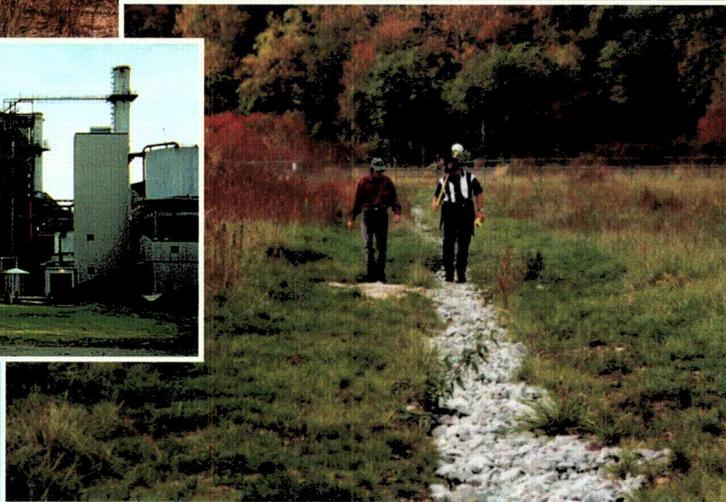
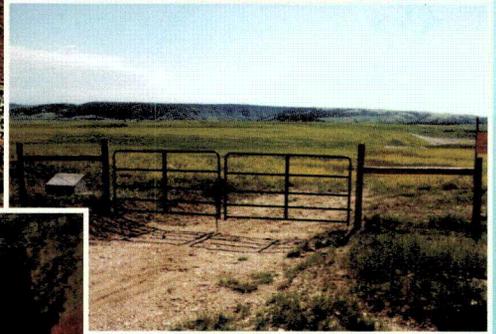
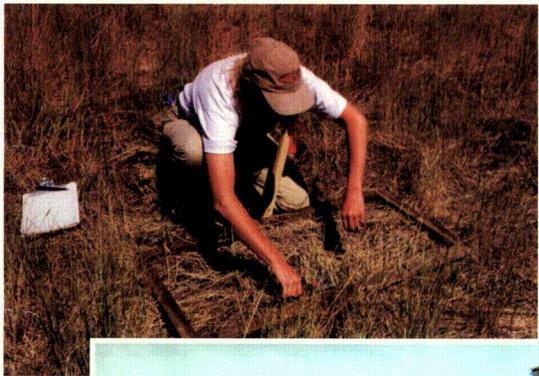
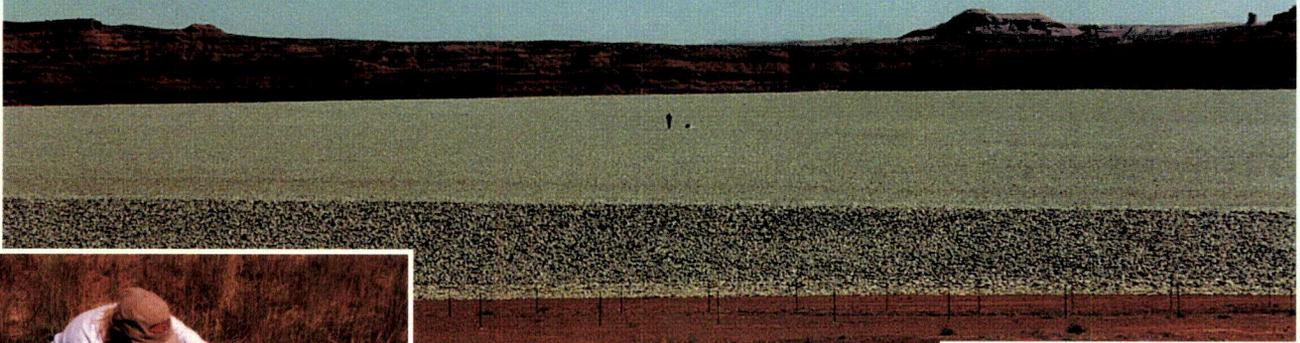




1999

Long-Term Surveillance
and Maintenance Program

REPORT



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



Long-Term Surveillance and Maintenance Program 1999 Report

Long-Term Surveillance and Maintenance Program
U.S. Department of Energy
Grand Junction Office
Grand Junction, Colorado

March 2000

Front cover photographs (clockwise from top)

An LTSM Program inspector traverses the top slope of the Mexican Hat, Utah, Disposal Cell.

Limited grazing is allowed on the grass-covered disposal cell at Edgemont, South Dakota.

LTSM Program personnel inspect a rock-filled drain installed at the Burrell, Pennsylvania, Disposal Site to channel run-on water away from the cell.

The sealed heat-exchanger building (with the "Sheldon Station" sign) is all that remains above the ground surface at the Hallam, Nebraska, Decommissioned Reactor Site.

A plant ecologist removes the aboveground plant material to measure the leaf area index at the Lakeview, Oregon, Disposal Site.

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Contents

Foreword	v
Acronyms	vi
Protecting the Health of Future Generations	1
Stewardship of DOE Low-Level Radioactive Waste Disposal Sites	3
LTSM Program Stewardship Activities	5
1999 Program Accomplishments	7
LTSM Program Planning and Implementation	12
Missions and Objectives	12
Organization and Administration	12
Assumptions	13
Risks	14
LTSM Projects and Sites	16
UMTRCA Title I Disposal Sites	16
UMTRCA Title II Disposal Sites	20
NWPAs Section 151 Sites	21
CERCLA Sites	22
Weapons Program Site	22
D&D Program Sites	23
Long-Term Radon Management Project	23
Grand Junction Office Remedial Action Project	23
FUSRAP Sites	24
Cover Monitoring and Long-Term Performance Project	24
Contacts/Resources	26

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Foreword

In 1999, the Long-Term Surveillance and Maintenance (LTSM) Program at the U.S. Department of Energy (DOE) Grand Junction Office marked its 11th year of operations.

Currently, the LTSM Program has custody of 26 disposal sites with low-level radioactive material. By 2006, approximately 60 sites are expected to be assigned to the LTSM Program for custody and care. The program ensures protection of the environment from the potentially hazardous materials contained at the assigned sites and maintains the sites in full compliance with applicable regulations.

Stewardship services provided by the program during 1999 included inspecting sites, conducting minor maintenance, monitoring groundwater, supervising permits, monitoring institutional controls, providing information and assistance to other agencies and stakeholders, and managing records. This work was accomplished while improving methods and procedures to reduce costs and increase efficiencies.

The LTSM Program is in a unique position of having acquired actual stewardship experience while many sites in the DOE complex and elsewhere still are undergoing remediation. LTSM Program sites and methods provide test cases and lessons learned for other stewards. To fulfill the obligation to share this information, the LTSM Program serves as a resource to stewardship and stakeholder working groups at many sites, to DOE Headquarters, and to workers in other countries.

LTSM Program outreach activities continued in 1999. A public information site on the World Wide Web was inaugurated in March. A second Stewardship Workshop was held in Grand Junction in September. LTSM Program experts expanded cooperative research projects with other Federal agencies to investigate isolation and monitoring technologies.

I am pleased to present this report of the operations and recent accomplishments of the DOE Grand Junction Office LTSM Program. In this report, we provide descriptions of the spectrum of activities that constitute a working stewardship program as well as the condition of and concerns about the sites in our custody. For more information about the LTSM Program, please contact me at (970) 248-6037 or visit our World Wide Web site at <http://www.doegjpo.com/programs/ltsm/>.

Russel Edge
LTSM Program Manager
U.S. Department of Energy
Grand Junction Office



Acronyms

AEC	U.S. Atomic Energy Commission
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 or Superfund Program (42 <i>United States Code</i> [U.S.C.] 9601, <i>et seq.</i>)
CFR	<i>Code of Federal Regulations</i>
D&D	Defense Decontamination and Decommissioning [Program]
DOE	U.S. Department of Energy
FUSRAP	Formerly Utilized Sites Remedial Action Program
GJO	Grand Junction Office
LTSM	Long-Term Surveillance and Maintenance
NPL	National Priorities List
NRC	U.S. Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101 <i>et seq.</i>)
RCRA	Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901, <i>et seq.</i>)
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978 (42 U.S.C. 7901, <i>et seq.</i>)
UMTRA	Uranium Mill Tailings Remedial Action [Project]

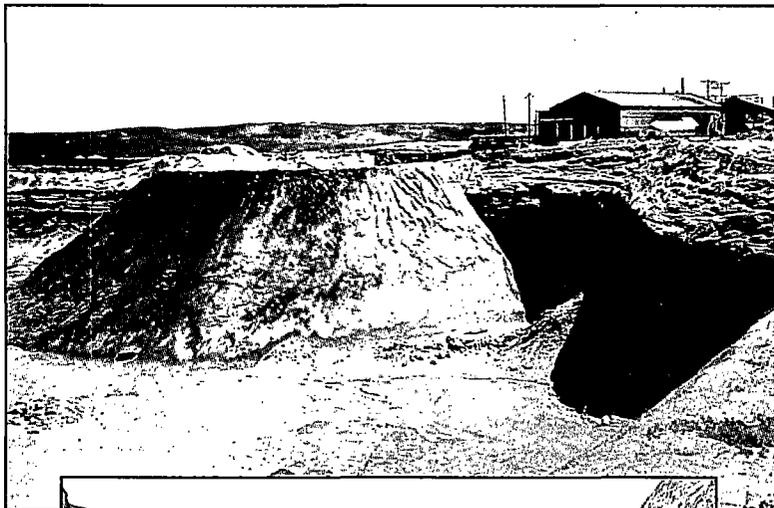


Protecting the Health of Future Generations

Radioactive materials have been commercially extracted from ores in the United States since the early 1900s. Accompanying this production has been the creation of radioactive waste. Historically, these waste materials have been abandoned, with no controls on exposure or redistribution. Many of the activities sponsored by the Federal government also resulted in generation of low-level radioactive waste.

For much of the "nuclear age," health officials were not aware of the dangers posed by these materials. However, as the potential effects became apparent, the U.S. Department of Energy (DOE) and the U.S. Congress acted to mitigate this threat to public and environmental health. Public resources were committed to remediate radioactive waste sites and isolate remaining wastes from the environment.

Unfortunately, most radioactive waste materials remain hazardous for long periods of time. Cleaning up a contaminated site solves the immediate need to block exposure pathways to current populations. Long-term care is required, though, to ensure that the wastes remain isolated from the environment and do not threaten the health of future generations. Congress recognized this need when it stipulated that DOE would provide stewardship services for sites remediated under the Uranium Mill Tailings Radiation Control Act (UMTRCA). Stewardship requirements are implicit in other environmental protection regulations that apply to radioactive waste cleanup or environmental protection.



Two views of tailings discarded in the open-pit mine at Spook, Wyoming, from uranium ore-processing operations at that site (circa 1960s).

Chronicle of Low-Level Radioactive Waste

1914 to 1928	Western U.S. sandstones mineralized with both uranium and vanadium oxides are mined for their radium content. Most of the ore is processed in Denver, Colorado, and Canonsburg, Pennsylvania.
1920s	Demand increases for vanadium as a component of steel. Mines and mills are opened on the Colorado Plateau to produce the metal. Uranium is discarded as a waste material.
1943	The Manhattan Engineer District establishes a refinery at Grand Junction to concentrate uranium from vanadium slimes produced at mills in the region.
1946	Passage of the Atomic Energy Act (superseded by the Atomic Energy Act of 1954) establishes civilian control of nuclear power production and authorizes the U.S. Atomic Energy Commission (AEC) to possess radioactive materials and regulate their use.
1950s through 1970	AEC operates a uranium exploration and procurement program from the Grand Junction Area Office to encourage domestic uranium production. Milling research is conducted by AEC at the Grand Junction Area Office and at Monticello, Utah.
1950s through 1990s	Uranium is produced commercially for the Federal government and the private sector. Because of changing demands, production is cyclical and tapers off to almost nothing from 1980 to the present. Many uranium mills are abandoned.
1964	Passage of the Private Ownership of Special Nuclear Materials Act encourages civilian development of nuclear electricity generation. This action helps create a market for domestic uranium.
1978	AEC is reorganized into the U.S. Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration, the precursor of DOE. Passage of the Uranium Mill Tailings Radiation Control Act (UMTRCA) specifies remedial action at abandoned uranium ore processing mills and stewardship of the resulting disposal sites. UMTRCA provides a mechanism for active millsites to be reclaimed, owner licenses terminated, and the sites assigned to DOE for stewardship.
1980s	DOE establishes the Defense Decontamination and Decommissioning (D&D) Program, Formerly Utilized Sites Remedial Action Program (FUSRAP), and Surplus Facilities Management Program (SFMP) to remediate sites contaminated with radioactive materials during Manhattan Project and early AEC activities.
1982	Passage of the Nuclear Waste Policy Act (NWPA) authorizes DOE to become custodian of designated civilian nuclear waste sites.
1988	DOE establishes the Long-Term Surveillance and Maintenance Program at DOE-GJO.
1999	DOE and the U.S. Army Corps of Engineers finalize a Memorandum of Understanding to transfer remediated FUSRAP sites to DOE for stewardship.



Stewardship of DOE Low-Level Radioactive Waste Disposal Sites

DOE established the Long-Term Surveillance and Maintenance (LTSM) Program to provide stewardship services at low-level radioactive waste disposal sites. Effective January 1, 1989, the DOE Grand Junction Office (GJO) was designated as the program office for "disposal site long-term surveillance and maintenance." Headquarters most recently reconfirmed assignment of this responsibility to GJO in 1998.

DOE intends to assign all long-term stewardship responsibilities for sites that meet two criteria to the LTSM Program: (1) the site is not physically a part of a major DOE facility, and (2) the site does not have a DOE mission after cleanup. Assignment of site responsibility to the LTSM Program ensures cost minimization and uniform compliance with applicable regulations, licenses, and agreements within DOE.

All locations with contamination left on site require long-term care. These sites were remediated under different environmental restoration programs, each with its own regulations and standards. In each case, specific regulations, general environmental laws, and DOE orders establish standards and limits for protection of workers, the public, and the environment.

Currently, the LTSM Program is responsible for annual surveillance, monitoring, and maintenance of 26 disposal sites remediated under UMTRCA Title I and Title II, the Nuclear Waste Policy Act (NWPA) Section 151, and the DOE Defense Decontamination and Decommissioning (D&D) Program. By 2006, the LTSM Program expects to provide stewardship services for approximately 60 sites. These will include UMTRCA Title I and Title II sites, two sites remediated under the Comprehensive Environmental Response, Compensation,

United States Government	Department of Energy
memorandum	
DATE: NOV 30 1988	
REPLY TO ATTN OF: NE-20	
SUBJECT: Disposal Site Long-Term Surveillance and Maintenance	
TO: Don Ofte, Manager, IDO	
<p>As a result of ideas generated following the 1986 Remedial Action Annual Meeting at Oak Ridge, four working groups were formed in December 1986 to examine issues related to the various aspects of work performed by the DOE remedial action projects of the Assistant Secretary for Nuclear Energy.</p> <p>One of the four working groups examined "disposal sites long-term surveillance and maintenance."</p> <p>... During July 1987, the group issued a report that made the following recommendations:</p> <ul style="list-style-type: none"> • Establish a common office to control and monitor all surveillance and maintenance programs for all remedial action projects. • Establish one main contractor, or local contractors or regional institutions in the long-term implementation for surveillance and maintenance programs. • Develop funding requirements for long-term surveillance and maintenance programs. • Develop a DOE general remedial action program surveillance and maintenance guidance document or order. <p>Based on these recommendations and my analysis of the report, I am designating the Idaho Operations/Grand Junction Project Office (GJPO) as the program office for "disposal site long-term surveillance and maintenance" effective January 1, 1989. . . .</p> <p style="text-align: right;"><i>John E. Baublitz</i> Acting Director, Office of Remedial Action and Waste Technology Office of Nuclear Energy</p>	

Excerpts from a directive that authorizes the LTSM Program at the Grand Junction Office.



Summary of Sites in LTSM Program Custody (January 2000)

Program/Site	1999	2000	2001	2002	2003	2004	2005	2006
UMTRCA Title I	19	19	19	19	19	19	19	19
UMTRCA Title II	2	6	12	15	15	15	17	18
NWPA Section 151(c)	1	1	1	1	1	1	1	1
Long-Term Radon Management Project	1	1	1	1	1	1	1	1
D&D	3	3	3	3	3	3	3	3
NWPA Section 151(b)				2	4	6	8	10
Weldon Spring, Missouri				1	1	1	1	1
Grand Junction Office Remedial Action Project			1	1	1	1	1	1
Monticello, Utah				1	1	1	1	1
Pinellas, Florida					1	1	1	1
FUSRAP					3	3	5	5
Total	26	30	37	44	50	52	58	61

and Liability Act (CERCLA) (Monticello, Utah, and Weldon Spring, Missouri) and Formerly Utilized Sites Remedial Action Program (FUSRAP) sites. Negotiations for a Memorandum of Understanding are under way between DOE and the U.S. Nuclear Regulatory Commission (NRC) for the NWPA Section 151(b) sites; if accepted by DOE, some of these sites may be assigned to the LTSM Program. Descriptions of these remedial action programs and the sites governed by their regulations are provided later in this report.

For UMTRCA Title I and Title II disposal sites in the LTSM Program, DOE becomes a licensee to NRC. Inspection, reporting, and



The Spook, Wyoming, Disposal Site as it appears now that remediation is complete. Remedial action has prevented the spread of contaminated materials and allowed return of the site to productive use.

record-keeping requirements are defined in Title 10 *Code of Federal Regulations* (CFR) Parts 40.27 and 40.28 that establish the general licenses for long-term custody of Title I and Title II sites, respectively. The general licenses for long-term custody are indefinite in duration; these licenses will not expire. Usually, title for the land is assigned to an agency of the Federal government, and the land is administratively withdrawn from unrestricted public use. Sites located on Tribal land revert to Tribal control, and DOE obtains a site access agreement with the Tribe that allows DOE to fulfill its custodial responsibilities.

For disposal sites transferred to DOE under the authority of NWPA, the long-term stewardship requirements are not explicitly defined as under UMTRCA. Similarly, for disposal sites remediated under the DOE D&D Program, stewardship requirements are not statutorily defined. However, DOE conducts long-term custody and care activities to eliminate risks from potentially hazardous materials under the department's responsibility. For NWPA and D&D Program sites, the LTSM Program adopts a long-term stewardship approach that is analogous to the program mandated by the NRC license-driven stewardship activities for sites remediated under UMTRCA Title I and Title II. The LTSM Program will develop Long-Term Surveillance Plans (LTSPs) for these sites, if necessary.



LTSM Program Stewardship Activities

As steward, the LTSM Program must ensure that the sites in its care do not cause harm to workers, the public, or the environment. The program also must ensure that the sites remain fully compliant with applicable regulations. Program systems and activities are designed to meet these goals.

The LTSM Program conducts site surveillance and monitoring activities in accordance with approved site-specific LTSPs. LTSM Program personnel inspect each assigned site at least annually. They prepare, distribute, and archive an annual site condition report. The purposes of the annual inspection are to confirm the integrity of visible features at the site; to identify changes or new conditions that may affect site integrity; and to determine the need, if any, for maintenance or follow-up inspections and monitoring. At the time of the inspection, program specialists evaluate the effectiveness of site-specific institutional controls and ensure that the site remains in full compliance with applicable regulations.

The disposal impoundments were designed to require only minimal maintenance for the duration of their design lives. Because these cells are relatively new, only minor maintenance is required at present. However, as the sites age, they will require routine replacement of wear items such as fencing and signs.

LTSM Program activities also include groundwater monitoring and other environmental monitoring, as stipulated in the site-specific LTSPs. Monitoring results are reviewed to ensure regulatory compliance. All sites remain in full compliance.

If a disposal site receives severe damage or sustains catastrophic failure, DOE will undertake the necessary corrective action. The LTSM Program maintains contacts with local law enforcement officials near each site, who will notify DOE in case of an incident or emergency. Signs with the DOE-GJO 24-hour phone number [(970) 248-6070] are posted at each site.



An LTSM Program soil scientist meets with representatives of the U.S. Bureau of Land Management to inspect the revegetated haul road near the Gunnison, Colorado, Disposal Site.

As site steward, the LTSM Program documents all activities at the site. That information is archived at the GJO facility so that it is available to future stewards. Records that describe baseline conditions are acquired from remedial action contractors before site transfer. Ongoing surveillance and monitoring results are preserved so trends may be established. Records are maintained in National Archives and Records Administration-compliant storage areas and are tracked in an electronic database.

The LTSM Program encourages stakeholder involvement with program operations. Stakeholders consist of all interested parties for a given site, including local residents, regulators, elected officials, and the general





A representative of the Navajo Nation and an LTSM Program inspector assess the effectiveness of an herbicide application on tamarisk, a deep-rooted invasive shrub, at the Shiprock, New Mexico, Disposal Cell.



Signs in both Navajo and English warn local residents against using water that intermittently issues from seeps below the Mexican Hat, Utah, Disposal Cell.

public. The program has implemented the *LTSM Program Public Participation Plan*, which is an appendix to the *Long-Term Surveillance and Maintenance Program Plan* posted at www.doegjpo.com/programs/ltsm/ under "General," "Program Information."

Program personnel provide transfer assistance to site owners as remediation activities approach completion. The

program obtains necessary records to conduct ongoing stewardship and develops an LTSP for the site. Real property transfer or access acquisition activities are supervised by LTSM Program personnel, often in coordination with the U.S. Army Corps of Engineers. Program personnel participate in a site-handoff inspection and ensure that the site complies with stipulated requirements before accepting responsibility for the site.



1999 Program Accomplishments

The LTSM Program inspected and performed necessary monitoring and maintenance of all sites assigned to the program. Visits were also made to sites that will likely be transferred to the program, and transition assistance was provided to the owners of those sites.

During 1999, the LTSM Program

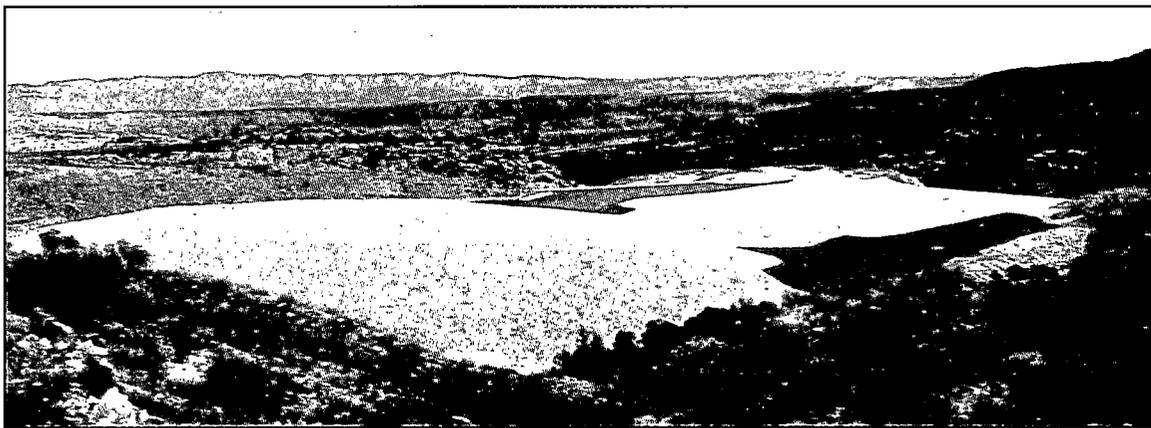
- Inspected 25 sites and prepared reports of site conditions. These inspections evaluated site integrity and conformance to regulations and identified needed maintenance.
- Collected groundwater samples at 14 UMTRCA sites and two non-UMTRCA sites. At some sites, groundwater sampling is required in the site-specific LTSP to demonstrate that precipitation is not passing through disposal cell contents and carrying leached contaminants into the underlying groundwater system. Groundwater samples were collected from permanent monitor wells or, at some sites, from streams, seeps, or springs hydraulically downgradient from the disposal cell. This activity was coordinated with the Uranium Mill Tailings Remedial Action (UMTRA) Ground Water Project to realize cost efficiencies and to avoid duplication of effort. At UMTRCA Title I sites, the LTSM Program is responsible for monitoring groundwater associated with the disposal cell; the UMTRA Ground Water Project is responsible for addressing groundwater contaminated by pre-UMTRCA processing operations.
- Monitored groundwater levels at 13 sites. This monitoring is necessary to ensure compliance with State and Federal groundwater protection regulations. Monitoring is used also to document changes in local groundwater regimens as flow changes caused by processing-related activities dissipate and flows return to a natural state. At the Slick Rock, Colorado, Disposal Site, water levels within the cell are monitored to ensure that transient-drainage

accumulations do not enter the local groundwater system. Standpipes were installed in the Slick Rock cell for this purpose. Water levels are monitored at the Durango and Rifle, Colorado, Disposal Sites to ensure that water accumulation within the cells does not cause side slopes to become unstable.

- Continued riprap durability studies at the Lakeview, Oregon, Disposal Site. A modified field procedure was implemented this year to determine more accurately the size distribution of the riprap. Riprap size is calculated to resist the erosive effects of a theoretical maximum precipitation event. Implementation of the revised procedure required NRC approval of changes to the LTSP. Radon decay-product concentration measurements were completed at this location. No anomalous radon concentrations were detected, indicating that the radon barrier component of the cover is functioning as designed.
- Initiated radon decay-product concentration monitoring and surveyed the settlement monitoring devices at the Shiprock, New Mexico, Disposal Site. This work was conducted at the request of the Navajo Nation, a stakeholder and regulator at this location. Settlement monitors, installed during construction, were surveyed to obtain initial elevations. The cell has not consolidated as much as predicted; results indicate that the settlement that has occurred poses no threat to cover integrity. Also this year, the program began monitoring moisture within the cell and the cover.
- Assumed responsibility for the Maybell, Colorado, and the Naturita, Colorado,



An LTSM Program technician collects water samples from a point-of-compliance well at the Green River, Utah, Disposal Site.



The U.S. Nuclear Regulatory Commission licensed the Naturita, Colorado, Disposal Cell in 1999. An UMTRCA Title II disposal cell to the right of the cell contains raffinate crystals from the UMETCO mill at Uravan, Colorado.

UMTRCA Title I Disposal Sites. These sites came under the NRC general license in 1999. Acquisition of these sites marks the completion of the DOE UMTRA Surface Project. Site acquisition included conducting verification and orientation inspections to document baseline site conditions and integrating site records into LTSM Program archives.

- Performed routine maintenance at 12 sites. Maintenance activities included replacing signs that were defaced or stolen, repairing fences, removing debris and windblown sand, cutting encroaching vegetation, and spraying weeds. Perimeter signs and boundary monuments were installed at the Grand Junction (Cheney) Disposal Site. Boundary monuments and perimeter signs were relocated at the Green River, Utah, Disposal Site to reflect changes in the boundaries of the land acquired for the site.
- Operated the Grand Junction, Colorado, Disposal Cell. Activities included installing a pipeline between two ponds to enhance wastewater management, relining one of the ponds, and disposing of low-level radioactive waste received during 1999 from the DOE-GJO facility and from private removals of UMTRCA-related residual radioactive material from Rifle and Grand Junction. The cell was secured for the coming year by sealing the contaminated material in the open portion of the cell with an elastomeric binder. The LTSM Program inspects the site weekly when the facility is not accepting waste.
- Reduced groundwater-sampling frequencies at the Grand Junction, Colorado; Gunnison, Colorado; Parkersburg, West Virginia; and Lakeview, Oregon, sites. These changes reflect assessments of low risk at these locations and were implemented with the concurrence of regulators. DOE will realize cost savings as a result.
- Compiled the results of a biointrusion risk assessment for the Burrell, Pennsylvania, Disposal Cell and began revising the LTSP to recommend halting vegetation control. Studies indicate that plant encroachment could occur without risk to local populations or the environment. This modification allows curtailing herbicide application at the site and allowing the natural hardwood forest to re-establish on the disposal cell cover. Results of the risk assessment are reported in *Plant Encroachment on the Burrell, Pennsylvania Disposal Cell: Evaluation of Long-Term Performance and Risk* (GJO-99-96-TAR).
- Continued studies at western U.S. sites to determine if volunteer plant growth degrades the water-infiltration barrier properties of cell covers. This work addresses concerns that water infiltration might increase if deep-rooted plants are allowed to establish on the Lakeview, Oregon, and Tuba City, Arizona, covers. Results will be applicable to the Lowman,



Idaho, Disposal Cell, where the native ponderosa pine forest will colonize the cell if active vegetation control measures are not implemented.

- Reviewed the slope stability analysis of the embankment at the Durango, Colorado, Disposal Cell in preparation for shutting the toe drain. Transient drainage has been routed through the toe drain to a holding pond since 1989. The pond water must be treated, analyzed, and discharged every fall to prevent damage caused by ice formation. Plans call for closing the toe drain in 4 years; this action will not result in embankment instability.
- Operated treatment cells at the Durango Disposal Site. The cells were constructed by Sandia National Laboratories/New Mexico to test the effectiveness of zero-valent iron in removing uranium and other contaminants from the transient drainage water. Since 1996, the LTSM Program has operated these cells. Results have been used to design and install permeable reactive barriers at the Monticello, Utah, CERCLA Site and at Travis Air Force Base in California. Treatment studies will continue until 2002, and the toe drain will be permanently closed in 2004.
- Developed a design to stabilize the Chartiers Creek stream bank adjacent to the Canonsburg, Pennsylvania, Disposal Site. This task included coordinating activities with borough-sponsored sanitary sewer construction through the project area. A U.S. Army Corps of Engineers permit is required for this activity. The stream bank will be stabilized in 2000.
- Negotiated a contract with a local landowner near the Falls City, Texas, Disposal Site to harvest hay from the cell top and the site perimeter. The landowner will fertilize, cut, and remove the hay at no cost to DOE. Regular cutting is necessary to maintain the health of the desired grasses, to discourage woody plant growth, and to reduce the fire hazard.
- Installed a barrier along the access road to the Burrell, Pennsylvania, Disposal Site

to discourage trespassing and dumping on land adjacent to the disposal site.

- Installed a second caisson lysimeter in Monticello, Utah, and installed a full-scale drainage lysimeter within the cell cover at the Monticello CERCLA Site. The drainage lysimeter will allow collection of empirical data to verify theoretical work on evapotranspiration cover technology.
- Completed studies of revegetation techniques at the Tuba City, Arizona, Disposal Site. Program range scientists identified planting techniques and species that resulted in the greatest revegetation success at this site. These results may be applicable to other arid sites, as well.
- The Long-Term Performance Project continued monitoring cell covers and provided summaries on cover design and material properties for UMTRCA Title I covers. Researchers can use the collected data to support development of more



LTSM Program scientists measure the pH of a water sample at the retention pond at the Durango, Colorado, Disposal Site before the water is released into a nearby drainage.



Native grasses on the top slope and adjacent to the Falls City, Texas, Disposal Cell are harvested regularly to ensure a healthy turf and to reduce the risk of fire.

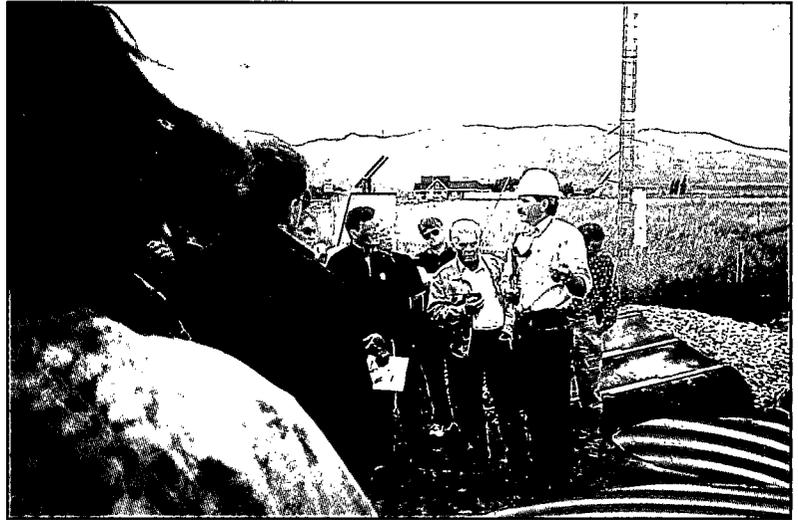
appropriate, less-expensive disposal cell covers for municipal landfills, nonradiologic hazardous waste sites, and other applications.

- Released the *Long-Term Surveillance and Maintenance Program Plan*. This document defines program scope and activities, responsibilities, and requirements.
 - Developed the draft *Guidance for Implementation of Long-Term Surveillance and Maintenance at DOE Sites in Long-Term Stewardship* to serve as a basis for stewardship activities within DOE. This national guidance is applicable to stewardship activities at all sites where DOE has or will have postclosure obligations. The LTSM Program at DOE-GJO was selected by the DOE Long-Term Stewardship Working Group to prepare this document because the LTSM Program has more experience with providing stewardship services than any other office within DOE.
 - Presented LTSM Program cost estimates in a separate project baseline summary. The program is in a unique position within DOE to provide explicit stewardship cost estimates independent of infrastructure or remediation costs. DOE formally compiled stewardship costs for all sites as part of the *Accelerating*
- *Cleanup: Paths to Closure* budget process. LTSM Program managers have advised planners at other sites on estimating stewardship costs.
 - Developed life-cycle stewardship cost estimates for the Rocky Flats Environmental Technology Site near Denver, Colorado. The LTSM Program was asked to develop and verify these costs because of the program's experience in providing postclosure stewardship services since 1988.
 - Participated in a rock placement workshop hosted by NRC. This workshop included visits to five UMTRCA Title I sites to demonstrate to agreement-State regulators what the UMTRA Surface Project learned about rock placement and durability testing. The intent of the workshop was to share this knowledge so that it can be applied to UMTRCA Title II site construction and acceptance.
 - Issued guidance to implement the monitor well decommissioning project. Program personnel began verifying the inventory of DOE monitor wells at UMTRCA Title I sites. Unneeded wells pose a liability to DOE and will be abandoned; any associated permits will be closed out.
 - Hosted the Long-Term Stewardship Workshop in Grand Junction, Colorado. More than 160 managers and specialists representing more than 80 agencies, companies, and stakeholder groups attended this workshop. The workshop provided opportunities for exchanging information, problem solving, and establishing contacts. Field trips were conducted to the disposal sites at Rifle and Grand Junction, Colorado, and Monticello, Utah. The LTSM Program will again host a stewardship workshop in 2000.
 - Assumed responsibility for obligations remaining from the UMTRA Surface Project for Title I sites, now that funding authority for that project has expired. Concerns include warranty claims for vicinity property remediation; permit obligations for storm water, reclamation, and other ongoing regulatory



requirements at UMTRCA Title I locations; and disposal of incidental waste from vicinity properties. Activities include managing the wetland restoration and permit closure at the Slick Rock, Colorado, processing sites and managing the haul road revegetation and establishment of critical habitat for endangered sage grouse near the Gunnison, Colorado, Disposal Site.

- Began incorporating UMTRA Surface Project records into the LTSM Program records archive. This activity will continue through fiscal year 2000.
- Presented technical papers at the Waste Management '99 symposium and prepared draft technical papers for the 2000 symposium. LTSM Program personnel made presentations at the Technology Information Exchange conference, the National Mining Association annual meeting, and an American Geophysical Union meeting. Program personnel participated in workshops sponsored by or meetings with the Energy Community Alliance; the Long-Term Stewardship Working Group and the stewardship cross-cutting team sponsored by the DOE Office of Environmental Management; the National Academy of Science; the West Valley, New York, site stakeholders group; and the State and Tribal Government Working Group.
- Established a liaison with U.S. Army Corps of Engineers officials in preparation for assuming responsibility for FUSRAP sites. A Memorandum of Understanding was finalized specifying that sites requiring stewardship will be transferred to DOE upon completion of remedial action.
- Continued to disseminate inspection results and site status information to regulators, the public, and other stakeholders.



An LTSM Program research scientist (in hard hat) explains the new caisson lysimeter at the Monticello, Utah, CERCLA Site to participants of the 1999 Long-Term Stewardship Workshop.

LTSM Program Planning and Implementation

LTSM Program activities are conducted in accordance with the *Long-Term Surveillance and Maintenance Program Plan* (the program plan). Portions of the program plan are summarized in this section. In addition to the information presented in this report, the program plan establishes responsibilities, regulatory requirements, and controls for the LTSM Program. Guidance and plans for routine operations and extraordinary circumstances are identified. A major component of the program plan addresses public participation. The program plan is posted at www.doegjpo.com/programs/ltsm/.

Mission and Objectives

LTSM Program functions have been defined in mission and objectives statements. In the program plan, these broad objectives are broken down into specific goals, and a strategy for achieving each goal is presented.

Mission—

To fulfill DOE's responsibility to implement all activities necessary to ensure regulatory compliance and to protect the public and the environment from long-lived wastes associated with the nation's nuclear energy, weapons, and research activities.

Objectives

- Protect the public and the environment.
- Maintain site records and information so future custodians can continue to provide effective stewardship.
- Provide a resource to manage long-term disposal and storage sites.

- Maintain compliance with applicable regulations.
- Serve as a source of stewardship information and expertise for other entities with long-term care responsibilities.
- Provide services and products within approved schedule and budget limits.
- Provide an outreach and information dissemination resource to the public to maintain public trust in local LTSM Program sites.

Organization and Administration

The program plan establishes responsibilities for key program personnel and organizations. In the future, some stewardship services may be acquired for remote sites through cooperative agreements between the LTSM Program and local, Tribal, or State agencies.

The LTSM Program is administratively responsible to the DOE Office of Environmental Management, which is responsible for the remediation and control of waste materials for which the Department is responsible.

Funding is acquired through an annual budget request administered through the DOE Albuquerque Operations Office. Projected funding through 2006 is summarized in a separate LTSM Program project baseline summary under the direction of DOE-GJO.

LTSM Program costs will increase from \$2,900,000 in 2000 to approximately \$13,500,000 in 2006 as the number and complexity of sites increase.

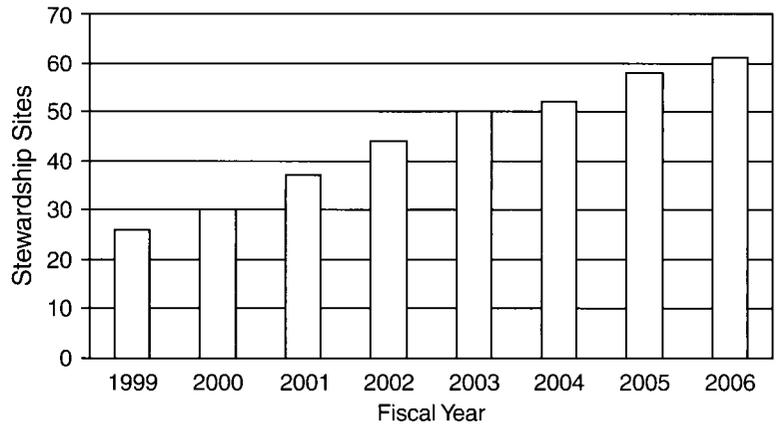


Assumptions

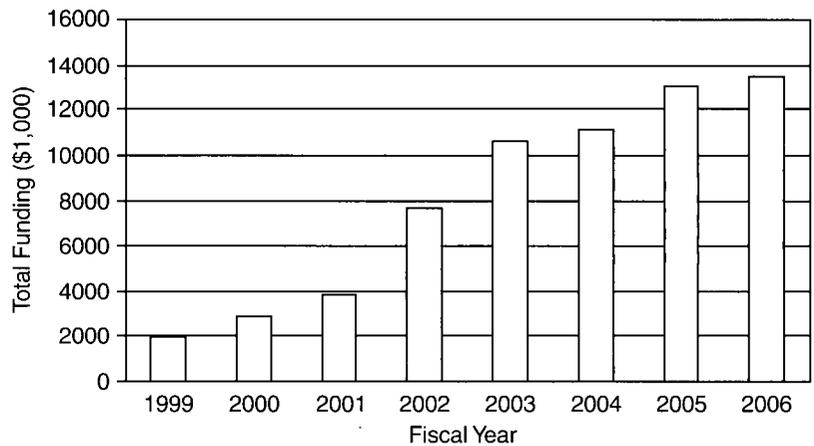
Key assumptions for the LTSM Program are divided into two categories: institutional and environmental protection/regulatory compliance.

Institutional Assumptions

- Adequate funding will be provided to carry out the LTSM Program mission.
- Native American tribes/nations, States, the public, regulators, and the U.S. Congress are program stakeholders and influence program policy and conduct.
- As program stakeholders, communities near the LTSM Program sites expect no unacceptable risks from the contaminated materials.
- DOE will negotiate institutional controls to protect the public and the environment, will entrust implementation of those controls only to governmental agencies with the resources to manage and enforce them, and will periodically monitor the effectiveness of institutional controls.
- DOE will seek public participation in the development of required compliance strategies.
- Tribal, State, and local agencies will continue to take an active role in monitoring site compliance and may become actively involved in supporting stewardship operations.
- Local changes in land use will not affect the siting or configuration of sites in the custody of the LTSM Program.
- Waste disposal capacity will be available, if needed.



Anticipated Number of Sites in LTSM Program



Anticipated LTSM Program Funding



Environmental Protection/ Regulatory Compliance Assumptions

- Applicable regulatory drivers have been identified, and the program will achieve and maintain full compliance with those laws and regulations.
- The program will remain informed of changes to pertinent regulations and will revise program procedures as necessary.
- The sites are stable and protective of the environment and will remain so for the foreseeable future. This assumption is predicated on the goal of cell designs, which was to construct waste impoundments that maintain isolation with only minimal maintenance. The program recognizes that corrective action may, at some future time, be required.
- Surveillance and monitoring activities will identify degradation of site containment systems and the potential for contaminant release.

Risks

Risks and risk-reduction strategies have been identified for the LTSM Program. Risks are identified as either programmatic or site specific.

Among long-term programmatic risks is the uncertainty of whether some individual sites or sites in a given restoration program will be transferred to the LTSM Program. Because the owner or restoration agency implements a site transfer, the actual transfer schedule is uncertain. Unresolved regulatory issues or other concerns can affect transfer schedules.

Site-specific risk reduction is achieved by monitoring trends and conducting corrective action before extraordinary events occur. Risk reduction is enhanced by adhering to the LTSM Program quality assurance program, following procedures for routine program activities, conducting periodic inspections and regulatory compliance reviews, communicating with affected parties, and planning for extraordinary situations.

The table on page 15 presents LTSM Program risks and responses. The risks are ranked according to the permanence or the severity of the impact to either human health and the environment or to a Federal agency.

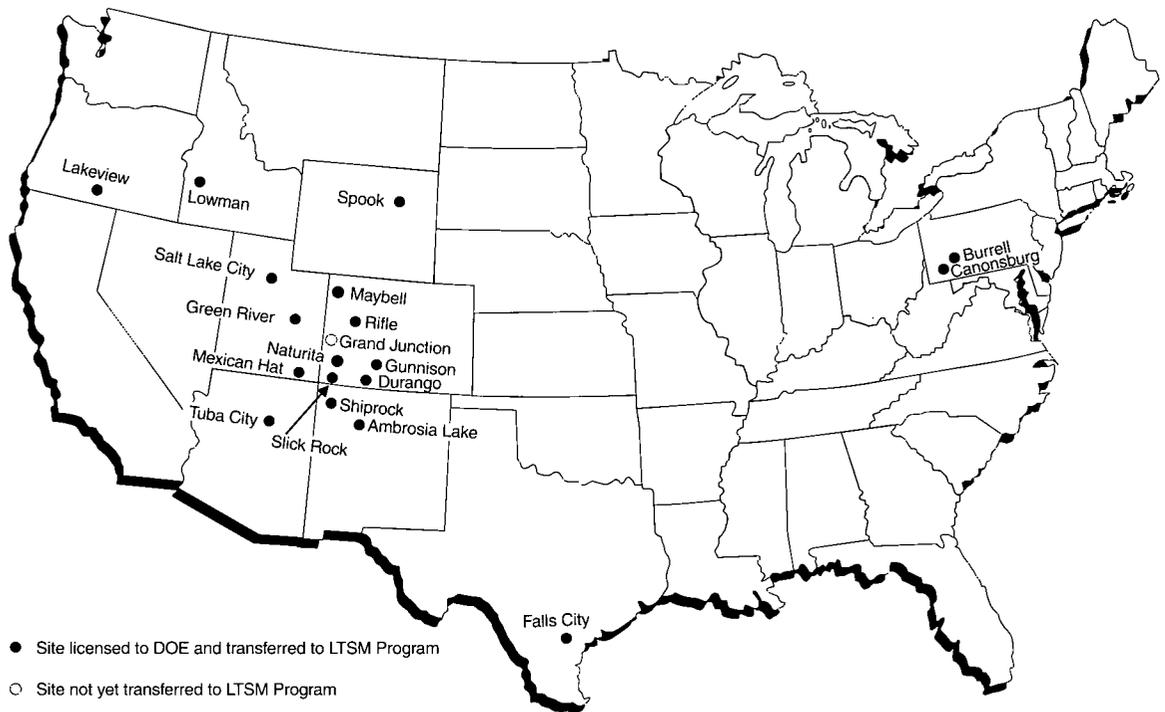


LTSM Program Risks and Responses

Risk	Extent of Risk	Probability	Impact	Risk-Reduction Response
Release of contaminated solids	Site	Low	Increased risk to public and environment, violation of laws or regulations, potential contamination of soil and groundwater	Sites are inspected to identify and address potential problems before a release can occur. DOE-GJO maintains an emergency response team that can be called upon to respond if necessary. The LTSM Program also maintains communication with local response agencies.
Release of contaminated leachate	Site	Moderate	Increased risk to public and environment, violation of laws or regulations, potential contamination of soil and groundwater	Leachate accumulation levels are monitored at sites with leachate collection systems. Conservative action points have been established. If leachate levels rise to the action points, leachate will be pumped and treated. Early warning point-of-compliance monitor wells are sampled at other sites where this risk is identified. Cover integrity is evaluated annually.
Public injury at site	Site	Low	Potential lawsuit, negative publicity	Exercise due diligence. Sites are clearly marked and access is impeded where necessary.
Failure of institutional controls	Site	Low, near-term; increases with time	Increased risk to local population and environment	A review of institutional controls is conducted at the time of the annual inspection and before conducting a nonroutine activity.
Records damage or loss	Program	Low	Loss of mission-critical active and historical records. Inability to respond to frequent requests for information	National Archives and Records Administration-compliant records management system in place and operational.
Loss of funding	Program	Low	Site operations would scale down or cease, may incur fines or other penalties	Sites are designed to require only minimal surveillance and maintenance; they should remain protective for short periods of time without intervention. If funding is curtailed for longer periods, Federal regulators can order DOE to resume work.
Degradation of containment systems	Site	Varies from low to high	Expense to re-evaluate containment system design and implement repair	Sites are inspected regularly for early warning of integrity reduction. The LTSM Program is notified of severe natural events or events that might threaten site integrity.
Vandalism to sites	Site	Moderate, high at some sites	Theft or damage to cover materials, possible release of or exposure to contaminated materials	Passive security measures are evaluated annually and maintained as necessary. Ongoing vandalism may require upgrades to access controls or increased site presence.
Regulatory noncompliance	Program	Low, but funding dependent	Noncompliance notification, potential negative publicity	A regulatory compliance review is conducted at the time of the annual inspection and before conducting a nonroutine activity.
Loss of key personnel	Program	Moderate	Short-term disruption of operations	Program operations are guided by approved plans. Records are maintained of site conditions and program activities.



LTSM Projects and Sites



Locations of UMRCA Title I Sites

UMTRCA Title I Disposal Sites

UMTRCA specified 24 inactive uranium processing sites for remediation. Of these, two sites in North Dakota were removed from the UMTRA Project. Remediation resulted in creation of 19 disposal cells that contain encapsulated uranium mill tailings and associated contaminated material. Almost 43 million cubic yards of low-level radioactive material are contained in UMRCA Title I disposal cells.

The U.S. Environmental Agency (EPA) sets forth UMRCA remedial action, cell performance, and groundwater standards in 40 CFR 192. These standards direct DOE to design the cells to endure with minimum maintenance for 1,000 years, or at least 200 years. Upon NRC concurrence that remedial action is complete and acceptance of the site-specific LTSP, each site comes under the DOE general license for long-term care granted in 10 CFR 40.27. If groundwater at a particular site was contaminated by former site activities, NRC will allow

only the surface improvements to come under the general license; the site will not be fully licensed until groundwater quality meets the applicable regulations. The NRC license mandates annual inspections of the disposal cells.

Two UMRCA Title I disposal cells (Maybell and Naturita, Colorado) came under the general license in 1999. A portion of the Grand Junction, Colorado, Disposal Cell will be left open under the Long-Term Radon Management Project that is managed by DOE-GJO in conjunction with the LTSM Program.

LTSM Program personnel inspected 19 UMRCA Title I disposal sites during fiscal year 1999. The following summaries provide a brief status report on each site; complete annual inspection reports and fact sheets are available on the LTSM Program World Wide Web site (www.doegjpo.com/programs/ltsm/) or from the LTSM Program office at DOE-GJO.



Ambrosia Lake, New Mexico—Contaminated materials were consolidated and encapsulated on the existing tailings pile. The riprap-armored disposal cell was closed in 1995. NRC has concurred that groundwater quality conforms to the requirements of 40 CFR 192 through the application of supplemental standards. Therefore, groundwater monitoring is not required to determine compliance or cell performance at this location, and NRC fully licensed the site in 1998. The shallow depression on the cell cover noted in 1998 is probably an artifact of cell construction and has not changed. Minor vegetation encroachment upon the cell will be monitored.

Burrell, Pennsylvania—Mill tailings were hauled to this location from the Canonsburg, Pennsylvania, site for use as fill. Because of the large volume of tailings on the site, a disposal cell was constructed at Burrell. The disposal cell was accepted under the NRC general license in 1994. In 1999, the LTSM Program completed a biointrusion study indicating that plant encroachment will not result in an increased risk or in regulatory noncompliance. If NRC concurs in the LTSM Program recommendation that vegetation control be halted, an indigenous hardwood forest will likely establish on the cell cover. Groundwater monitoring indicates that the cell is operating as designed.

Canonsburg, Pennsylvania—DOE encapsulated low-level radioactive material from the millsite and 163 vicinity properties in an engineered disposal cell in 1985. NRC accepted the site under the general license, and the site was transferred to the LTSM Program in 1996. This urban disposal cell has a compacted clay liner to prevent the isolated radioactive materials from causing groundwater contamination. The tailings were covered with 3 feet of a clayey soil radon/water infiltration barrier and layers of rock and soil; the cover was seeded with grass. Custodial maintenance at the Canonsburg Disposal Cell includes mowing the grass within the site boundary and preventing the establishment of shrubs or trees on the cell cover, thus ensuring the success of the grass cover and preventing erosion. Limited groundwater and surface water monitoring will continue annually

through 2003. Unneeded monitor wells will be abandoned. Canada thistle, a noxious weed, has been identified growing at the site and may require control. A stream bank stabilization project is planned for 2000.

Durango, Colorado—DOE removed tailings, contaminated building debris, and soil from the processing location on the Animas River and vicinity properties. The low-level radioactive material was encapsulated in the Durango Disposal Cell southwest of Durango in 1990. NRC accepted the cell under the general license in 1996. The cell cover includes a radon/water infiltration barrier consisting of multiple layers of compacted clay materials and an overlying bentonite geomembrane mat. Over this layer are placed a sand filter/drainage layer, a rock biointrusion layer, and a frost-protection/rooting medium layer. A planted rock-soil matrix layer protects the top slope of the cell; the side slopes are covered with riprap to protect against wind and water erosion. Groundwater is monitored annually to confirm cell performance.

Falls City, Texas—NRC concurred that this site conformed to EPA standards, and the site was brought under the general license in 1997. Tailings from seven deposits were combined in a disposal cell on the original millsite. The cell top is grass covered and is mowed twice a year to discourage growth of deep-rooted plants on the cover. Plant encroachment on the riprap-armored side slopes is a concern. Area drainage was corrected after flooding occurred on adjacent properties. Because groundwater at this location contains widespread naturally occurring contamination, it is classified as limited use. The groundwater is sampled to monitor cell performance.

Grand Junction, Colorado—Low-level radioactive materials from the Grand Junction, Colorado, area were relocated to the Grand Junction Disposal Cell. A portion of the cell will remain open until as late as 2023 under the Long-Term Radon Management Project (see page 23). The LTSM Program assumed responsibility for the entire site in 1998, but the provisions of the site-specific LTSP address only the closed portions of the cell. Groundwater



monitoring is not required at this site because of poor ambient quality. However, shallow paleochannels near the cell are monitored to detect any seepage that might escape the cell. Volunteer plant encroachment on the rock-armored cell cover may become a concern.

Green River, Utah—Tailings, contaminated soil, and building debris were encapsulated in an on-site disposal cell in 1989. NRC accepted the Green River Disposal Cell under the general license for UMTRCA Title I in 1998, and the site was transferred to the LTSM Program. The program conducts annual inspections; no extraordinary repairs or maintenance have been required to date. Groundwater at the site was contaminated by processing operations and is sampled to monitor cell performance. Site groundwater contains naturally elevated levels of selenium and is not used as drinking water in the region.

Gunnison, Colorado—Uranium mill tailings along the Gunnison River and contaminated materials from demolished mill structures and vicinity properties in Gunnison were relocated to the Gunnison Disposal Cell in 1995. NRC licensed the site in 1997. Groundwater monitoring is required at point-of-compliance wells to confirm cell performance. In 1999, the sampling frequency was reduced from semiannual to annual sampling events. Potential concerns at this location include freeze-thaw degradation of the riprap and changes in drainage patterns that could be caused by future expansion of the adjacent Gunnison County Landfill. Unneeded monitor wells will be abandoned.

Lakeview, Oregon—Remedial action was completed at the Lakeview site in 1989, and NRC placed the site under the DOE general license in 1995. The disposal cell side slopes are armored with riprap; the top slope is covered with riprap, overlain with soil, and planted with native grasses. The olivine basalt armor rock is monitored annually for signs of accelerated weathering and consequent reduction in size. The LTSM Program monitors site groundwater to verify that contaminants are not leaching from the disposal cell. In 1999, the sampling frequency was reduced from

annual sampling to sampling once every 5 years.

Lowman, Idaho—In 1992, DOE consolidated radioactive materials from processing operations and vicinity properties onto existing radioactive sand piles and encapsulated the material beneath an engineered cell cover. NRC licensed the disposal cell in 1994. Groundwater monitoring is required to confirm cell performance. In 1999, modifications were made to a runoff water diversion system to prevent erosion on adjacent property. Plant encroachment upon the cell cover will be monitored to determine if vegetation will compromise cell integrity. Otherwise, the site is in excellent condition, without any maintenance needs.

Maybell, Colorado—Tailings and process-related waste were consolidated on the existing tailings pile and encapsulated in 1998. NRC concurred in the remediation and accepted the site under the general license in 1999. The site lies in a uranium mining district and several abandoned mines and processing sites are located nearby. Local groundwater was contaminated by uranium mineralization and from mining activities and is not monitored for compliance. Groundwater levels will be measured to monitor for potential transient drainage from the cell until at least 2004. Settlement plates within the cell will be surveyed through 2003 because the large quantity of encapsulated slimes creates a potential for consolidation.

Mexican Hat, Utah—Mill tailings from the UMTRCA Title I processing site in Monument Valley, Arizona, were hauled to the Mexican Hat Disposal Cell and co-disposed with tailings left at this location. In 1997, NRC accepted the disposal cell under the general license for UMTRCA Title I sites, and the site was transferred to the LTSM Program. The Navajo Nation retains title to the land. The program conducts annual inspections; no extraordinary repairs or maintenance have been required to date. Groundwater at the site was contaminated by processing operations and is sampled at downgradient seeps and monitor wells by the LTSM Program and the UMTRA Ground Water Project. The



shallow aquifer is naturally unsaturated and is expected to drain empty of contaminated water.

Naturita, Colorado—Contaminated soil and building debris from a processing site on the San Miguel River were relocated to a sandstone quarry pit near the UMETCO Title II site at Uravan, Colorado, and were encapsulated beneath an engineered cover. NRC licensed the Naturita site in 1999. Tailings from the processing site had previously been relocated to the Hecla Durita millsite, which will become an UMTRCA Title II disposal site. Because the Naturita Title I cell is located in a region of uranium mineralization and mining activity, formation fluids beneath the site have elevated uranium concentrations. The LTSM Program will monitor water levels in shallow water-bearing formations to detect transient drainage; samples will be collected if enough water is present. If contamination from the cell is detected, the program will begin monitoring the uppermost aquifer, located 600 feet beneath the cell.

Rifle, Colorado—In 1996, DOE relocated wastes from two uranium and vanadium processing sites near the Colorado River and waste from decontaminated vicinity properties to the Rifle Disposal Cell, located north of Rifle. NRC granted DOE a general license for custody and long-term care of cell in 1998. Ongoing maintenance concerns include abandoning monitor wells that are no longer used and monitoring transient drainage accumulating at the toe of the cell. Minor site-related groundwater contamination would not pose a risk to local water supplies or human health; therefore, postclosure groundwater monitoring at the disposal site is not required.

Salt Lake City, Utah—Mill tailings and associated contaminated materials were relocated from the Salt Lake City processing site to the Salt Lake Disposal Cell in 1988. NRC licensed the disposal site in 1997. The cell is located adjacent to a commercial low-level radiological waste disposal operation. Remedial action was conducted by the State of Utah under the direction of the UMTRA Surface Project. The existing groundwater is classified as limited use because of poor ambient water quality;

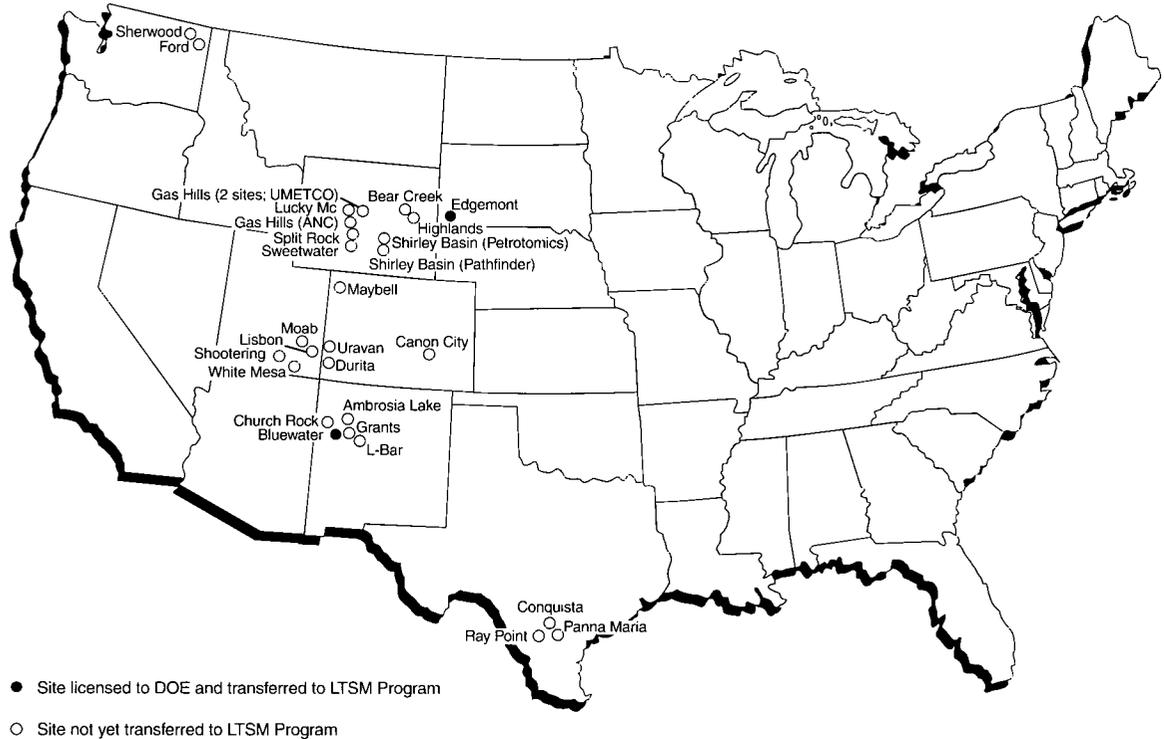
therefore, groundwater monitoring is not required.

Shiprock, New Mexico—Cleanup of the Shiprock site was completed in November 1986 by consolidating and stabilizing the mill tailings in an on-site engineered disposal cell. NRC licensed the Shiprock Disposal Cell in 1996. The Navajo Nation retains title to the land. Maintenance activities include controlling annual deep-rooted weeds and salt cedar (tamarisk), a noxious shrub. The UMTRA Ground Water Project is characterizing groundwater contaminated by former processing operations and may conduct active groundwater remediation in the adjacent San Juan River floodplain. The LTSM Program initiated radon monitoring this year.

Slick Rock, Colorado—Tailings from two processing sites on the Dolores River were relocated to the Slick Rock Disposal Cell in 1996. This site was accepted under the NRC general license in 1998 and transferred to the LTSM Program. The cell contains tailings, contaminated debris, and soil from the demolished mill structures and vicinity properties. The riprap-armored cell is sited on a small mesa on unsaturated sedimentary rock. No groundwater monitoring is required at the disposal cell location. The remedial action contractor reseeded the site in September 1998 after the initial restoration failed because of dry weather. The LTSM Program is monitoring transient drainage water accumulation within the cell.

Spook, Wyoming—This site consisted of a small, open-pit uranium mine, with associated tailings, ore piles, mine adits, and ore-processing structures. DOE placed all contaminated materials in the pit on a low-permeability soil layer and constructed an engineered cover over the waste. The stockpiled overburden was compacted over the disposal cell under the Surface Mining Control and Reclamation Act and graded to provide drainage. As much as 60 feet of earthen material covers the encapsulated tailings at this site. Groundwater monitoring is not required at this site; the existing groundwater is classified as limited use because of widespread naturally occurring uranium contamination. Monitor wells will





Locations of UMTRCA Title II Sites

be abandoned; Canada thistle, a noxious weed, may require control.

Tuba City, Arizona—DOE encapsulated mill tailings in place over the existing tailings pile in 1990. NRC granted DOE a general license for custody and long-term care of the surface impoundment at the Tuba City Disposal Cell in 1996, and the site was transferred to the LTSM Program. The Navajo Nation retains title to the land. Minor volunteer vegetation growth on the rock cover has been studied to assess if the plants are affecting the water barrier properties of the cover system. The UMTRA Ground Water Project will begin active groundwater remediation in 2001.

UMTRCA Title II Disposal Sites

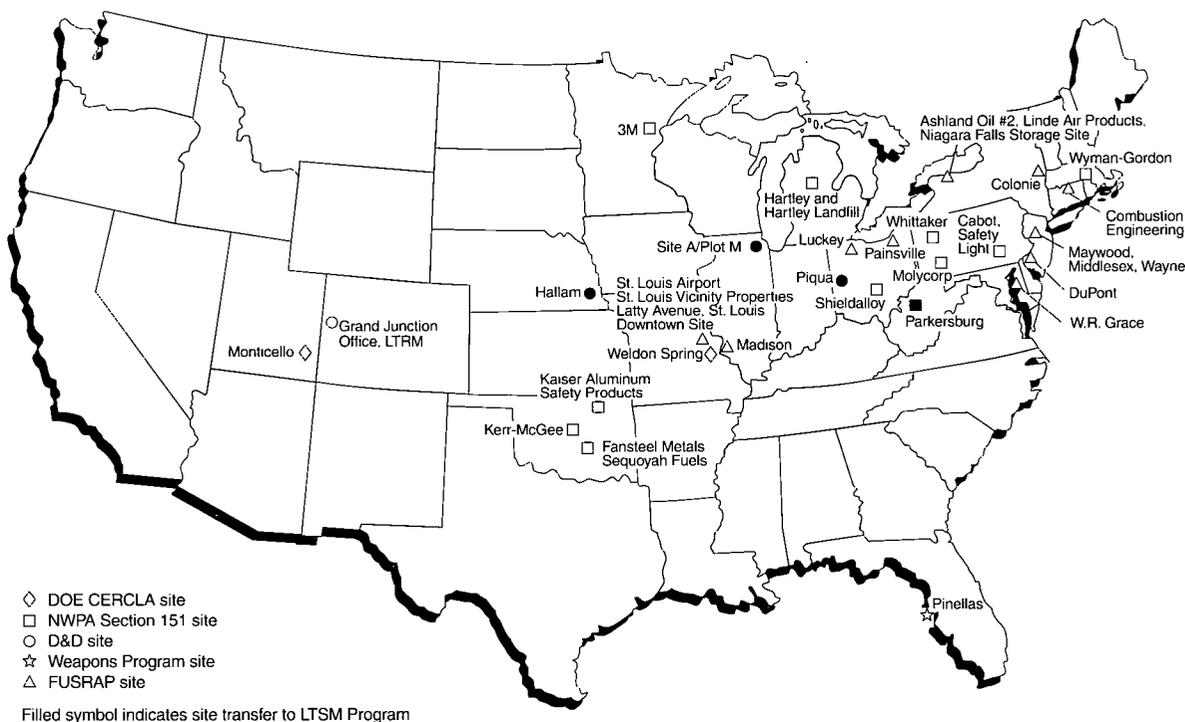
Uranium processing sites addressed by UMTRCA Title II were active when the act was passed in 1978. These sites were commercially owned and are regulated under NRC license. For license termination, the owner must conduct an NRC-approved reclamation of any on-site radioactive waste remaining from uranium ore-processing operations. The site owner also must ensure

full funding for inspections and, if necessary, ongoing maintenance. The sites are then transferred to DOE for custody and care. DOE administers the sites under the provisions of a general NRC license granted in 10 CFR 40.28.

To date, the LTSM Program manages two UMTRCA Title II sites; this number is expected to increase to 18 sites by 2006 as ongoing site reclamations are completed. Ultimately, as many as 27 UMTRCA Title II sites may be managed by the LTSM Program.

Bluewater, New Mexico—ARCO Coal Company stabilized mill tailings piles in place and completed engineered covers in 1995. NRC accepted the site under the general license in 1997. The radon barrier covering the wastes is protected by rock armor. All surrounding disturbed areas were graded and revegetated with indigenous species. The Bluewater site also contains other stabilized disposal areas, including a small riprap-armored disposal cell containing polychlorinated biphenyl-contaminated uranium mill tailings that was permitted by EPA and is in compliance





Locations of Non-UMTRCA Sites in the LTSM Program

with the Toxic Substances Control Act. Several years of active groundwater treatment did not succeed in returning groundwater contaminant levels to background concentrations. Subsequently, alternate concentration limits were granted for the site. DOE conducts groundwater monitoring at the Bluewater site to verify continued compliance with the approved limits.

Edgemont, South Dakota—The Tennessee Valley Authority relocated tailings from the millsite to an engineered disposal cell in 1989. Material from Edgemont vicinity properties, remediated by the UMTRA Surface Project, was co-located with the material from the millsite. NRC concurred with placing this disposal cell under the general license for long-term custody in 1996. The 9-foot-thick radon/water infiltration barrier, consisting of 3 feet of compacted clay, 5 feet of clean compacted fill, and 1 foot of topsoil material, was revegetated with native grass species to prevent soil erosion. Groundwater monitoring is not required for this site because the closest confined aquifer lies below an impermeable bedrock layer. Controlled livestock grazing of the grassed site cover

is administered by the LTSM Program to promote the long-term health of the turf.

NWPA Section 151 Sites

Certain sites with low-level radioactive contamination remediated by the owner under the NRC Site Decommissioning Management Program can be transferred to DOE under NWPA Section 151. This law allows DOE to assume title and responsibility for the long-term custody and care of these sites. Because these sites are not addressed by an NRC license after transfer, DOE long-term surveillance and monitoring activities are self-regulated. As with the UMTRCA Title II sites, the owners of these sites must obtain NRC concurrence with the results of the implemented remedial action and must ensure future funding for long-term stewardship before NRC will terminate the site license.

At present, the LTSM Program manages one site transferred to DOE under NWPA Section 151. In 1994, the Parkersburg, West Virginia, site was transferred to DOE under NWPA Section 151(c). DOE may transfer additional sites to the LTSM Program under

Section 151(b). This action depends on the successful implementation of a Memorandum of Understanding between NRC and DOE and the acceptance of the candidate sites by DOE.

Parkersburg, West Virginia—At this site, radioactive zircon ore was processed under contract to the U.S. Atomic Energy Commission (AEC) from 1957 to 1968, resulting in waste accumulation and soil contamination. Some of the waste was pyrophoric, or capable of causing fires and explosions. Remediation of the site was completed in 1982 when the NRC-approved disposal cell was closed. The grass-covered, gently sloping stabilized mound covers an area of approximately 12 acres and is surrounded by a posted security fence. Custodial maintenance for the Parkersburg site includes discouraging the establishment of shrubs or trees that may degrade the cover. The LTSM Program initiated annual inspections at this location in 1994. Site groundwater complies with the Federal Safe Drinking Water Act and State of West Virginia groundwater standards. As a best management practice, DOE will monitor the groundwater at approximately 5-year intervals.

CERCLA Sites

DOE is the responsible party at two sites that were placed on the National Priorities List (NPL) by EPA. These sites were remediated in accordance with CERCLA guidance. Neither site has been deleted from the NPL. Because these sites cannot be released for unrestricted use, DOE is required by statute to conduct 5-year remedy performance reviews.

Weldon Spring, Missouri—The Weldon Spring, Missouri, CERCLA site was operated as the Weldon Spring Uranium Feed Materials Plant from 1955 until 1966. Previous use of the site included manufacture of trinitrotoluene (TNT) by the U.S. Army from 1941 to 1945. The Army reoccupied the property in 1966 and began decontamination of structures to allow the production of defoliants, but the project was canceled before new equipment was installed. The site was placed on the NPL in 1987 because of contamination in a rock

quarry that had been used for waste disposal. Raffinate ponds and the former chemical plant were added to the NPL in 1989. Contaminated plant buildings were removed by 1994, and bulk removal of contaminants from the quarry was completed in 1995. Significant LTSM Program activities at Weldon Spring will begin in 2002 as the site begins transition to DOE custody. The LTSM Program will conduct postclosure activities at the Weldon Spring facility.

Monticello, Utah, Sites—EPA listed the Monticello, Utah, Mill Tailings Site and the Monticello Vicinity Properties Site on the NPL in 1989. Monticello mill activities generated approximately 2.5 million cubic yards of low-level radioactive waste as a result of uranium and vanadium ore processing. Contaminated materials were distributed by wind and water and limited amounts were used for construction, resulting in contamination of approximately 400 vicinity properties. These properties and the millsite have been cleaned up and the materials were placed in a disposal cell. All cell cover materials were placed in 1999; the cover will be seeded in 2000. Supplemental standards were applied to limited occurrences of radioactive material that was left in place because the material posed no risks and remediation would be technically unfeasible, unjustifiably expensive, or harmful to the environment. According to the LTSP proposed for Monticello, annual inspections of the cell and the supplemental standards areas will be conducted in perpetuity. The LTSM Program will assume stewardship responsibility for the cell and may conduct groundwater remediation beginning in 2002.

Weapons Program Site

The Pinellas Science, Technology, and Research Center in Largo, Florida was contaminated with low-level radioactive materials created during the manufacture of neutron generators and other devices for DOE. Facility remediation at the Pinellas site was completed in 1997 by DOE under the EPA Resource Conservation and Recovery Act (RCRA) Corrective Action Program. The facility was transferred to local government ownership in 1995, but DOE continues to



conduct pump-and-treat groundwater remediation. Responsibility for the Pinellas site is scheduled for transfer to the LTSM Program in 2003.

D&D Program Sites

The LTSM Program has custody of three DOE D&D Program sites: Piqua, Ohio; Hallam, Nebraska; and Site A/Plot M located near Chicago, Illinois. These sites were transferred from the custody of the DOE Chicago Operations Office in 1998. One additional D&D Program site (the GJO facility) will be transferred to the LTSM Program.

Hallam, Nebraska, and Piqua, Ohio—The Piqua, Ohio, and Hallam, Nebraska, sites are former nuclear reactor facilities that were built for the AEC Power Demonstration Program during the mid-1960s. In both cases, the reactors were operated in cooperation with, and on the property of, area electric utilities. Both reactors were decommissioned in the late 1960s, and the reactor vessels were sealed with concrete and steel during decommissioning after removal of spent fuel and other removable contamination. Annual inspections and monitoring are conducted by the LTSM Program to verify encapsulation integrity.

Site A/Plot M, Illinois—The Site A/Plot M area is the former location of Argonne National Laboratory and its predecessor, the University of Chicago Metallurgical Laboratory. Site A contains buried contaminated building debris and the biological shield for the CP-3 reactor. Plot M contains radioactive wastes from the mid-1940s to 1949 buried in trenches. Both Site A and Plot M were decommissioned in 1956. The LTSM Program is responsible for air, surface water, and groundwater monitoring at Site A/Plot M.

Long-Term Radon Management Project

Radioactive material from the Climax millsite in Grand Junction, Colorado, and tailings and tailings-contaminated material from more than 4,000 Grand Junction vicinity properties were relocated to the



The open portion of the Grand Junction, Colorado, Disposal Cell is visible within the completed riprap-covered portions of the cell.

UMTRCA Title I Grand Junction Disposal Cell under the DOE UMTRA Surface Project. Contaminated material from the Grand Junction Office Remedial Action Project at the DOE-GJO site was colocated with the UMTRA waste. The 360-acre disposal site is located 18 miles south of Grand Junction in Mesa County, Colorado. A 60-acre disposal cell was constructed on the site to contain 4,600,000 cubic yards of low-level radioactive material. A portion of the cell was left open to accept up to 250,000 cubic yards of tailings from Mesa County, other UMTRCA locations, and the Monticello, Utah, CERCLA sites. This action was taken to provide a disposal location for incidental low-level radioactive material, such as might be removed from utility trenches and from beneath streets as those structures are rebuilt. The cell will not remain open past 2023. The LTSM Program operates the cell and provides long-term care for the facility.

Grand Junction Office Remedial Action Project

The DOE Grand Junction Office was established as part of the Manhattan Project to purchase uranium ore concentrates. DOE conducted pilot uranium milling studies at the site between 1953 and 1958. Mill tailings, contaminated soils, and most of the contaminated buildings have been removed or decontaminated. The remaining



contaminated buildings will be decontaminated or removed by 2001, when the site will be transferred to the LTSM Program for monitoring. Groundwater monitoring will be necessary for 60 to 80 years until the aquifer is remediated through natural flushing.

FUSRAP Sites

The U.S. Congress directed the U.S. Army Corps of Engineers to remediate contaminated sites designated under FUSRAP. DOE negotiated a Memorandum of Understanding with the U.S. Army Corps of Engineers to transfer responsibility for the sites to the DOE for long-term care after remedial action is completed. The remediated sites will become the responsibility of the LTSM Program, but the actual number of sites is not known at this time.

Cover Monitoring and Long-Term Performance Project

DOE designed and constructed engineered soil and rock covers on uranium mill tailings disposal cells to contain contaminants for 1,000 years. The LTSM Program initiated the Cover Monitoring and Long-Term Performance activity in 1998 to evaluate how changes in disposal cell environments, both observed changes and changes projected over hundreds of years, may alter cover performance. Research results improve LTSM Program site inspections and benefit UMTRA Ground Water Project remediation tasks, long-term cover design initiatives at DOE weapons sites, and new cover design guidance by EPA.

EPA Alternative Cover Assessment Project—LTSM Program scientists continued participation in EPA's Alternative Cover Assessment Program in 1999. The goal of this program is to develop new guidance for cheaper, more effective covers for municipal and hazardous waste landfills in arid and semiarid western States (these sites currently are regulated under RCRA Subtitle C or D). Researchers will use field studies, modeling, and natural analog studies to acquire data needed to evaluate alternative covers. The Alternative Cover Assessment Program has funded the

lysimeter test facility in Monticello, Utah, since 1998.

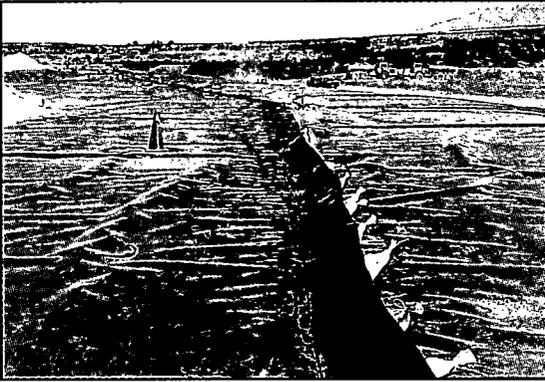
Monticello Cover Lysimeter—Research continued in 1999 to demonstrate the performance of the water-control features of the Monticello, Utah, Disposal Cell cover. The cover designed for this cell departs from conventional UMTRCA and RCRA designs in that it relies on a thick topsoil layer and a capillary barrier to retain precipitation and on soil evaporation and plant transpiration (evapotranspiration) to seasonally dry the topsoil and limit water movement into the encapsulated tailings. The LTSM Program teamed with EPA Region 8 to conduct a controlled field test of the design with drainage lysimeters at the Monticello site. The lysimeter test facility consists of caissons buried in the ground. A full-scale vertical profile of the cover was constructed in one caisson, incorporating the most suitable materials available at the site. Instrumentation for automated monitoring of the soil-water balance was accessed in an adjacent caisson. In 1999, a second full-depth cover profile was constructed at the facility incorporating the actual cover materials sampled from stockpiles.

The lysimeters will be used to model the water storage capacity of the Monticello cell cover. They will be irrigated until drainage occurs across the capillary break, then covered and allowed to stabilize so the water storage capacity of the soil layer can be measured. The lysimeters will then be planted and monitored for at least 5 years. Data will be collected on precipitation, change in water storage, drainage, and evapotranspiration.

A 7.5-acre drainage lysimeter was installed in the Monticello Disposal Cell cover during construction. This facility will be used to confirm in-place water storage capacity and water balance parameters.

In Situ Moisture Monitoring—In situ moisture monitoring was initiated at the Shiprock, New Mexico, Disposal Cell in 1999. Moisture profiles are measured with a neutron hydroprobe. The monitoring will proceed through the coming year to determine if (1) the tailings have dried out





A flap welded to the synthetic liner in the Monticello, Utah, Disposal Cell cover creates a 7.5-acre drainage lysimeter. Water passing through the overlying soil and rock layers of the cover will collect behind the flap and will be directed to automated measuring equipment.

since closure and (2) if infiltration of the tailings can be inferred from changes in soil water content at depth.

Tuba City, Arizona, Revegetation Study—Revegetation success is critical at this desert location to stabilize drifting and windblown sand. This ongoing study has been conducted in cooperation with the University of Arizona. Study plots were established using a variety of irrigation and planting techniques. Revegetation success was greatest when seedlings were planted in deeply ripped rows and watered weekly for the first growing season. These results and research methods are applicable to many sites in the arid southwest United States and elsewhere.

Gravel Admixture Ecology—The cover on the Durango, Colorado, Disposal Cell includes a soil/gravel admixture layer at the surface that is intended to limit erosion without compromising plant growth or evapotranspiration. The design was based on studies at the DOE Hanford Site in the 1980s. LTSM Program researchers began a study of plant ecology on the Durango gravel admixture in 1998 to determine if the high percentage of gravel is altering plant growth or evapotranspiration and, therefore, the performance of the cover. Because 1998 was a relatively dry year,

the plant ecology studies were repeated in 1999, when the region received significantly more precipitation. Comparisons were made between plant cover and biomass in the admixture on the cell top and in a revegetated off-cell area with similar soil and setting. Leaf area index measurements were also obtained in 1999. Preliminary results indicate that plant cover and productivity are greater in the reference area. The results were used to proportion the gravel content of the topsoil layer of the cover on the Monticello, Utah, Disposal Cell.

Leaf-area index measurements were collected on the vegetated cell top and at analog sites that represent the natural plant community at the Lakeview, Oregon, site. Studies at this location are ongoing. Deep-rooted plants are colonizing the cell top. These studies will help determine if the vegetation must be controlled or if other remedial action is required.

DOE Long-Term Cover Guidance—The LTSM Program continued to support a DOE Headquarters initiative to develop a guidance document for designing long-term covers for buried wastes at DOE weapons production sites. LTSM Program researchers teamed with scientists from DOE national laboratories and the academic community on a technical task plan that incorporates lessons learned from the LTSM Program Cover Monitoring and Long-Term Performance activity. LTSM Program personnel also participated in discussions at the DOE Hanford Site about constructing infiltration barrier covers over the tank farms where high-level radioactive and transuranic waste from leaking underground storage tanks has been carried into the vadose zone by precipitation.

Subsurface Containment Focus Area—LTSM Program scientists participated in a workshop on vadose zone technologies in Seattle, Washington. Program personnel were asked to provide information on UMTRCA covers, the use of analog studies for cover design, and the design of the Monticello, Utah, evapotranspiration cover.

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LTSM Program Web Site: <http://www.doegjpo.com/programs/ltsm/>
This site contains downloadable fact sheets about LTSM Program sites, long-term surveillance plans, site status reports, links to applicable or relevant and appropriate regulations, and other information.

DOE Albuquerque Operations Office: <http://www.doeal.gov/>
This site presents the mission and descriptions of the activities of DOE Operations Office, under which the Grand Junction Office operates.

DOE Office of Environmental Management: <http://www.em.doe.gov/>
This site provides descriptions of many of the DOE remedial action programs under which sites in the LTSM Program were remediated and has information on individual sites.

Lasting Legacy: <http://www.lastinglegacy.net/legacy3.1/loadup.htm>
This site provides descriptions of the DOE weapons complex, plans for each site, and discussions of stewardship issues.

EPA Alternative Cover Assessment Program Activities Summary:
<http://www.rtdf.org/public/phyto/minutes/altcov/default.htm>
Summaries of the work of the Alternative Cover Assessment Program are available at this site.

State and Tribal Governments Working Group: <http://www.em.doe.gov/stgwg>
This stakeholder organization, sponsored by DOE, has been active since 1989 in promoting sound stewardship practices for DOE sites after remediation is complete.

Long-Term Stewardship Information Center: <http://lts.apps.em.doe.gov/>
This site presents references describing stewardship activities and resources within DOE.



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