notices, such as perimeter signs for radiological hazards. Engineered ICs, such as access controls and notices, are described in the discussion of disposal site conditions (see Section 2.2.5.4 of this guidance). Real

property instruments that describe ICs in place for a particular site should be appended to the LTSP. Monitoring of ICs is discussed in Section 2.3.8 of this guidance.

In addition to applicable laws and regulations, DOE Policy 454.1 addresses implementation and enforcement of ICs. DOE's IC guidance document provides what is necessary and acceptable for implementing the provisions of DOE Policy 454.1 (DOE pending). NRC and EPA also provide guidance on ICs (NRC 2003b and EPA 2010).

2.3 LTSP Section 3.0, "Long-Term Surveillance Program"

Section 3.0 of the LTSP describes the long-term surveillance program.[10] This may include descriptions of inspection frequency, NRC reporting requirements, inspection personnel qualifications, inspection procedures, routine maintenance and emergency measures, environmental monitoring programs, ICs monitoring, recordkeeping, and quality assurance procedures (10 CFR 40.27[b][3] or 10 CFR 40.28[b][3]). The LTSP refers to cooperative agreements and other instruments in place between DOE and the tribes or the states, for direction on notifications, reporting, or other needed actions.

2.3.1 General License for Long-Term Custody

This section of the LTSP describes the circumstances under which the site came under an NRC general license (10 CFR 40.27 for Title I sites or 10 CFR 40.28 for Title II sites), states that the general license remains effective in perpetuity, and provides the longevity requirements of the disposal cell design. Further, this section defines the requirement for notification to NRC should any change in the LTS&M program be warranted. This section also demonstrates how DOE provides permanent right-of-entry for NRC representatives (10 CFR 40.27[c][4] or 10 CFR 40.28[c][4]).

2.3.2 Requirements of the General License

To meet the requirements of the general licenses described in 10 CFR 40.27 or 10 CFR 40.28 and in 10 CFR 40, Appendix A, Criterion 12, the LTSP must, at a minimum, address the following requirements:

- Annual site inspection.
- Annual inspection report.
- Follow-up inspections and inspection reports, as necessary.
- Site maintenance, as necessary.
- Emergency measures and notifications in the event of a catastrophe.
- Environmental monitoring, if required.

The LTSP contains a table that shows where each requirement is addressed in the LTSP (see Table 1 in Section 2.1.2).

[10] The term "long-term surveillance program" is used interchangeably with "LTS&M program" in this guidance.

2.3.3 Annual Site Inspections

The LTSP describes disposal site inspections. The objectives of the site inspection are to evaluate and document the condition of the disposal cell and its associated surface water diversion structures, note any changes or modifications to the disposal cell and disposal site over time, and identify potential problems that could affect the performance of the disposal system and the protectiveness of the site. The LTSP should state that all activities will be conducted in compliance with all applicable regulations, and in accordance with DOE orders and DOE-approved personnel health and safety programs. The inspection detects and documents progressive changes as a result of slow-acting, natural modifying processes such as erosion, settlement, or rock degradation that could warrant subsequent evaluation and maintenance or repair. Visual inspection is the initial means of detecting a concern, which is typically documented with photographs (NUREG-1620, Appendix D, D2.2.3[5]). Quantitative measurements (e.g., land or aerial surveys to monitor settlement, rock gradation and durability measurements to monitor riprap degradation) may then follow if warranted. Additionally, the inspection should detect the results of intrusive human actions that can indicate failure of ICs or disturbance to the disposal system. Comparing baseline conditions recorded in the completion report to inspection findings provides a basis for evaluating cell performance and overall cell stability.

The LTSP will divide the site into "transects" for inspections. Transects are portions of a site that share common features or functions. Typical transects may include the disposal cell top slope and side slopes, diversion channels, the balance of the site between the outer edge of the disposal cell and the site perimeter, and outlying areas. DOE has adopted a protocol of including in the outlying area transect the land within 0.25 mile of the site's long-term care boundary. Features and activities more than 0.25 mile beyond the long-term care boundary may be of interest in assessing the long-term stability of the disposal site, and may be addressed in the inspection. An outlying area transect may be inspected from within the site boundary if features of interest or concern can adequately be assessed.

2.3.3.1 Frequency of Inspections

An inspection is conducted at least annually at each disposal site, as required by 10 CFR 40, Appendix A, Criterion 12, and NUREG-1620, Appendix D, D2.2.3(1). If circumstances warrant, follow-up inspections may be needed as described below in Section 2.3.5.

2.3.3.2 Inspection Procedure

The LTSP refers to this guidance document for recommendations on inspection preparation and conduct (10 CFR 40.27[b][3] or 10 CFR 40.28[b][3], and NUREG-1620, Appendix D, D2.2.3[5]). Prior to conducting inspections, inspectors should:

- Review the remedial action plan or reclamation plan, completion report, as-built drawings, and other appropriate documents listed in the LTSP references, such as an ACL application (if applicable).
- Review the LTSP, the permanent site file, previous site inspection reports and checklists, site inspection maps, and any maintenance tracking sheets or emergency-measures reports, and interview inspectors who participated in the previous inspection event.

- Prepare a site inspection checklist that indicates protocols (i.e., notifications), site directions and access routes, inspection transects, specific items of concern noted on previous inspections, and site surveillance features to be inspected.
- Prepare a site inspection field map that shows areas of concern and site surveillance features.
- Review safety procedures and generate a job safety analysis.
- Schedule the inspection in coordination with the DOE site manager.
- Notify NRC, State regulators, and tribal agencies (if applicable) of the inspection; coordinate logistics and provide directions to the site.
- Obtain permission to enter adjacent property, if necessary.
- Prepare a folder that includes copies of the following: the LTSP, the most recent inspection report, the current checklist and site inspection field map, the job safety analysis and pre-job brief/safety meeting attendance record form, the map showing directions to the nearest medical facility, and emergency response numbers and information.
- Check out a first aid kit from the Health and Safety department.
- Assemble equipment and supplies needed to conduct the inspection and perform any minor maintenance that is needed (e.g., folder of paperwork, cell phone and handheld communication radios, camera, first aid kit, water, sunscreen, insect repellant, proper field and work clothing, replacement warning signs and installation equipment, herbicide and clippers, fence repair equipment, personal protective equipment). Refer to the list of inspection equipment and supplies.

During an inspection, site inspectors must:

- Observe the condition of permanent disposal system structures and the balance of the site, including all site surveillance features. Note any anomalous or unexpected features or departures from as-built conditions that may require closer inspection (e.g., cell settlement or slumping, cover degradation, deep-rooted vegetation on cell, erosion features such as gullies or rills, sediment or vegetation accumulations in surface water diversion channels, vandalism, animal intrusion, noxious weeds, invasive plant growth).
- Record observations as necessary in field notebooks, on site maps, or on the inspection checklist. Field notes become part of the permanent site collection.
- Take photographs as necessary to document site conditions and to provide an ongoing record for monitoring changing conditions over time, particularly those that could impact the performance of the disposal system or the protectiveness of the site. The LTSP should reference current photograph documentation procedures to record photo locations and subject matter. DOE archives inspection photographs in DOE systems.

The LTSP incorporates by reference Attachment 3 of this guidance document, which presents general disposal site and disposal cell inspection techniques that should be considered while site inspections are being planned and performed. It is important that inspectors utilize both these inspection techniques and this guidance in order to maintain consistency among inspectors in performing site inspections.

2.3.3.3 Inspection Checklist

An inspection checklist (Attachment 4) that addresses site-specific conditions will be developed for each site inspection. Prior to an annual inspection, previous inspection results should be reviewed as discussed above in Section 2.3.3.2. Information or concerns documented in the previous inspection report should be included in the checklist, along with protocols (i.e., notifications), site directions and access routes, inspection transects, and site surveillance features to be inspected. The checklist addresses the areas of the site to be inspected (e.g., disposal system, perimeter, outlying area) and site-specific conditions and requirements, including the following:

- Disposal system integrity (e.g., settlement, erosion, bio-intrusion).
- Changes to surface water diversion structures, such as sedimentation, erosion, and vegetation accumulation.
- Condition of surveillance features (e.g., monuments, site markers, wells).
- Integrity of access to site (unfettered permanent right-of-entry must be maintained, e.g., rights-of-way are valid).
- Confirmation that site access controls are effective in preventing unwanted intrusion and that there are no impediments to authorized access (e.g., entrance gate is locked, no-trespassing/warning signs are posted).
- Review of the area within approximately 0.25 mile of the long-term care boundary of the disposal site for potential issues, such as evidence of human activity that could impair the performance or protectiveness of the disposal system and site, or geomorphic features (e.g., stream channels, gullies) that could initiate significant erosion within the site that would have the potential to impact the disposal system.

Other conditions that might require observation include:

- Unique cell design criteria that require monitoring.
- Livestock or other animal intrusion on the site.
- Volunteer plant growth that requires identification and measurement and could possibly require control or removal (particularly with regard to deep-rooted vegetation on the disposal cell or significant accumulations within surface water diversion structures).
- High-water marks, areas of active erosion and sedimentation, and changes in the alignment of surface water flow channels.

The initial site inspection checklist is appended to the LTSP.

2.3.3.4 Personnel

The LTSP establishes the qualifications for the site inspection team. Qualifications include the need for technical specialists on the team based on knowledge of disposal site design, specific site surveillance requirements, and conditions expected at the site (10 CFR 40.27[b][3] or 10 CFR 40.28[b][3], and NUREG-1620, Appendix D, D2.2.3[4]). An inspection team must comprise at least two inspectors. Team members should have the technical background and experience needed to evaluate physical and environmental conditions at the site. Typically inspectors are engineers (civil, geotechnical, or geological) or scientists (geologists, hydrologists,

or ecologists). Personnel knowledgeable of real property and environmental compliance may also need to be consulted periodically.

2.3.4 Annual Inspection Report

Applicable regulations (10 CFR 40, Appendix A, Criterion 12, and NUREG-1620, Appendix D, D2.2.3[2]) require DOE to annually submit the results of all site inspections and monitoring to NRC within 90 days of the last site inspection for a given calendar year. The purpose of the report is to demonstrate that all license conditions are met and that the sites remain protective.

DOE compiles the results of all site-specific inspections and other site-specific information (such as monitoring results) into separate reports for Title I sites and Title II sites. The results and assessment for each site make up a chapter of the report.

A copy of all site inspection reports, including field notes, will be maintained in the permanent site file.

2.3.5 Follow-Up Inspections

This section of the LTSP addresses NRC regulations requiring that the criteria for follow-up inspections in response to unusual observations from routine inspections and extreme natural events must be included in the LTSP (10 CFR 40.27[b][4] or 10 CFR 40.28[b][4], and NUREG-1620, Appendix D, D2.2.4[2]). NRC guidance indicates that events such as a heavy storm or an earthquake are examples of the type of events that should warrant a follow-up inspection (NUREG-1620, Appendix D, D2.2.4[1]). NRC is notified prior to the follow-up inspection if the reported problem indicates that the disposal cell has been compromised or that extensive repair or emergency measures could be needed.

An LTSP describes the DOE agreement with the U.S. Geological Survey National Earthquake Information Service to notify DOE in the event of an earthquake in the disposal site area. Attachment 5 provides the criteria for earthquake reporting. DOE also typically monitors severe weather and other disaster notifications issued by the federal government for those areas where disposal sites are located.

2.3.5.1 Personnel

Follow-up inspections will be conducted by technical specialists in the disciplines appropriate to the problem that has been reported. The LTSP should state that the same criteria for selecting inspectors for the annual inspection will be used for follow-up inspections.

2.3.5.2 Reports of Follow-Up Inspections

Follow-up inspection reports should reflect the urgency of the need for the follow-up inspection. If unusual damage or disruption is discovered during the inspection, or is reported to DOE, and a follow-up inspection is conducted, DOE will submit a preliminary site inspection report to NRC within 60 days (10 CFR 40, Appendix A, Criterion 12, and NUREG-1620, Appendix D, D2.2.3[2]). NRC regulations and guidance provide no definition or example of what constitutes unusual damage or disruption, but DOE will submit a report if site structures are degraded or

there is a threat of release of regulated materials or another threat to human health and the environment. If the follow-up inspection is for a routine matter, results will be reported in the next annual compliance report.

Follow-up inspection reports should include:

- A description of the problem that triggered the follow-up inspection.
- A preliminary assessment of the maintenance, repair, or emergency measures required.
- Conclusions and recommendations.
- Assessment data, including field inspection data and photographs.
- Inspectors' names, qualifications, and signatures.

2.3.6 Routine Site Maintenance and Emergency Measures

2.3.6.1 Routine Site Maintenance

Although UMTRCA disposal cells are designed to be effective for 1,000 years or at least 200 years (40 CFR 192.02[a]–[d] and 10 CFR 40, Appendix A, Criterion 6) and are constructed so that "ongoing active maintenance is not necessary to preserve isolation" of radioactive material (10 CFR 40, Appendix A, Criterion 12), the LTSP should identify any routine site maintenance required to preserve site function and conditions (i.e., to ensure protection of human health and the environment).

As a steward of the land, DOE also recognizes the need to maintain compliance with all other applicable federal, State, and local regulations. However, the LTSP should include only those activities necessary to maintain compliance with requirements of the general license at 10 CFR 40.27 (Title I sites) and 10 CFR 40.28 (Title II sites). Any other land steward maintenance activities being performed that are not required by the NRC general license should be addressed in programmatic documents external to the LTSP.

The LTSP identifies routine or reasonably anticipated custodial activities, the timing and frequency with which they are performed, and the manner in which the work is authorized (10 CFR 40.27[b][5] or 10 CFR 40.28[b][5]). The LTSP should describe how these activities are necessary to maintain protectiveness, and how they will be performed, evaluated, and reported.

The following are examples of maintenance or repair tasks that might be specified in an LTSP:

- **Planned maintenance:** grass mowing, road maintenance, control of noxious and invasive weeds, removal of accumulated debris, vegetation control (e.g., deep-rooted plants growing on the disposal cell or significant growth within surface water diversion structures), or sign replacement.
- **Unscheduled maintenance:** removal of deep-rooted or other unwanted vegetation on the disposal cell, if required to maintain performance.
- **Repair:** restore the function of the fence, gate, or locks; surveillance features; wells; or roads.
- **Repair:** mitigation of modifying processes that could eventually compromise disposal cell integrity (e.g., erosion, settlement, slumping, rock degradation).

Failure of planned vegetation to establish within a specified amount of time may warrant further analysis and action, particularly if it results in erosion that could impact the performance of the disposal cell or associated surface water drainage structures.

The LTSP describes custodial care implementation and reporting requirements. At a minimum, the party that performs the work provides DOE with verification of the work. DOE inspects the work and certifies that it was completed in accordance with the specifications. Documentation of the site custodial maintenance or repairs is included in the annual compliance report to NRC.

A record of the custodial work that is documented and incorporated into the permanent site file includes the following:

- A summary of the work required (statement of work)
- Procurement documents (drawings, specifications, subcontract)
- Documentation of completion of the work

As discussed in Section 1.0, DOE will provide a technical or regulatory basis and cost estimate (for the LTS&M scope presented in the LTSP) for NRC's consideration in determining the LTSC prior to transition of an UMTRCA Title II disposal site.

2.3.6.2 Emergency Measures

This section defines how DOE will respond to unusual damage or disruption that threatens or compromises site safety, site security, or the integrity of the disposal system (10 CFR 40.27[b][5] or 10 CFR 40.28[b][5], and NUREG-1620, Appendix D, D2.2.5). The difference between maintenance or repairs and emergency measures is determined by the cause and magnitude of the problem, the immediate threat to public health or the environment, and the need to comply with applicable regulatory standards.

Site inspectors evaluate the problem and make recommendations for follow-up activity (e.g., immediate action or continued evaluation). Recommendations for the next step will be determined as follows: (1) DOE will assess the design bases governing the adequacy of the damaged site feature and the ability of the site design to control or accommodate the observed problem; (2) DOE will determine the extent of the damage or degradation and will compare existing conditions to design conditions; (3) as necessary, DOE will evaluate the existing conditions to determine if a design-basis event or continuation of the event causing the concern can be withstood by the feature in its existing condition; and (4) DOE will provide to NRC (verbally and in either the annual report or a separate report) a technically defensible basis for concluding whether the event causing the concern can be withstood by the feature in its existing condition or whether remedial measures or another response is necessary. After NRC reviews the report recommending no action or follow-up action, if action is recommended, DOE then prepares an action plan and submits it to NRC for review. DOE begins the follow-up action only after NRC has concurred with the plan.

NRC regulations or guidance do not specify a time frame for implementing emergency measures. The relative severity and threat to public health and safety or the environment will dictate how quickly action must be taken.

For groundwater corrective actions, the U.S. Environmental Protection Agency groundwater standards require that a corrective action program must be in operation no later than 18 months after a finding of exceedence (40 CFR 192.04, 40 CFR 192.33, and NUREG-1620, Appendix D, D2.2.4[1]). Assessing the extent of the problem and developing a corrective action plan is not considered initiation of the corrective action program.

The following are examples of disposal site conditions that might require emergency measures (depending on the magnitude and severity of the problem), all of which could result in exposure to or release of regulated materials at concentrations that may impact human health or the environment:

- Surface rupture of the disposal cell, such as cracks, differential settlement, or severe shrinkage of the cover materials.
- Subsidence, sliding, or slope instability on the disposal cell caused by mass wasting, liquefaction, or differential settlement.
- Development of rills or gullies on the cell surface threatening an actual or potential breach of cell integrity.
- Deterioration to the point of loss of function of the erosion protection rock on the disposal cell or in surface water drainage ditches.
- Seepage originating from within the disposal cell that results in a surface expression.
- Development of gullies on or adjacent to disposal site property that could affect the integrity of the disposal cell.
- Rapid headward cutting of a nearby gully, arroyo, or ravine that threatens the stability of the disposal cell.
- Encroachment of stream channels onto the disposal site.
- Damage to the cell cover or disposal site property because of river encroachment, seismic events, flooding, catastrophic events, volunteer plant growth, bio-intrusion, or vandalism such as the removal of cell construction materials.
- Groundwater quality degradation from site-related constituents originating from the disposal cell that are above applicable protection standards and that may require corrective action.

The LTSP discusses emergency measures and reporting requirements for response actions. NRC reviews the reports, which may be submitted as generated or incorporated into the annual report (depending on the magnitude and severity of the problem). After an action is completed that involves modifying or restoring engineered structures, DOE certifies that the work is in accordance with design specifications. NRC concurs with the certification. All reports, data, and documentation generated during emergency measures or corrective actions, including a copy of the certification statement and the NRC concurrence, are retained in the DOE permanent site file.

2.3.6.3 Criteria for Routine Site Maintenance and Emergency Measures

In accordance with NUREG-1620, Appendix D, D2.2.5, this section of the LTSP defines the DOE response criteria for increasingly serious levels of disruption. The LTSP should include a table of criteria for maintenance and emergency measures. Table 4 has been used in recent LTSPs.

Table 4. DOE Criteria for Maintenance and Emergency Measures

Priority	Description[a]	Example	Response
1	Breach of disposal cell with dispersal of radioactive material.	Seismic event that exceeds design basis and causes massive discontinuity in cover.	Notify NRC and State. Immediate follow-up inspection by DOE radiological control personnel. Emergency actions to prevent further dispersal, recover radioactive materials, and repair breach.
2	Breach without dispersal of radioactive material.	Partial or threatened exposure of radioactive materials.	Notify NRC and State. Immediate follow-up inspection by DOE radiological control personnel. Emergency actions to repair the breach.
3	Breach of site security.	Human intrusion, vandalism.	Restore security; urgency based on assessment of risk.
4	Maintenance of specific site surveillance features.	Deterioration of signs, markers.	Repair at first opportunity.
5	Minor erosion or undesirable changes in vegetation.	Erosion not immediately affecting disposal cell, invasion of undesirable plant species.	Evaluate, assess impact, and respond as appropriate.

[a] Other changes or conditions will be evaluated and treated similarly on the basis of risk.

2.3.6.4 Reporting Maintenance and Emergency Measures

In accordance with 10 CFR 40.27(b)(5) or 10 CFR 40.28(b)(5), this section of the LTSP defines the NRC notification requirement prior to DOE undertaking any significant construction, action, or repairs related to the disposal site, even if the action is required by a State or another federal agency.

The LTSP should also state that if a site-related emergency requires public notification, DOE will take appropriate action to notify parties who might be affected and advise them of precautions that should be taken. Local law enforcement and government officials, news media, DOE and NRC representatives, and tribal or State representatives should be included in this process. Nothing in the LTSP may negate or override DOE occurrence-reporting requirements.

The DOE 24-hour contact telephone number, 970-248-6070, is posted on the site entrance sign. Area residents may contact DOE to report problems or concerns. DOE also maintains a public website that provides notification phone numbers; this website can be found through an Internet search engine by inputting "U.S. Department of Energy, Office of Legacy Management." The LTSP should mention this DOE website.

The following information should be provided in the LTSP to address reporting:

> Routine maintenance will be reported in the annual report to NRC. In accordance with 10 CFR 40.60, within 4 hours of discovery of any occurrence "that prevents immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed regulatory limits or releases of licensed materials that could exceed regulatory limits . . . ," such as a Priority-1 or Priority-2 event listed in Table 4, DOE will notify the following group at NRC:
>
> Decommissioning and Uranium Recovery Licensing Directorate,
> Division of Waste Management and Environmental Protection,
> Office of Federal and State Materials and Environmental Management Programs,

U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, Maryland 20852-2738

If an event is determined to require NRC notification within 4 hours, the NRC Operations Center should be contacted. The phone number for the NRC Operations Center is 301-816-5100.

2.3.7 Environmental Monitoring

This section of the LTSP describes environmental monitoring requirements for the site and the rationale or drivers for the monitoring. Program descriptions should include criteria for discontinuing monitoring, any periodic review requirements, and the parameters for the reviews. The LTSP should describe how the long-term environmental monitoring activities are necessary to maintain and demonstrate protectiveness, and comply with applicable regulatory requirements both within and at the site's long-term care boundary.

As discussed in Section 1.0, prior to the transition of an UMTRCA Title II disposal site, DOE will provide a technical or regulatory basis and cost estimate for the LTS&M scope, including environmental monitoring, presented in the LTSP for NRC's consideration in determining the LTSC.

2.3.7.1 Groundwater Monitoring

This section of the LTSP describes site-specific groundwater monitoring requirements as required to implement the approved groundwater remedy. Groundwater monitoring might be required to determine if the cell is performing as designed, to track legacy plume movement, or to demonstrate compliance with applicable water quality standards at the POC. Groundwater monitoring is also beneficial in demonstrating compliance with applicable water quality standards at the POE, and for measuring the rate of attenuation (as predicted by fate and transport modeling) at designated trend wells located between the POC and POE. Groundwater monitoring is not required at all sites.

An LTSP does not describe compliance activities for preexisting groundwater contamination associated with uranium milling activities unless these activities could impact the long-term groundwater protection strategy of the disposal cell or the ability to assess this strategy. If so, they are summarized in the LTSP. Preexisting (i.e., legacy) groundwater contamination associated with former uranium milling activities that underlies a disposal cell constructed from a preexisting/in-place tailings impoundment often complicates an assessment of cell performance in the relative near term because of the difficulty in distinguishing legacy contamination from contamination that may have resulted from a more recent cell performance issue. Additionally, in-place tailings impoundments are often located in areas that contain uranium-ore-bearing formations, which also tend to complicate an assessment of cell performance and legacy contamination due to the presence of naturally occurring constituents in groundwater within these formations that are also present in the tailings pore fluid. Again, distinguishing between these sources can be difficult.

For a transitioning UMTRCA Title II disposal site, an assessment of the licensee's pre-transition groundwater monitoring program should be performed to establish a technical basis for the long-

term groundwater monitoring program proposed in the draft LTSP that is submitted to NRC for acceptance. Trend graphs of the licensee's historical groundwater monitoring data should be generated and reviewed to determine whether stability has been achieved and to ensure that concentrations of site-related COCs are below applicable groundwater protection standards at both the POC and POE, and that concentrations are within predicted values at trending locations between the POC and POE. This assessment should be appended to the LTSP.

Disposal Sites Not Requiring Groundwater Monitoring—If long-term groundwater monitoring is not necessary at a disposal site, the basis for the decision not to conduct monitoring is summarized in the LTSP, and the regulatory concurrence for the decision is cited. This summary refers to the site hydrology and groundwater characteristics description from Section 2.0 of the LTSP and provides a technical rationale for not monitoring groundwater. It references appropriate documents for more information on groundwater characteristics.

If regulatory concurrence to not conduct groundwater monitoring does not exist and long-term groundwater monitoring is determined to be unnecessary or discontinued, a detailed technical basis for not performing the monitoring should be presented as an appendix to the draft or revised LTSP. NRC acceptance of the LTSP will then serve as the regulatory concurrence to not conduct groundwater monitoring.

For a transitioning Title II site, if site-specific circumstances warrant, the licensee typically submits a license amendment request to NRC prior to transition that would include the technical basis for not conducting groundwater monitoring under long-term management. NRC approval and subsequent license amendment would provide the regulatory concurrence for adopting this approach into the LTSP for the site (provided DOE agreed with the technical rational for not conducting groundwater monitoring).

Disposal Sites Requiring Groundwater Monitoring—NRC regulations require that each LTSP describe (1) the proposed frequency and extent of groundwater monitoring and (2) appropriate constituent concentration limits for groundwater (10 CFR 40.27[b][3] or 10 CFR 40.28[b][3] and NUREG-1620, Appendix D, Section D2.2.3[3]). The LTSP should provide the rationale and technical justification for the locations, analytes, and frequencies invoked in the long-term groundwater monitoring program. Predicted concentrations (or target levels) of COCs, over time, at the designated POC, POE, and trend well locations should also be provided, if available. Specific citations and guidance for LTSP content with regard to groundwater monitoring include the following:

- Background groundwater condition (40 CFR 192.12[c][1] and NUREG-1620, Appendix D, D2.2.3).
- Hazardous constituents in the groundwater (40 CFR 192.02[c][1], Section 4.3.3.1.1 of NRC 1993, and Section 4.0 of NRC 2003).
- POC for monitoring (40 CFR 192.02[c][4] and NUREG-1620, Appendix D, D2.2.3[3]).
- POE for monitoring (NUREG-1620, Appendix D, D2.2.3[3]).
- Monitoring well locations (40 CFR 192.20[b][4] and NUREG-1620, Appendix D, D2.2.3[3]).

- Groundwater protection standards (40 CFR 192.02[c][3], 40 CFR 192.12, 40 CFR 192.32, and NUREG-1620, Appendix D, D2.2.3[3]).
- Indicator parameters (40 CFR 192.20[b][4] and NUREG-1620, Appendix D, D2.2.3[3]).
- Sampling frequency (40 CFR 192.20[b][4] and NUREG-1620, Appendix D, D2.2.3[3]), noting that follow-up or additional sampling events may be triggered by an unexpected increase of hazardous constituent concentrations in the groundwater (NUREG-1620, Appendix D, D2.2.4[1]).
- Sampling and analysis procedures (NUREG-1620, Appendix D, D2.2.3[3]). The *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PLN/S04351 [DOE current version]) or an equivalent plan should be cited.
- Corrective actions to be taken if exceedences occur (40 CFR 192.04; 40 CFR 192.33; NUREG-1620, Appendix D, D2.2.3[3] and D2.2.4[1]). The LTSP should address not only the timing of a corrective action but also the criteria for determining if a corrective action is warranted and that it is required.
- Exit strategy (i.e., the criteria that must be met in order to discontinue the long-term groundwater monitoring program entirely). No specific citation or regulatory guidance regarding this matter is available; however, the LTSP should state that regulatory concurrence is required to discontinue groundwater monitoring.

It may be useful to include tables in this section to summarize the groundwater monitoring program. Tables should include the following information: a list of the wells to be sampled, the sampling frequency, the analytes or COCs to be sampled for in each well, the applicable groundwater protection standards, predicted maximum concentrations over time at key monitoring locations (i.e., POC, POE, and trend wells), background concentrations, and the rationale (the hydrologic relationship and purpose of the data) for each well in the monitoring network.

Groundwater monitoring may be determined necessary for a finite period (i.e., duration). The monitoring duration determined must have a valid and defensible technical basis (e.g., modeling predictions that have been validated using observed trends). The LTSP should also define the conditions (i.e., criteria) that must be met in order to halt groundwater monitoring. If the criteria are met, NRC then must concur that groundwater monitoring can be halted, and the LTSP must be revised and accepted by NRC. The duration of groundwater monitoring will influence DOE's life-cycle annual cost estimate for performing LTS&M, and therefore, it should also influence the LTSC NRC accesses the licensee for a transitioning UMTRCA Title II disposal site.

2.3.7.2 Vegetation Monitoring

This section of the LTSP should discuss how vegetation will be managed onsite, primarily with regard to the disposal cell and surface water diversion structures. The growth of deep-rooted plants on the disposal cell may or may not be of concern; it is typically a site-specific determination. The growth of vegetation within surface water diversion structures should be monitored and controlled if the performance of the structures is becoming impacted.

Field observations show that rock covers on UMTRCA disposal cells support volunteer plant growth (DOE 1992, Burt 1995). Although this plant growth was not planned, DOE observed

soon after completion of the first Title I disposal cells that some limited plant growth likely would occur on the cells (DOE 1995). More recent research suggests that allowing the natural succession of native vegetation to proceed on the disposal cells may actually benefit the long-term performance of the cells by transforming the conventional low-permeability covers into water balance covers, particularly in arid and semiarid environments (Waugh et al. 2009). Additional information regarding managing vegetation encroachment on a disposal cell is provided in Attachment 3 of this guidance.

If control of vegetation on the disposal cell is required or determined to be warranted, the common plant species growing on many of the disposal cells are known and should be described or referenced in the LTSP. Conversely, DOE may propose that vegetation on the engineered cover does not need to be managed. The LTSP also should summarize (or provide the reference for) the following information, if available:

- Status of volunteer plant growth on the cell and the anticipated plant succession, with an assessment of the long-term impact of these plants on cover integrity.
- The potential for bio-uptake of contaminants or effect of the plant growth on the performance of the radon barrier.
- Information (including field data) regarding the rooting patterns of some of the common plants observed on the rock-covered disposal cells (DOE 1992, Burt 1995), and data from the literature pertaining to rooting patterns of some common species observed at the sites so that root depth may be predicted (DOE 1995).
- Vegetation control measures used at the site.
- Conditions that may dictate the initiation or continued use of vegetation control measures.

For a transitioning Title II disposal site, regardless of whether the control of vegetation growth on the disposal cell was required as part of the remedy to maintain cell performance or was being performed by the licensee prior to transition, deep-rooted plants establishing on the engineered cover may be of concern. DOE should assess the need for controlling vegetation growth on the disposal cell under long-term management based on the findings of recent research. The assessment should be appended to the draft LTSP submitted to NRC for acceptance. Proposed vegetation management practices on the disposal cell or the determination that vegetation management is not a required part of the LTS&M program should be presented under the maintenance section of the draft LTSP.

Although control of noxious weeds and undesirable invasive plants may be required by other federal, State, or local regulations and is therefore performed by DOE as a land management practice, because it is not included under the general license for UMTRCA Title I or Title II disposal sites (10 CFR 40.27 or 10 CFR 40.28) or addressed in NRC guidance for UMTRCA Title II disposal sites (NUREG-1620), requirements for managing this type of vegetation should not be incorporated into the LTSP.

2.3.8 Land Use Monitoring

The LTSP should describe land use monitoring that will be performed. Land use monitoring should be conducted at the time of the annual inspection to identify uses in the surrounding area that might impact the site (e.g., local water use, adjacent land development) and which could have the potential to impact the migration of a site-related contaminated groundwater plume or

result in diminishing protectiveness. Periodically, State and local records should be checked to verify that any changes in the surrounding land use do not significantly impact the site's overall protectiveness.

2.3.9 Institutional Controls Monitoring

The LTSP should define the frequency of monitoring and the steps DOE will take to ensure that any required ICs remain effective (i.e., durable), such as a periodic documented awareness check with applicable property owners or verification of continued transparency within the public record. This includes monitoring of those ICs related to (1) restricting unauthorized entry, (2) notices of contamination, and (3) enforceable restrictions that limit land uses and prevent access to contaminated soil or groundwater. Procedures for responding to violations in ICs should be included or cited in this section of the LTSP.

2.3.10 Records

The LTSP identifies and summarizes DOE-approved recordkeeping requirements that apply to LTS&M documentation (DOE 2004). DOE updates and maintains the following documents:

- DOE's annual report to NRC that documents the results of inspections as required by 10 CFR 40.27(b)(3) or 10 CFR 40.28(b)(3).
- Files and original deeds, custody agreements, and other real property documents.
- Surveillance and maintenance documentation.
- Emergency-measures records.
- Groundwater monitoring and corrective action records.
- Other documents that describe site conditions and activities.

Records will be managed and maintained in accordance with schedules and procedures established by the National Archives and Records Administration and DOE Order 1324.5B, *Records Management Program*. The LTSP should reference current guidance and policy for records management.

2.3.11 Quality Assurance

The LTSP refers to DOE quality assurance requirements and procedures (10 CFR 40.27[b][3] or 10 CFR 40.28[b][3], and NUREG-1620, Appendix D, D2.2.3[6]) that must be followed during implementation of the surveillance and maintenance program, including DOE Order 414.1C, *Quality Assurance*.

2.3.12 Health and Safety

This section of the LTSP should include references to DOE orders, the DOE Integrated Safety Management System, and other applicable federal regulations. The most current version of the applicable health and safety manual should be referred to specifically. This section of the LTSP should also state that all LTS&M activities conducted under the LTSP will adhere to these referenced health and safety regulations, programs, and documents.

2.4 LTSP Section 4.0, "References"

Future custodians will need access to site information to augment descriptive information that is summarized in an LTSP. As stated previously, NRC regulations and guidance allow site information to be incorporated into an LTSP by reference (10 CFR 40.27[b][2] or 10 CFR 40.28[b][2], and NUREG-1620, Appendix D, D2.2.2). The references section of an LTSP must contain citations for decision documents, plans and specifications, and pertinent correspondence that substantiate site conditions and remedy concurrence. Regulations and guidance in effect when the LTSP was developed should also be cited. The LTSP author must check the references to ensure that all applicable reference materials are cited in the LTSP and that the references cited are the most current version.

Below is a sample list of references. It includes some documents that are broadly applicable to sites in general, and typical kinds of site-specific documents (in this example, specific to the Bear Creek, Wyoming, UMTRCA Title II disposal site):

ASQC (American Society for Quality Control), 1994. *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs*, ANSI/ASQC E4–1994, Energy and Environmental Quality Division, Environmental Issues Group.

10 CFR 40. U.S. Nuclear Regulatory Commission, "Domestic Licensing of Source Material," *Code of Federal Regulations*, January 1, 2009.

10 CFR 40.28. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-term Care of Uranium or Thorium Byproduct Materials Disposal Sites," *Code of Federal Regulations*, January 1, 2009.

10 CFR 40.60. U.S. Nuclear Regulatory Commission, "Reporting Requirements," *Code of Federal Regulations*, January 1, 2009.

44 USC 29. "Records Management by the Archivist of the United States and by the Administrator of General Services," *United States Code*, available online at http://www.archives.gov/about/laws/records-management.html (accessed June 1, 2009).

44 USC 31. "Records Management by Federal Agencies," *United States Code*, available online at http://www.archives.gov/about/laws/fed-agencies.html (accessed June 1, 2009).

44 USC 33. "Disposal of Records," *United States Code*, available online at http://www.archives.gov/about/laws/disposal-of-records.html (accessed June 1, 2009).

DOE (U.S. Department of Energy), 2001. *Guidance for Implementing the Long-Term Surveillance Program for UMTRCA Title I and Title II Disposal Sites*, prepared by the U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, GJO–2001–215–TAR, April. [The LTSP will cite the current version of this guidance]

DOE (U.S. Department of Energy), 2004. *LM Information and Records Management Transition Guidance*, March.

DOE Guides: 1324.5B, *Implementation Guide for Use with 36 CFR Chapter XII – Subchapter B – Records Management*, July 19, 1996.

DOE Orders: 231.1A Chg. 1 *Environment, Safety, and Health Reporting*, June 3, 2004.
414.1C, *Quality Assurance*, June 17, 2005.
430.2B, *Departmental Energy, Renewable Energy and Transportation Management*, February 27, 2008.
450.1A, *Environmental Protection Program*, June 4, 2008.

Executive Orders: 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, January 24, 2007.

Health and Safety Manual, LMS/POL/S04321, continually updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

NRC (U.S. Nuclear Regulatory Commission), 1990. *Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites,* NRC Final Staff Technical Position, August.

NRC (U.S. Nuclear Regulatory Commission), 1991. "Notice of Intent to Amend License Approving Change to a Reclamation Plan for an Inactive Uranium Recovery Facility—Bear Creek," *Federal Register*, Volume 56, Number 245, Page 66089, December 20.

NRC (U.S. Nuclear Regulatory Commission), 1997. "Review of Request for Alternate Concentration Limits," letter from J. Holonich, NRC, to G. Chase, Bear Creek Uranium Company, includes Technical Evaluation Report, June 30.

NRC (U.S. Nuclear Regulatory Commission), 2001. "Review of the Bear Creek Tailings Reclamation Construction Report, Amendment No. 45 to Source Material License SUA-1310," letter to E. Scott, Bear Creek Uranium Company, from M. Leach, NRC, includes Technical Evaluation Report, July 3.

NRC (U.S. Nuclear Regulatory Commission), 2002. "Review of the Draft Long-Term Surveillance Plan for the Bear Creek Tailings Disposal Site in Converse County, Wyoming," letter to A. Kleinrath, DOE, from D. Gillen, NRC, includes Technical Evaluation Report, October 8.

NRC (U.S. Nuclear Regulatory Commission), U.S. Department of the Interior, U.S. Department of Agriculture, 1977. *Final Environmental Statement Related to the Bear Creek Project*, June.

UPR (Union Pacific Resources Group Inc.), 1991. *Bear Creek Tailings Reclamation Plan*, November.

UPR (Union Pacific Resources Group Inc.), 1997. *Alternate Concentration Limit Application*, February 28.

UPR (Union Pacific Resources Group Inc.), 1999. *Bear Creek Tailings Reclamation Construction Report*, December.

WDEQ (Wyoming Department of Environmental Quality), 1994. Letter to J.E. Virgona, DOE, from D. Hemmer, WDEQ, declining custody of all UMTRCA Title II sites within the State of Wyoming, July 15.

WDEQ (Wyoming Department of Environmental Quality), 1999. "Long-Term Groundwater Quality Concerns," based on Review of the Application for Alternate Concentration Limits (ACLs), TFN 3 33/122, letter to E. Scott, UPR, from G. Cash, WDEQ, May 3.

Wright Water Engineers, 1975. *Preliminary Ground Water Hydrological Report, Bear Creek Project*, Denver, Colorado, March.

2.5 LTSP Appendixes

Additional information is appended to the LTSP to further describe or support the LTS&M program. This information typically includes the following:

- **Appendix A:** real property documentation, including a recorded deed, withdrawal notices, access agreements, and documentation of other real property interests such as ICs.
- **Appendix B:** sample field photograph log.
- **Appendix C:** initial site inspection checklist.

For a transitioning Title II site, an evaluation of the pre-transition groundwater monitoring program conducted by the licensee, which is used for establishing the technical basis for the long-term groundwater monitoring proposed in the draft LTSP, should also be appended. The evaluation should include time-versus-concentration trend graphs of historical groundwater monitoring data.

An assessment that determines whether vegetation should be controlled on the disposal cell should also be appended to all UMTRCA Title I and Title II disposal site LTSPs.

2.6 Supplemental Information

The NRC LTSP acceptance letter for the initial LTSP at transition, along with the NRC acceptance letters for any subsequent revisions, should be included (and titled) as supplemental information at the end of all LTSPs. NRC's corresponding technical evaluation reports should also be included.

3.0 Document Review

Once the LTSP has been drafted, it is useful for the site lead, subject matter experts, and personnel from functional support groups to review the content to ensure that it is correct and presented properly for acceptance by NRC. For an initial LTSP for a Title II transition site, it can be beneficial to also request a review by the site licensee.

4.0 LTSP Revision

During the course of long-term stewardship, site conditions, new data, or reuse opportunities may require or warrant changes to the LTS&M program for a site. In these cases, NRC must be notified of the changes, and the LTSP must be revised and submitted to NRC for acceptance (10 CFR 40.27[c][3] or 10 CFR 40.28[c][3]). Any changes made to an LTSP require NRC notification and acceptance.

5.0 Environmental Management System

The LTSP includes the federal mandates for an environmental management system and the associated objectives for resource conservation, resource management, and sustainability. This information is typically presented in Section 1.0 of the LTSP and should include references to DOE Order 450.1A, *Environmental Protection Program*; Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*; and Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*. LTSPs should also state the ongoing obligation to implement sound environmental stewardship practices that are protective of the air, the water, the land, and other natural and cultural resources that DOE operations may impact.

6.0 References and Bibliography for this Guidance

10 CFR 40, Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations*, January 1, 2009.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*, January 1, 2009.

10 CFR 40.28. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Uranium or Thorium Byproduct Materials Disposal Sites," *Code of Federal Regulations*, January 1, 2009.

10 CFR 40.60. U.S. Nuclear Regulatory Commission, "Reporting Requirements," *Code of Federal Regulations*, January 1, 2009.

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*, July 1, 2010.

44 USC 29. "Records Management by the Archivist of the United States and by the Administrator of General Services," *United States Code*, http://www.archives.gov/about/laws/records-management.html (accessed June 1, 2009).

44 USC 31. "Records Management by Federal Agencies," *United States Code*, http://www.archives.gov/about/laws/fed-agencies.html (accessed June 1, 2009).

44 USC 33. "Disposal of Records," *United States Code*, http://www.archives.gov/about/laws/disposal-of-records.html (accessed June 1, 2009).

Burt, C., 1995. Jacobs Engineering Group Inc., personal communication with S. Cox, Jacobs Engineering Group Inc., UPDCC File Location No. 5.15.1.1, Albuquerque, New Mexico, October 5.

DOE (U.S. Department of Energy), 1992. *Vegetation Growth Patterns on Six Rock-Covered UMTRA Project Disposal Cells*, DOE/AL-400677.0000, prepared for the U.S. Department of Energy UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

DOE (U.S. Department of Energy), 1995. *UMTRA Project Disposal Cell Cover Biointrusion Sensitivity Assessment*, DOE/AL/62350-200, Rev. 1, prepared for the U.S. Department of Energy Environmental Restoration Division, UMTRA Project Team, Albuquerque, New Mexico.

DOE (U.S. Department of Energy), 2004. *LM Information and Records Management Transition Guidance*, March.

DOE (U.S. Department of Energy), 2012. *Process for Transition of Uranium Mill Tailings Radiation Control Act Title II Disposal Sites to the U.S. Department of Energy Office of Legacy Management for Long-Term Surveillance and Maintenance*, LMS/S05096, Office of Legacy Management, March.

DOE (U.S. Department of Energy), current version. *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*, LMS/PLN/S04351, continually updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

DOE (U.S. Department of Energy), pending. *Guidance for Developing and Implementing Institutional Controls for the U.S. Department of Energy Office of Legacy Management Sites*, LMS/S07617, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

DOE Guides: 1324.5B, *Implementation Guide for Use with 36 CFR Chapter XII – Subchapter B – Records Management*, July 19, 1996.

DOE Orders: 231.1A, *Environment, Safety, and Health Reporting*, Chg. 1, June 3, 2004.
414.1C, *Quality Assurance*, June 17, 2005.
430.2B, *Departmental Energy, Renewable Energy and Transportation Management*, February 27, 2008.
450.1A, *Environmental Protection Program*, June 4, 2008.
1324.5B, *Records Management Program*, January 12, 1995.

DOE Policies: 454.1, *Use of Institutional Controls*, April 9, 2003.

Executive Orders: 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, January 24, 2007.
13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, October 5, 2009.

DOE and NRC (U.S. Department of Energy and U.S. Nuclear Regulatory Commission), 1998. *License Termination/Site Transfer Protocol between the U.S. Department of Energy and the U.S. Nuclear Regulatory Commission*.

EPA (U.S. Environmental Protection Agency), 2010. *Institutional Controls: A Guide to Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites*, interim final, OSWER 9355.0-89, November.

NRC (U.S. Nuclear Regulatory Commission), 1988. "Use of Title I Supplemental Standards for Title II Sites," memorandum from H. L. Thompson, U.S. Nuclear Regulatory Commission, to R. D. Martin, U.S. Nuclear Regulatory Commission, June 27, NRC ADAMs Accession No. ML11167A048.

NRC (U.S. Nuclear Regulatory Commission), 1993. *Standard Review Plan for the Review and Remedial Action of Inactive Mill Tailings Sites Under Title I of the Uranium Mill Tailings Radiation Control Act*, Revision 1, June.

NRC (U.S. Nuclear Regulatory Commission), 2000. *Standard Review Plan for the Review of DOE Plans for Achieving Regulatory Compliance at Sites with Contaminated Groundwater under Title I of the Uranium Mill Tailings Radiation Control Act, Draft Report for Comment,* NUREG-1724, June.

NRC (U.S. Nuclear Regulatory Commission), 2003a. *Standard Review Plan for Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978*, NUREG-1620, Revision 1, June.

NRC (U.S. Nuclear Regulatory Commission), 2003b. *Consolidated NMSS Decommissioning Guidance; Decommissioning Process for Materials Licensees*, NUREG-1757, Volume 1, Revision 1, September.

NRC (U.S. Nuclear Regulatory Commission), 2011. *Regulatory Issue Summary 2011-11 Regarding Long-term Surveillance Charge for Conventional or Heap Leach Uranium Recovery Facilities Licensed Under 10 CRF Part 40*, September 29, NRC ADAMS Accession No. ML111290381.

Stoller (S.M. Stoller Corporation), 2009. *Regulatory Basis for Content of Long-Term Surveillance Plans for Sites Regulated under the Uranium Mill Tailings Radiation Control Act*, S06090, prepared for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, December.

Waugh, W.J., C.H. Benson, and W.H. Albright, 2009. "Sustainable Covers for Uranium Mill Tailings, USA: Alternative Design, Performance, and Renovation," *Proceedings of 12th International Conference on Environmental Remediation and Radioactive Waste Management*, Liverpool, UK.

Attachment 1

Sample LTSP Table of Contents
(from the draft LTSP for the Bear Creek, Wyoming, UMTRCA Title II Disposal Site)

This page intentionally left blank

Contents

Tables

Figures

Appendixes

Attachment 2

Specifications for Permanent Site Surveillance Features

This page intentionally left blank

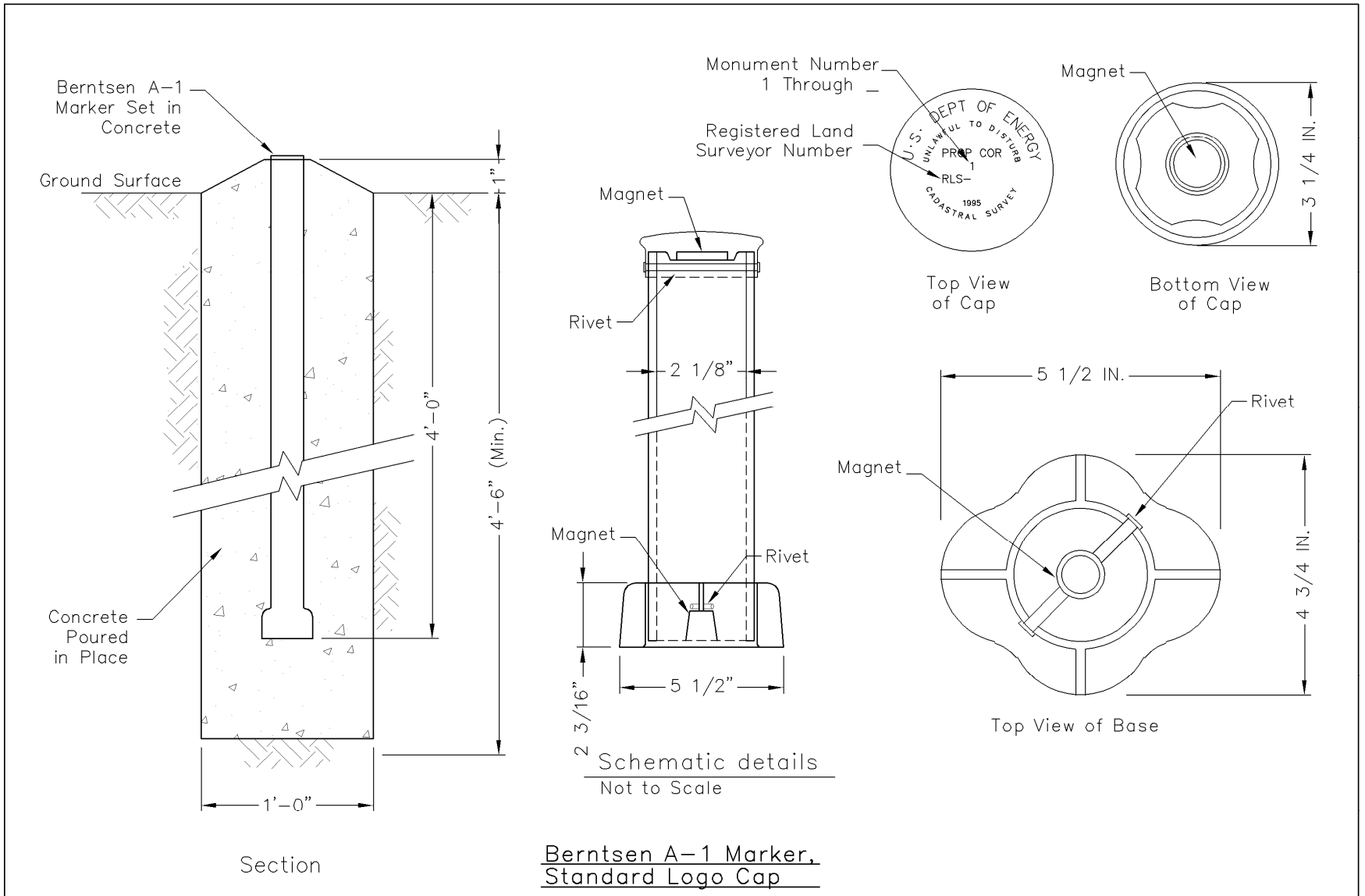


Figure A2–1. Example of a Disposal Site Boundary Monument

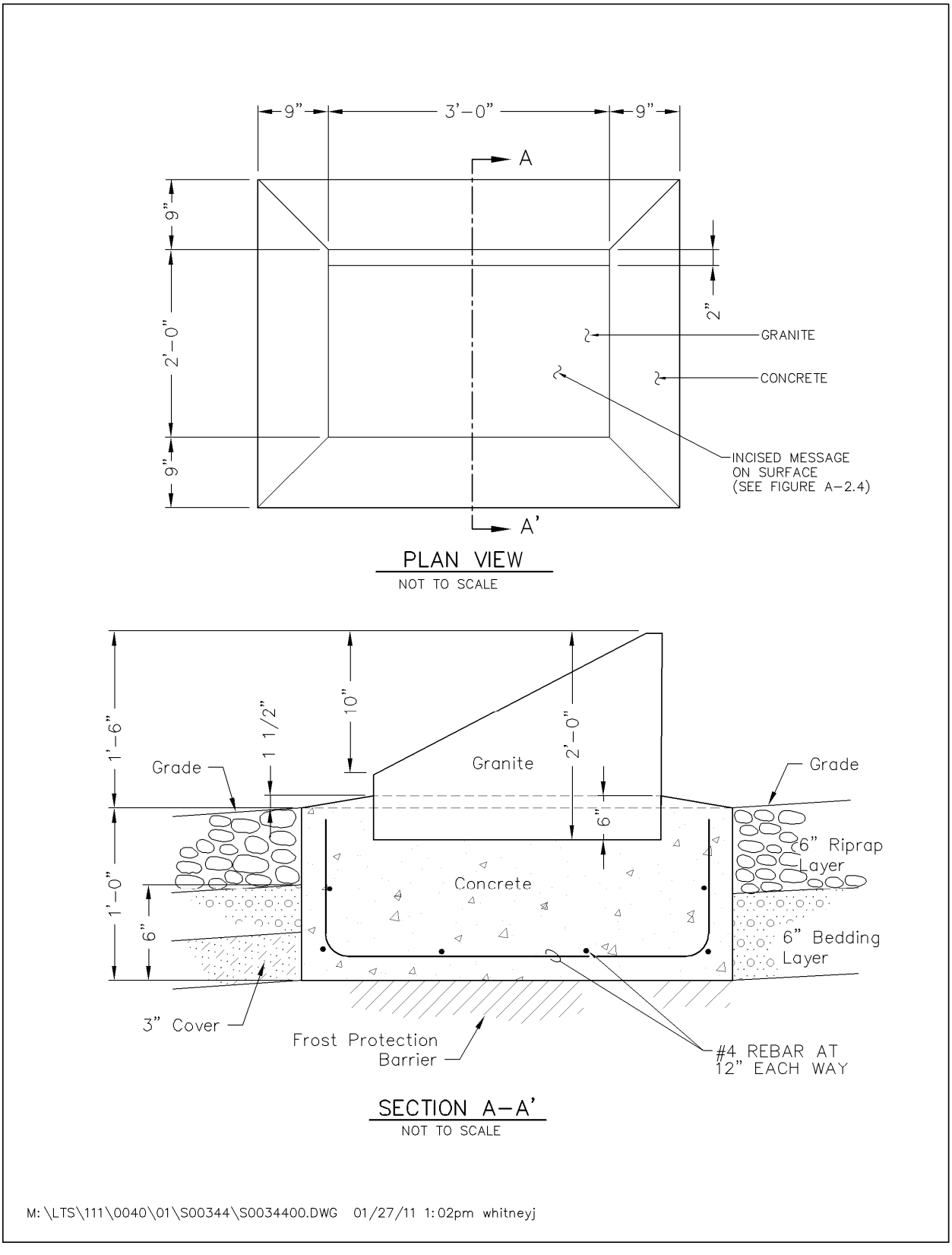


Figure A2–2. Example of a Disposal Site Marker

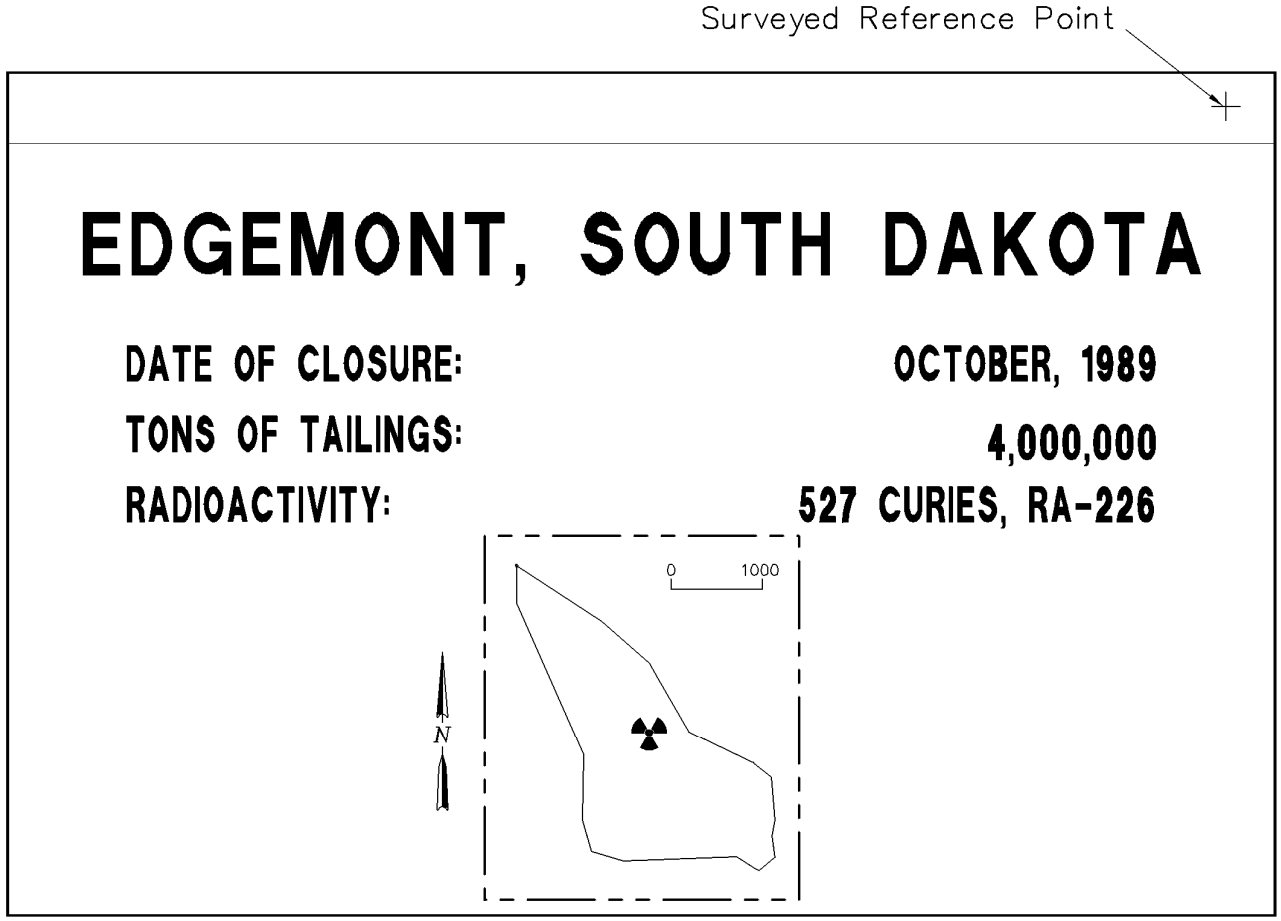
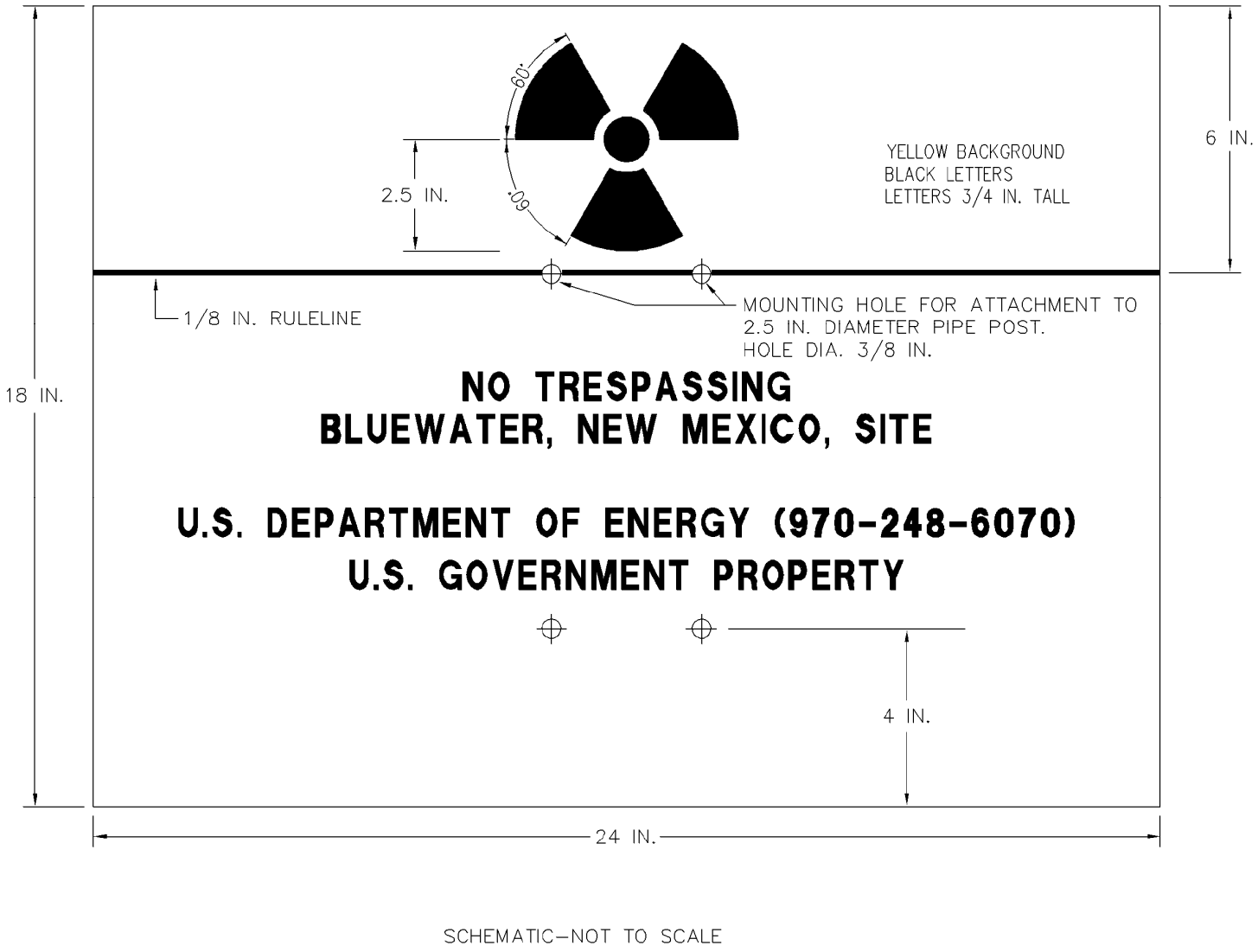


Figure A2–3. Example of a Disposal Site Marker Message



SCHEMATIC—NOT TO SCALE

M:\LTS\111\0040\01\S00346\S0034600.DWG 01/31/11 09:35am whitneyj

Figure A2–4. Example of a Disposal Site Warning Sign

Attachment 3

Disposal Site and Disposal Cell Inspection Techniques

This page intentionally left blank

Protocols

The U.S. Department of Energy (DOE) provides inspection schedule information to the U.S. Nuclear Regulatory Commission. The U.S. Nuclear Regulatory Commission can send inspectors at its discretion. DOE will determine if regulators or other stakeholders should be notified of an upcoming inspection. Often, State and tribal representatives have an interest in site conditions and protectiveness and will choose to observe an inspection.

General Inspection Approach

Prior to performing a Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I or Title II disposal site inspection, inspectors should review the site's long-term surveillance plan (LTSP); the permanent site file; the previous site inspection report, checklist, and site inspection map; and any maintenance tracking sheets or emergency-measures reports available. Inspectors should also review DOE's *Guidance for Developing and Implementing Long-term Surveillance Plans for UMTRC Title I and Title II Disposal Sites* (LTSP guidance). The inspectors prepare a checklist that addresses site-specific conditions and concerns, complete an inspection field map that shows all site surveillance features and areas of concern, generate a job safety analysis, notify appropriate stakeholders, and gather inspection and minor maintenance equipment (as needed) before the inspection.

The inspection team will refer to the designated transects for inspections. It may not be appropriate to divide inspection tasks by transect, but the transect designations will reinforce to inspectors the location and function of the various site features. DOE has adopted a protocol of including in the outlying area transect the land within 0.25 mile of a site's long-term care boundary. Features and activities more than 0.25 mile beyond the long-term care boundary may be of interest in assessing long-term stability of the disposal site and may be addressed in the inspection (and through a periodic search of State and local land records). An outlying area transect may be inspected from within the site boundary if features of interest or concern can adequately be assessed.

Following the tailgate safety briefing (which includes a review of the directions to the nearest medical facility and communication procedures), the inspection team will plan the inspection. An effective way to initiate inspection of the disposal site area and disposal cell is to review the inspection checklist and field map, and discuss which portions of the site and surveillance features each inspector will cover. The inspection then proceeds with a series of well-planned traverses around the perimeter of the disposal site; along the base, sideslopes, and top slope of the disposal cell; and along diversion channels. The number of traverses along the sideslopes is determined by the height of the disposal cell. Sideslope traverses generally should be spaced at 50-yard (46-meter) intervals. Traverses across the disposal cell top slope should be diagonal to its long axis. At a minimum, the site perimeter and site area traverses should be selected to observe damage or disturbance to the following features:

- Site perimeter roads.
- Fences, gates, and locks.
- Permanent site-surveillance features.
- Groundwater monitoring wells and other monitoring points.
- Other instrumentation or surveillance features.

- Site area vegetation or volunteer plant growth.
- Sedimentation or erosion.
- Lateral stream cutting or channel migration.

Traverses along the engineered components of the disposal system (surface water diversion channels, cell sideslopes or top slope, cell apron and toe drains, and cell cover) should be walked along their complete length and examined for evidence of the following:

- Structural instability caused by differential settlement, subsidence, cracking, sliding, or creep.
- Erosion evidenced by the development of rills or gullies.
- Sedimentation or debris.
- Rapid deterioration of rock caused by weathering or erosion.
- Removal of rock or other disposal cell material.
- Seepage from the disposal cell.
- Intrusion (inadvertent or deliberate) by humans or animals (burrowing).
- Vandalism.
- Development of trails from human or animal activity.
- Volunteer plant growth, especially on the disposal cell or in the diversion channels.
- Condition of vegetation if the site area or disposal cell cover is vegetated.

It is important that inspectors utilize both these inspection techniques and DOE's LTSP guidance in order to maintain consistency among inspectors in performing site inspections.

Geotechnical Stability

Modifications due to natural processes are most likely to occur on the lower portion of the sideslopes of the disposal cell. These modifications include gullying and headward erosion, cracking, landslides, creep, piping, sheet erosion, sedimentation or deflation, animal and plant intrusion, and extreme natural events (e.g., tornadoes, floods, earthquakes). The inspectors should know how to recognize, quantify, and record these processes for future evaluation. If any modifying features are observed during the inspection, the following information should be summarized on the inspection checklist and fully discussed in the inspection report:

- Extent and severity of the area affected, its stability, and the nature of its movement (e.g., planar or rotational).
- Number, spacing, length, depth, and width of features.
- Related erosional features.
- Patterns of occurrence.
- Species present (if plants or animals are found on the site).
- Location and density of volunteer plant growth.

Inadvertent or casual intrusion by humans or animals is not of great concern, but evidence of removal of cover materials (e.g., rock riprap), extensive vandalism to site surveillance features (e.g., access roads, site markers, wells, signs, gates, fencing, monuments), or the presence of well-established trails should be described in detail. Continuing vandalism may require more active measures to control access to the site and notification of local law enforcement authorities.

If new conditions requiring continuing observation, monitoring, or immediate action are discovered during the inspection, a description of the problem and recommended follow-up actions, if required, should be included in the inspection report. Inspectors should refer to the site-specific LTSP, the LTSP guidance, and historical site documents (e.g., reclamation plan, completion report).

Vegetation Encroachment on the Disposal Cell

For cells with a rock cover, inspectors should review the LTSP to determine whether the control of vegetation growth on the disposal cell is required as part of the remedy to maintain cell performance. If so, it is typically deep-rooted plants that are of concern. For these sites, vegetation encroachment on the cell should be mapped during the inspection, various types of plants should be photographed, and (if they would prove useful) samples of plants should be collected, so that subject matter experts can determine if the plants are deep-rooted and so that control or removal measures can be implemented.

Some disposal cells have vegetated rather than rock covers. For those cells, a plant specialist should participate in inspections at these sites periodically to (1) monitor the progress of plant succession on the cell, (2) assess the overall health of the vegetative cover, and (3) determine if noxious weeds are present or have the potential to invade. The condition, types, and abundance of plants on the cell cover could affect its performance, and it may be important to detect potential problems early. For example, early identification and treatment of noxious weeds can prevent widespread infestations and minimize the use of chemical herbicides in the long term. For sites that are grazed by livestock, regular monitoring of rangeland health can identify early signs of overuse and cover degradation.

At disposal cells with rock covers, inspectors should first determine whether the LTSP for the particular site requires the control of vegetation growing on the disposal cell as part of the remedy to maintain cell performance, particularly deep-rooted vegetation. A discussion of whether control of deep-rooted vegetation is required on the disposal cell will likely be presented under the site maintenance section of the LTSP (an appendix that provides additional detail and a technical basis for whether control of deep-rooted vegetation is required on the disposal cell may also be included with the LTSP). If the LTSP for a particular site does requires control of deep-rooted vegetation on the disposal cell, volunteer plant growth will be noted on the field map during the inspection. If an inspection team member encounters an unknown plant species, he or she can consult with ecologists on the DOE contractor staff, with range scientists from the Natural Resources Conservation Service or the U.S. Bureau of Land Management, or with botanists from a local college or university to determine whether the particular type of vegetation is considered deep-rooted and requires control. (Note: Control of invasive plants and listed noxious weeds is required at all sites, including on the disposal cells, but is not a license condition and therefore is not incorporated into the LTSP.) Identification of the plant species will be accomplished more accurately if the inspector takes several photographs of the plant and

collects a sample. If a sample is collected, it is best to collect portions of the entire plant—including the flowers and seeds, stems, leaves, and portions of the root—and preserve the sample as soon as possible in a plant press or between two pieces of paper. Placing a plant sample in a plastic bag causes mold to grow on the plant, making it unidentifiable.

Institutional Controls and Land Use

Some of the UMTRCA cells are in populated areas or areas where adjacent human activity is occurring or is expected to increase with time. Inspectors should monitor changes in land use patterns and determine if these changes pose a risk to site integrity or protectiveness. If institutional controls (ICs) are imposed in association with a disposal site, inspectors will determine if there is an obvious indication of IC failure and potential exposure. Inspectors might also be required to contact appropriate parties to ensure that knowledge of ICs is preserved (i.e., an awareness check) and that responsible parties will continue to observe ICs and inform DOE of violations and failure. This may require documented communication with those third parties. Periodic verification of the continued transparency of the ICs within the public record may also be warranted.

Where nearby land use is changing, inspectors can monitor those changes over time using aerial or satellite imagery. The effect of the changes should be evaluated to determine if access controls, other site features, or the long-term surveillance program should be modified.

Inspection Wrap-Up

Before departing the site, inspectors should review the checklist to ensure that all inspection objectives have been met and all appropriate information has been updated on the field map, including the location and orientation (azimuth) of all photographs taken during the inspection. Follow-up activities should be included in field notes, along with checklist revisions for the subsequent inspection.

Reporting

DOE will generate an inspection case file after each inspection. The case file includes field notes, marked-up field maps, annotated checklists, photographs and a photograph log, and health and safety records. DOE generates an internal inspection trip report after each inspection. Formal reporting of inspection results is via the annual inspection and monitoring report (i.e., compliance report) that is created in accordance with 10 CFR 40, Appendix A, Criterion 12.

Attachment 4

Sample Inspection Checklist Package

This page intentionally left blank

Inspection Checklist

Bear Creek, Wyoming, UMTRCA Title II Disposal Site

Status of Site Inspections

Date of This Revision: July 20, 2010

Last Annual Inspection:

Inspectors:

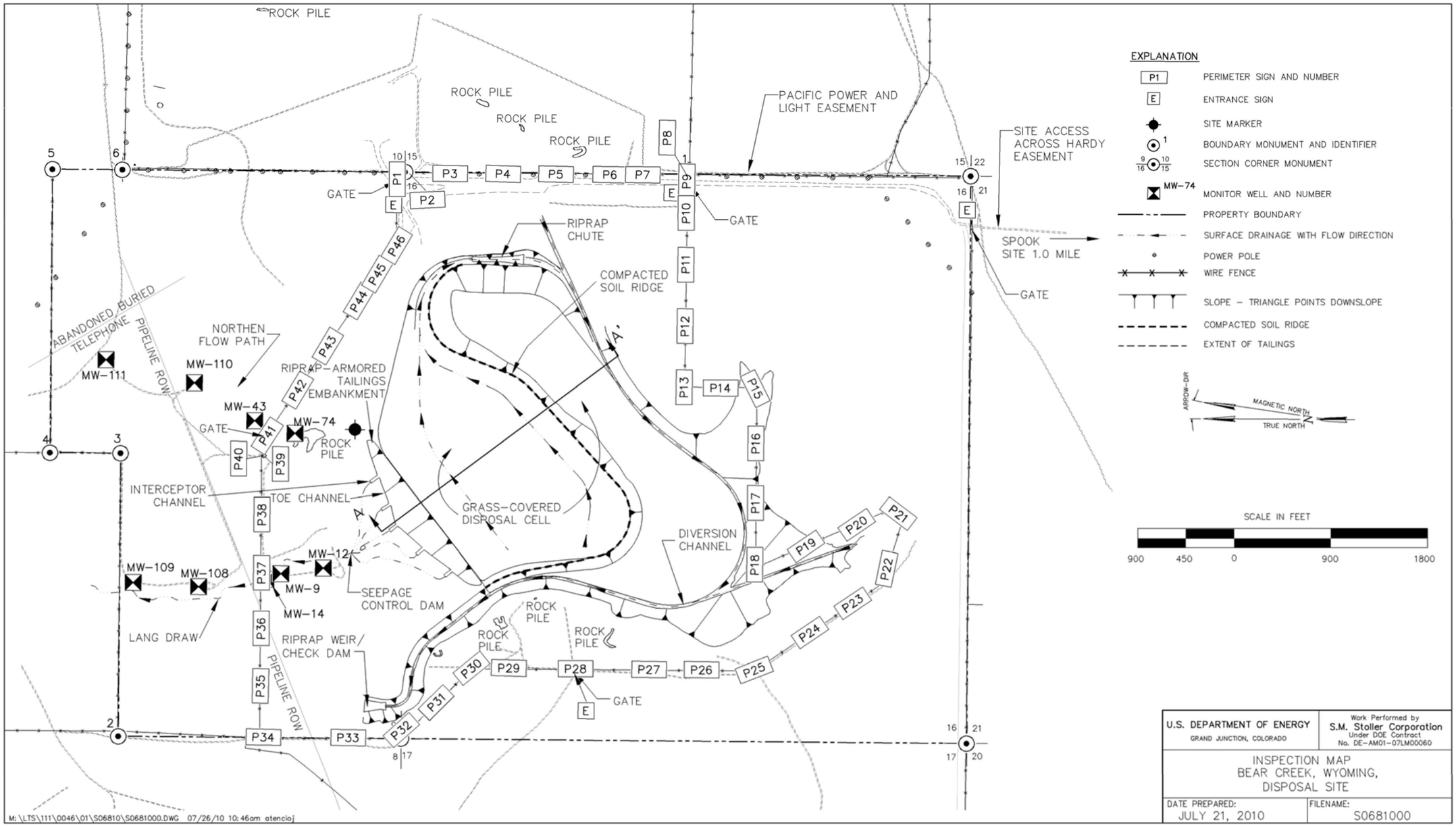
Next Annual Inspection (Planned):

Scheduled Inspectors:

No.	Item	Issue	Action
1	Protocols	NRC must be notified at least 30 days before the scheduled inspection.	
1	Access	Access is from the Spook, Wyoming, UMTRCA Title I site. Easement is established across Hardy property. Courtesy call to Gene Hardy or Sean Musselman is appropriate (307-358-3640). Ensure that a courtesy call to Kirk Hornbuckle (307-358-4807) has been made as well (easement to Spook site is across Hornbuckle property).	Gene Hardy and Kirk Hornbuckle have been contacted.
2	Specific site surveillance features	See attached table. No issues at this time.	Verify features and note condition.
3	Cover of tailings impoundment	The cover of the tailings impoundment has been revegetated to control wind and water erosion, although vegetation is not integral to the tailings isolation design.	Inspect impoundment cover settling or slumping and note condition of vegetation. There should not be any grazing on the impoundment cover at this time. Inspect for burrowing.
4	Tailings embankment and diversion channel	The tailings embankment face, the chute section and the check dam (weir) surfaces have been armored with riprap for erosion protection. Inspect all storm water management structures.	Inspect riprap and note evidence of settling, slumping, rock displacement, rock degradation, or erosion of non-armored areas.
5	Site perimeter and balance of site	Check site for trespass, vandalism, erosion, maintenance needs, hazards, and other departures from as-built conditions or indication of loss of institutional control. Note the condition of the seepage dam north of the tailings embankment. No erosion issues were noted during the last site visit in 2010. Canada thistle has been found and treated at the site.	Note the general condition of the site and any changes in activity within 0.25 mile of the site (the surrounding land currently is grazed). Inspect for Canada thistle or any other noxious weeds. If found, note locations on the inspection map.

Specific Site Surveillance Features—Bear Creek, Wyoming, Disposal Site

Feature	Comment
Access Road	Easement across Hardy property extending from easement across Hornbuckle property for Spook site. Road north of the Dry Fork has been improved for oil and gas operations.
Warning Signs	Located at the south site boundary at Hardy gate and inside the fence surrounding the cell.
Perimeter Fence	Barbed-wire stock fence.
Site Marker (1)	Located east of the tailings embankment crest.
Boundary Monuments and Section Corner Monuments (10)	Located on the property boundary.
Monitoring wells (9)	Background well: MW–9. POC wells: MW–12 (Lang Draw flow path) and MW–74 (Northern flow path). Downgradient wells: MW–14 and (Lang Draw flow path) and MW–43 (Northern flow path). Buffer zone wells: MW–108 and MW–109 (Lang Draw flow path); MW–110 and MW–111 (Northern flow path).



U.S. DEPARTMENT OF ENERGY GRAND JUNCTION, COLORADO	Work Performed by S.M. Stoller Corporation Under DOE Contract No. DE-AM01-07LM00060
INSPECTION MAP BEAR CREEK, WYOMING, DISPOSAL SITE	
DATE PREPARED: JULY 21, 2010	FILENAME: S0681000

This page intentionally left blank

Attachment 5

Earthquake Reporting Criteria and Event Monitoring

This page intentionally left blank

Earthquake Reporting Criteria

The U.S. Geological Survey National Earthquake Information Service (NEIS) (USGS 2012) will notify the U.S. Department of Energy (DOE) when an earthquake of a specified magnitude is reported within a specified radius of a Uranium Mill Tailings Radiation Control Act (UMTRCA) disposal site. In determining a specific magnitude of earthquake or a site radial distance significant to a specific site, the following limitations of these parameters should be understood:

- Ground conditions resulting from severe weather (such as recent heavy rains) may cause variations in ground response at the site.
- The accuracy of the distance and attenuation relationships may vary due to local structure and stratigraphy.
- The accuracy of the reported magnitude and epicentral distance depends on (1) the number and proximity of the reporting seismic stations and (2) the quality of the data.
- The significance of regional earthquakes may depend on the orientation of the structure associated with an earthquake relative to the site. An earthquake on a fault that trends near the disposal site has implications for possible focusing of the ground response and migration of future aftershocks closer to the site.

The variability of the potential ground response and the need to review the significance of regional earthquakes relative to known or unknown structures suggest that a minimum acceleration of 0.10 gravitational acceleration for long-term and short-term design should be used to define the significant radial distance from the site for a seismic event notification. The distance acceleration relationship of Campbell (1981) is recommended in the UMTRCA Title I *Technical Approach Document* (DOE 1989) for the western United States, and the relationship applicable to the central United States is taken from Nuttli and Hermann (1978). Licensee design documents (usually the reclamation plan) define the seismic stability design basis for each Title II site.

Event Monitoring

For each UMTRCA site listed in Table A5-1, NEIS will provide the following notifications:

- For an event of magnitude equal to or greater than magnitude 3.0 within 0.3 degree of a site (about 35 kilometers or 20 miles), an e-mail will be sent to a dedicated DOE e-mail address.
- For an event of magnitude equal to or greater than magnitude 5.0 within 1.0 degree of a site (about 115 kilometers or 70 miles), NEIS will report the occurrence to the DOE 24-hour number (970-248-6070) in Grand Junction, Colorado. This information will be forwarded to designated DOE personnel.
- In addition, for any event of magnitude 6.5 or greater within the contiguous United States, NEIS will call the same 24-hour number. This information will be forwarded to designated DOE personnel.

DOE will revise this monitoring protocol as necessary to maintain earthquake monitoring of UMTRCA sites. Revisions include adding sites to the notification process when the sites transition to DOE and adjusting for changes in NEIS protocols.

Table A5–1. Coordinates for UMTRCA Disposal Sites

Disposal Site	Latitude North	Longitude
Tuba City, Arizona, Disposal Site	36.145483	-111.134793
Durango, Colorado, Disposal Site	37.248481	-107.903876
Grand Junction, Colorado, Disposal Site	38.902364	-108.338213
Gunnison, Colorado, Disposal Site	38.51014	-106.846387
Maybell, Colorado, Disposal Site	40.543859	-107.99287
Maybell West, Colorado, Disposal Site	40.544556	-108.015615
Naturita, Colorado, Disposal Site	38.360283	-108.75443
Rifle, Colorado, Disposal Site	39.614434	-107.801258
Slick Rock, Colorado, Disposal Site	38.054538	-108.864253
Lowman, Idaho, Disposal Site	44.08479	-115.606689
Ambrosia Lake, New Mexico, Disposal Site	35.408798	-107.799285
Bluewater, New Mexico, Disposal Site	35.270623	-107.947483
L-Bar, New Mexico, Disposal Site	35.187651	-107.334722
Shiprock, New Mexico, Disposal Site	36.770014	-108.684297
Lakeview, Oregon, Disposal Site	42.285784	-120.433462
Burrell, Pennsylvania, Disposal Site	40.433059	-79.242531
Canonsburg, Pennsylvania, Disposal Site	40.256152	-80.199721
Edgemont, South Dakota, Disposal Site	43.273539	-103.794231
Falls City, Texas, Disposal Site	28.905375	-98.132276
Green River, Utah, Disposal Site	38.978164	-110.136749
Mexican Hat, Utah, Disposal Site	37.133607	-109.874549
Salt Lake City, Utah, Disposal Site	40.690666	-113.111437
Sherwood, Washington, Disposal Site	47.876183	-118.106188
Shirley Basin South, Wyoming, Disposal Site	42.335323	-106.196273
Spook, Wyoming, Disposal Site	43.238852	-105.622524

References

Campbell, K.W., 1981. "Near-Source Attenuation of Peak Horizontal Acceleration," *Bulletin of the Seismological Society of America*, Volume 71, pp. 2039–2070.

DOE (U.S. Department of Energy), 1989. *Technical Approach Document*, UMTRA-DOE/AL-050425.0002, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Nuttli, O.W. and R.B. Hermann, 1978. *State-of-the-Art for Assessing Earthquake Hazards, Report 12, Credible Earthquakes for the Central United States: U.S. Army Engineer Waterways Experiment Station*, Miscellaneous Paper S-73-1, Report 12.

USGS (U.S. Geological Survey), 2012. *National Earthquake Information Center*, http://earthquake.usgs.gov/regional/neic/, August 9 (accessed August 15, 2012).