U.S. DEPARTMENT of ENERGY | Office of Legacy Management

PROGRAM UPDATE

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THE LEGACY OF ENVIRONMENTAL CLEANUP

Director's Corner

LM Part of Rich U.S. Weapons, Cleanup, Stewardship Story

When visitors see sites managed by the U.S. Department of Energy (DOE) Office of Legacy Management (LM) today, they often see landscapes that look very different from what existed decades ago.

Sites such as Fernald in Ohio, Rocky Flats in Colorado, Weldon Spring in Missouri, and dozens of others were once active facilities. Together, they formed part of a nationwide nuclear enterprise that supported the U.S. during World War II and throughout the Cold War.

These sites included uranium mining, milling, and processing facilities, each contributing to a complex system that supported the nation's nuclear weapons program. The impacts of that system are still felt today.

After the Cold War ended, the U.S. began the long and difficult work of cleaning up facilities that supported its rise to a nuclear superpower.

By 1989, the nation faced what became the largest environmental cleanup effort in world history. The cleanup investment to date exceeds $200 billion, with hundreds of billions more expected, according to the U.S. Government Accountability Office.

DOE established the Office of Legacy Management to manage sites where cleanup was completed and to ensure that cleanup remedies remain effective over time. LM conducts long-term surveillance and maintenance, working with many partners to protect human health and the environment from contamination that occurred decades ago.

LM's mission also protects the federal government's substantial investment in cleanup. As more sites complete remediation, LM's portfolio continues to grow, as does our commitment to safeguard human health, environments, and public properties bound to the nation's post-closure responsibilities at former atomic defense sites.

In this edition of *Program Update*, we explain LM's role in this historic effort. We describe the scope of the cleanup challenge, the regulatory framework that guides the work, how Tribal nations have been affected and engaged, and why LM was established in 2003.

Routine work at LM sites includes annual site inspections, environmental monitoring, groundwater management, and enforcement of institutional controls. At some sites, groundwater contamination has been more difficult to clean up than originally expected. These sites require additional investigation, long-term monitoring, updated treatment approaches, and revisions to groundwater compliance plans.

LM also manages aging facilities and infrastructure, some of which are deteriorating faster than expected. The Office works with regulators, partners, and the public through sustainment, modernization, and maintenance programs to address these challenges.

As LM continues to evolve, it adapts to changes in technology, laws, and public expectations. Each day, the program works to meet these challenges and upholds a high standard of federal stewardship.

Although World War II ended in 1945 and the Cold War ended in 1991, the impacts of those conflicts continue today. To understand LM's mission, it is important to understand why these sites were created, how they were cleaned up, and what DOE's ongoing responsibilities to the American people are.

For decades, American workers performed the difficult and often dangerous work required during the Atomic Age in the U.S. LM also has a responsibility to help preserve their stories and the stories of the communities that played a critical role in shaping world history.

The DOE cleanup and long-term stewardship story is one worth understanding, and most certainly one worth telling.

Warm regards,

Carmelo

Carmelo Melendez

Safeguard human health, environments, and public properties bound to the nation's postclosure responsibilities at former atomic defense sites.

Welcome to the January-March 2026 issue of the U.S. Department of Energy Office of Legacy Management ***Program Update***. This publication provides a status of activities within LM.

Please direct all comments and inquiries to media@lm.doe.gov.

GOAL **ONE**
Protect human health and the environment.

GOAL **TWO**
Preserve, protect, and share records and information.

GOAL **THREE**
Safeguard former contractor workers' retirement benefits.

GOAL **FOUR**
Sustainably manage and optimize the use of land and assets.

GOAL **FIVE**
Sustain management excellence.

GOAL **SIX**
Engage the public, governments, and interested parties.

Inside This Update: Contents

The Four Elements of Environmental Legacy

A look into the complexities of nuclear waste remediation

During World War II, the U.S. Army Corps of Engineers Manhattan Engineer District (also known as the Manhattan Project) developed the world's first nuclear weapons with the help of sites across the United States. With the passing of the Atomic Energy Act of 1946, the weapons production transferred to the U.S. Atomic Energy Commission (AEC). The AEC expanded production to more facilities and sites across the country as they stockpiled weapons.

Once Congress abolished AEC in 1975, weapons production was transferred to the Energy Research and Development Administration, which was later absorbed into the U.S. Department of Energy (DOE) in 1977. In 1989, the Secretary of Energy created the Office of Environmental Management (EM) to carry out the massive undertaking of cleaning up sites that had been contaminated in service of the nation's defense.

"This was a huge undertaking for everyone involved, with the biggest responsibilities going to DOE," said Office of Legacy Management (LM) Director of Site Operations Jay Glascock. "This involved millions of gallons of contaminated water and materials, thousands of facilities, and millions of pounds of materials. They had not had to tackle something this large of a scale up until this point."

DOE's primary goals for these sites were to protect human health and the environment and return the sites for use by their communities when possible. DOE's first task was to figure out what kind of waste was involved and how to approach deciding which sites to address first.

"Up until then, there had been a lot of concerns with the level of contamination from these sites, so DOE needed to assess each one and determine which should be addressed first," Glascock said.

Barrels at the Weldon Spring Site, Missouri, raffinate pits required extensive cleanup during the Weldon Spring Site Remedial Action Project from 1987-2001.

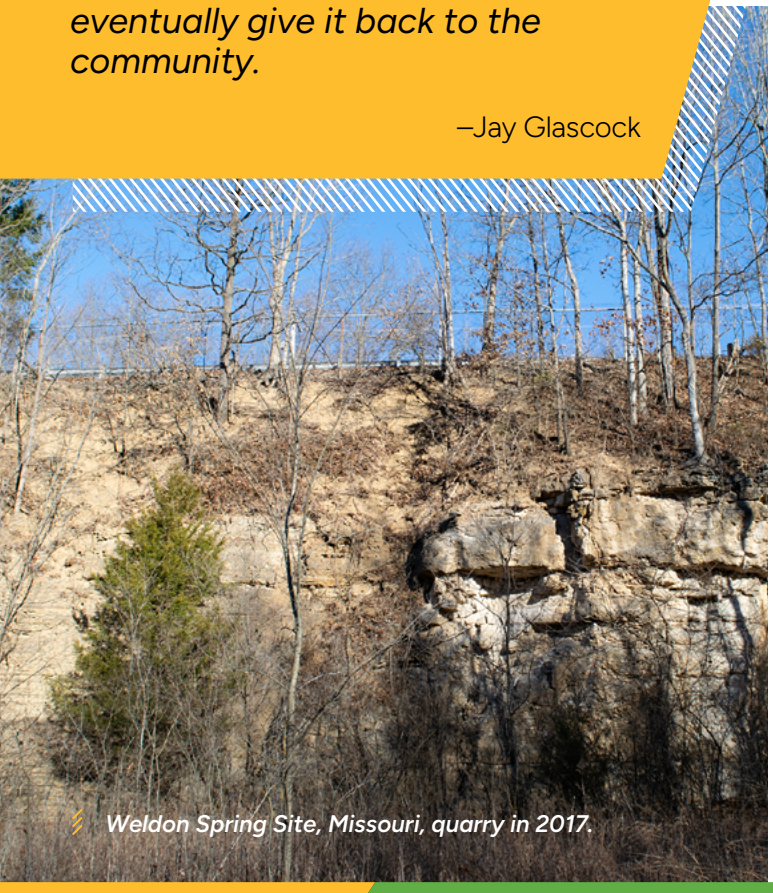
DOE started by defining the four major legacy elements:

- Contaminated environmental media — soil, groundwater, surface water, sediments, and other materials.
- Surplus facilities — used for weapons production and no longer needed. Scheduled to be deactivated and decommissioned.
- Waste — high-level waste, low-level waste, hazardous waste, and byproduct material.
- Materials in inventory — all materials not used in the past year and not expected to be used going forward.

The findings were daunting:

- Contaminated materials — 21 billion gallons of solid media and 475 billion gallons of water.
- Surplus facilities — 5,100 estimated facilities.
- Waste — 100 million gallons of high-level waste, 50 million gallons of transuranic waste, 8.5 million gallons of byproduct material, 870 million gallons of low-level waste, and 38.5 million gallons of mixed low-level waste.
- Materials in inventory — 1.8 billion pounds.

> *The end goal for every site remediated under DOE is to eventually give it back to the community.*
>
> —Jay Glascock



Weldon Spring Site, Missouri, quarry in 2017.

Remediation at the Fernald Preserve, Ohio, Site in 2006.

It was estimated that the remediation of sites would cost over $215 billion initially and take decades. Today, the total number spent is closer to $400 billion, with more projected over the coming years as more sites are undergoing cleanup.

Once DOE classified the different kinds of waste and assigned EM the task of cleanup, EM was faced with the question of where to start and what DOE would classify as successful remediation.

"EM conducted studies on different aspects of each site and then proceeded to rank which site would need to be prioritized over the others," Glascock added. "They wanted to be sure that they were addressing the most important sites first, based on whatever results came back from their research and testing."

DOE wanted to accomplish four things at every site: adhere to all environmental laws and regulations, work with state and local governments, engage with communities and stakeholders, and manage records.

"The end goal for every site remediated under DOE is to eventually give it back to the community," Glascock said. "DOE has entrusted that goal to LM since 2003, and we work hard to continue to achieve those parameters they set when they started remediation."

While returning sites to the public is the goal, it's not always possible in the near term due to residual contamination, which is why DOE established LM in 2003. Today, once a site is successfully cleaned up, long-term stewardship responsibilities are transferred to LM.

LM has now taken responsibility of more than 100 sites across the United States and Puerto Rico, with more expected in the coming years.

Long-Term Stewardship Responsibilities Required New Office

Legacy Management created in 2003 to protect public; cleanup progress highlights

The Rocky Flats Site in 2014, after nine years of long-term stewardship and revegetation.

The Office of Legacy Management (LM) was established in 2003 by the U.S. Department of Energy (DOE) to provide long-term surveillance and maintenance (LTS&M) at sites across the United States and Puerto Rico.

Some of these sites trace their roots back to World War II and the U.S. Army Corps of Engineers Manhattan Engineer District, commonly known as the Manhattan Project.

> *LM has learned a lot in working with these agencies, as we mutually share our lessons learned about site remediation and long-term stewardship.*
>
> — Carmelo Melendez

With the passage of the Atomic Energy Act of 1946, nuclear weapons development was transferred from the military to the newly formed, civilian controlled U.S. Atomic Energy Commission (AEC). In 1975, AEC dissolved, and its functions split into the U.S. Nuclear Regulatory Commission and the Energy Research and Development Administration (ERDA). The functions of ERDA were absorbed into DOE when it was established in 1977.

Work supporting national defense during World War II and the Cold War left a legacy of radiologically contaminated sites. In response, DOE created the Office of Environmental Management (EM) in 1989 to clean up sites and to protect human health and the environment.

DOE originally estimated it would take over $215 billion dollars to just clean up the sites, with more needed for additional work to maintain them. The sites' cleanup would be prioritized based on highest levels of contamination, proximity to local communities, and the potential for water contamination. EM investigated of these sites, which included surveys and water sampling.

During cleanup, EM is responsible for safely transferring large volumes of nuclear waste, safeguarding and preparing for transfer of nuclear materials, deactivating and decommissioning radiologically and chemically contaminated structures, and remediating extensive surface and groundwater contamination.

Rocky Flats Site, Colorado, in 1995 (left) and 2005, at the end of remediation (right). LM takes responsibility for sites after cleanup is complete.

"While DOE's goal was to eventually give these sites back to the public for unrestricted use, not all sites are going to be able to meet that standard," LM Director Carmelo Melendez said. "There were some sites that would need to be managed indefinitely, which is where the idea of LM started."

"After a site was cleaned by EM and successfully remediated, it would be transferred to LM for long-term surveillance and maintenance. LM was created with a common mission to protect human health and the environment."

LM's LTS&M activities include maintaining engineering and institutional controls designed to contain or prevent exposure to residual contamination and waste, inspecting and evaluating surface features, monitoring groundwater and surface water, treating groundwater, maintaining other barriers and contained structures, controlling access, responding to emergencies, posting signs, and keeping records.

Initially tasked with 33 sites, LM has grown significantly over the course of 22 years. As of January 2026, LM provides LTS&M to more than 100 sites across the United States and Puerto Rico.

In providing long-term stewardship for sites, LM follows a range of environmental laws and regulations, such as the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act. To be successful, LM also works closely with Tribal, state, and local governments as well as community members and international organizations.

"Since LM's inception, we've seen the broad acceptance of long-term care concepts, not only in the United States, but also on a global scale," Melendez said. "Since 2019, LM has worked in partnerships worldwide, collaborating with professionals and international groups to support LTS&M in places like Europe, central Asia, and Canada."

LM's international activities include meetings, symposia, and workshops across the globe. LM has also hosted visitors from organizations like the International Atomic Energy Agency's Coordination Group for Uranium Legacy Sites and the Nuclear Energy Agency's Forum on Stakeholder Confidence.

Through these partnerships, LM has further forged relationships with entities ranging from Canada to central Asia that are all managing cleanup and long-term stewardship of radiological sites that are part of the world's atomic and Cold War legacy.

"LM has learned a lot in working with these agencies, as we mutually share our lessons learned about site remediation and long-term stewardship," noted Melendez.

"We have a very dedicated staff that is constantly working to come up with solutions to problems every day to achieve our mission. We are constantly evolving, learning, and sharing what we've learned to help others. LM has had an impact not only at home, but all over the world — and will continue to do so."

The Legal Framework for DOE Remediation Efforts

Laws ensure accountability, protect human health and the environment

Regular site inspections are required under several of the legal frameworks LM operates under.

The U.S. Department of Energy (DOE) carries out a wide range of important activities. A significant part of its historical mission, especially during the Cold War, involved processes that left an environmental impact.

To address legacy contamination and to protect of human health and the environment, DOE's long-term stewardship efforts are governed by a robust framework of federal statutes — environmental laws and subsequent foundational decisions that have been established over several decades.

Foundational environmental laws passed by the U.S. Congress, along with subsequent amendments and regulations, have had a transformative impact on how the Office of Legacy Management (LM) addresses environmental challenges and mitigates risks.

"The decisions governing environmental cleanup at DOE sites represent our unwavering commitment to environmental stewardship," said LM Director of Site Operations Jay Glascock. "I call it the 'red taillight guarantee.' Cleanup is complete, and everyone is driving away, but LM will remain here for the long haul."

LM, as the long-term steward of these remediated sites, will operate and maintain the remedies put in place during cleanup for as long as it takes, working within these regulatory frameworks.

Key laws influencing DOE regulations have been implemented over the decades. While this isn't a complete list of every law or regulation, these are critical drivers of DOE's work.

Atomic Energy Act, 1946:
This act created the U.S. Atomic Energy Commission, a DOE precursor, granting broad authority over nuclear materials and facilities. It is fundamental to DOE's responsibilities towards radiological contamination and remediation.

National Historic Preservation Act, 1966:
This act requires federal agencies to consider the effects of work taking place on historic properties. DOE projects often involve evaluations for archaeological resources and historic properties.

National Environmental Policy Act (NEPA), 1970:
NEPA requires federal agencies to evaluate potential environmental impacts of their proposed actions.

Clean Air Act, 1970:
This legislation regulates air emissions, including those from DOE cleanup activities.

Clean Water Act, 1972:
This act controls pollutant discharges into U.S. waters and establishes water quality standards, affecting wastewater treatment and stormwater management at DOE sites.

Endangered Species Act, 1973:
This act protects species facing extinction and the ecosystems they depend on for survival. When DOE undertakes a project, this ensures assessments are made to understand how these actions might impact the protected species and their habitats.

Resource Conservation and Recovery Act (RCRA), 1976:
RCRA governs hazardous waste management from generation to disposal, often referred to as being from "cradle to grave." It is a cornerstone for DOE's cleanup program, particularly concerning mixed waste.

Uranium Mill Tailings Radiation Control Act (UMTRCA), 1978:
UMTRCA addresses sand-like radiological material, known as tailings, left over from milling uranium-bearing ore. It empowers the U.S. Environmental Protection Agency to establish safety standards. The U.S. Nuclear Regulatory Commission and its Agreement States use these standards in their oversight of UMTRCA sites that DOE manages.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 1980:
Sometimes referred to as Superfund, CERCLA provides a federal framework for cleaning up hazardous waste sites. CERCLA's principles are critical to DOE's mission, protecting people and the environment from past contamination.

National Defense Authorization Acts:
Passed annually, these authorize funding, specific cleanup activities, or modify regulatory requirements for defense-related sites. These annual acts often include specific provisions, funding allocations, and directives related to environmental cleanup activities at DOE facilities.

> *I call it the '**red taillight guarantee.**' Cleanup is complete, and everyone is driving away, but LM will remain here for the long haul.*
>
> — Jay Glascock

"Over time, Congress has passed various environmental laws to address the concerns of the American public," said LM Program Analyst Padraic Benson. "These statutes have clearly spelled out the responsibilities and obligations of the federal government."

They have also provided the opportunity for public engagement and prioritized transparency. These laws encourage public comment periods and community involvement, ensuring stakeholders have a voice in environmental decision making. This has built trust and ensured that environmental concerns are heard and addressed.

Even today, these laws provide a balanced roadmap providing the framework for remediation efforts while ensuring accountability and protecting human health and the environment.

The Converted Advanced Wastewater Treatment facility at the Fernald Preserve in Ohio ensures the site complies with the Clean Water Act of 1972.

LM Assists Tribal Communities Where Contamination Persists

Distinct but complementary role supports federal and Tribal agencies

For decades after the end of World War II, the U.S. government needed uranium to supply its large and growing nuclear-weapons complex.

Demand for the radioactive metal was fueled not only by the Cold War arms race with the Soviet Union, but also by the dawn of nuclear power production that began in the 1950s.

Uranium production centered on the unique geology of the American Southwest, where the mineral ore is found in abundance. Much of the mining and milling took place on the Navajo Nation, a 27,000-square-mile area encompassing parts of Utah, Arizona, and New Mexico.

Uranium milling on Navajo land ended in 1970, but contamination from former milling operations persisted at four sites that are now under the supervision of the Office of Legacy Management (LM): Mexican Hat, Utah; Monument Valley, Arizona; Shiprock, New Mexico; and Tuba City, Arizona.

In 1978, Congress passed the Uranium Mill Tailings Radiation Control Act, a federal law that requires safe disposal and long-term maintenance of mill tailings, the radioactive mine rock left over from milling operations. The tailings are encapsulated at engineered disposal cells on three of the four Navajo Nation sites.

Engaging with local communities is a vital part of LM's work at the Navajo Nation sites.

Operations at facilities like the Monument Valley mill in Arizona left contamination on the Navajo Nation.

As part of its mission, LM monitors physical changes that may need to be addressed at the disposal cells. LM also monitors groundwater conditions near the sites and mitigates potential health risks posed by contaminants of concern: compounds such as nitrates and traces of uranium, which exist in greater concentrations at former mill sites.

For day-to-day monitoring and site projects, the U.S. Department of Energy (DOE) has shared decades-long agreements to closely coordinate with the Navajo Nation Abandoned Mine Lands/Uranium Mill Tailing Remedial Action Department and the Hopi Office of Mining and Mineral Resources.

"The cooperative agreements have allowed DOE and our Tribal partners to engage regularly to share ideas, information, and strategic planning that has led to many successful projects," said Tuba City Site Manager Bill Frazier.

In 2007, Navajo communities and six agencies from the U.S. government began working together on the first Five-Year Plan, which outlined a strategy to learn the extent of the problem and address the greatest risks. That was followed by a second Five-Year Plan, and later, a Ten-Year Plan that outlined eight goals: remediate homes, increase water infrastructure in mining areas, focus on 43 priority mines located near homes, clean up Northeast Church Rock Mine in New Mexico, clean up Tuba City Dump in Arizona, treat groundwater at mill sites, conduct health studies, and expand interagency outreach.

"One of the actions from the second Five-Year Plan was to establish a Community Outreach Network to establish outreach among the agencies and communities," said Mexican Hat Site Manager Angelita Denny. "DOE took the lead and set up an outreach office in Window Rock, Arizona, and hired a part-time liaison to help coordinate outreach programs."

In 2019, the six federal agencies and various Navajo Tribal agencies extended the agreement to what is now known as the Ten-Year Plan (2019-2029). The extended agreement between the agencies further emphasizes planning and coordinating outreach events to enhance community understanding of the work agencies are doing to address uranium contamination.

LM plays a distinct but complementary role to the federal and Tribal agencies in addressing uranium contamination on the Navajo Nation. LM's involvement typically centers on:

Long-term surveillance and maintenance (LTS&M):
LM is responsible for LTS&M of sites where radioactive materials were processed or disposed of. This includes former uranium mill tailings sites that have undergone remediation and require ongoing monitoring to ensure the integrity of engineered barriers and to prevent the spread of contamination.

Groundwater monitoring:
A significant aspect of LM's work involves extensive groundwater monitoring at these legacy sites to detect and track the movement of uranium and other radionuclides, ensuring that contaminated groundwater does not impact human health or the environment.

Remediation of former mill sites:
While the U.S. Environmental Protection Agency (EPA) and other agencies address many of the abandoned mines, LM's purview often includes ongoing groundwater remediation at former uranium mill processing sites.

Information management:
LM maintains comprehensive records and data pertaining to former uranium production sites, providing valuable historical context and technical information crucial for ongoing cleanup and monitoring efforts.

Site-specific community engagement:
Similar to EPA, LM engages with local communities regarding the specific sites under its management, providing information on site conditions, monitoring results, and future plans.

In essence, while EPA handles the broader scope of abandoned mines and general contamination and various agencies address other concerns, LM focuses on the enduring responsibilities associated with former federal uranium processing facilities, ensuring their long-term stability and environmental protection after initial remediation.

LM Gets New Deputy Director

Lara Beasley comes to LM from the National Nuclear Security Administration

Department of Energy Headquarters located in the James V. Forrestal Building, Washington, D.C.

Lara Beasley | LM Deputy Director

Lara Beasley has taken her post as acting deputy director of the Office of Legacy Management (LM), effective Monday, Dec. 1, 2025.

Beasley, a Chicago-area native, comes to LM from the National Nuclear Security Administration (NNSA), where she was the principal deputy associate administrator for Environment, Safety, and Health. In that role, Beasley provided executive direction and management of the agency's Enterprise Stewardship and Safety responsibilities.

> *My favorite thing to do as an SES is to help the people who do the '**real work**' solve problems and remove barriers.*
>
> — Lara Beasley

Before working for NNSA, Beasley spent almost 20 years with the U.S. Army Corps of Engineers (USACE). Her last assignment with USACE was as chief of environmental programs, as which she oversaw the technical management, design, and execution of approximately $2.9 billion annually in environmental cleanup, compliance, pollution prevention, and natural and cultural resources management for the U.S. Department of War (formerly U.S. Department of Defense) and other interagency partners.

Beasley also led USACE's Environmental Community of Practice for more than 4,000 USACE environmental professionals.

At USACE, Beasley worked closely with LM on sites managed under the Formerly Utilized Sites Remedial Action Program (FUSRAP). LM and USACE are partner agencies in the remediation and long-term surveillance and maintenance of FUSRAP sites.

While with USACE, Beasley oversaw FUSRAP, so joining LM "feels a little bit like coming home to me," she said. She welcomes the opportunity to help with the U.S. Department of Energy's (DOE) pilot detail program for Senior Executive Service (SES) officers.

"My favorite thing to do as an SES is to help the people who do the 'real work' solve problems and remove barriers," she said. "So bring me the stuff you are stuck on! Let's talk about it and get unstuck together."

Beasley did her undergraduate studies at the New Mexico Institute of Mining and Technology and started her professional career in Albuquerque. She attended Naval War College in Newport, Rhode Island, and spent the summer of 2024 in Sacramento, California, on detail for USACE in its South Pacific Division.

She moved to Washington, D.C., about 15 years ago. She met her husband of six years, Eddie, after moving to D.C. Her favorite thing to do is sit outside at the firepit with Eddie and their dog, a Great Dane named Murphy. ("Yes, I live with Eddie Murphy!" she said.)

Beasley is eager to learn more about DOE outside of NNSA and the aspects of LM's mission that she has not worked on before.

"I'm so excited to work with all of you," she said. "The Army and the DOD spent a lot of time and money developing me into the SES I am today. I really enjoy coaching and mentoring. I see it as an obligation to pay forward the amazing investments made in me, which I will happily do."

A Legacy of Leadership:
DOE Attorney Retires, Reflects on His Career and Evolution of the Department

DOE Deputy Assistant General Counsel for Environment Steven Miller leaves behind a legacy of his own after a long, successful career

After nearly half a century of numerous contributions to the U.S. Department of Energy (DOE), Deputy Assistant General Counsel for Environment Steven Miller has retired. Miller was a dedicated attorney in the field of environmental law and advised the Office of Environmental Management (EM) and the Office of Legacy Management (LM) on environmental issues, focusing on legacy sites across the country.

While Miller didn't know his career would lead him to DOE, he always had a passion for helping the environment. During an LM oral history session in 2022, Miller delved into what led him to his career and why. LM's oral history project aims to preserve the history of DOE through personal experiences and interviews.

> *My favorite thing about working within DOE is being able to share and learn. I love working with interns and sharing the best of the past and bringing that together with the future and solving problems and creating things.*
>
> — Steven Miller

"I was reading the newspapers since the time I was in fourth grade and was interested in real-world problems and addressing those kinds of issues," said Miller. "I always had an interest in tech, and more specifically trains, and learned the New York subway station by the time I was 5, so I thought I would become an urban planner for the city."

After enrolling at New York University (NYU), Miller joined an experimental program called the Metropolitan Leadership Program in the Liberal Arts. This program trained future governmental career employees in interdisciplinary problem-solving and advising senior political leaders how to address these issues.

"I did some internships in urban planning and related subjects at the New York Department of Planning, and also worked with scientists and engineers," added Miller. "I decided that my career path should be different, because planners back then didn't have a lot of influence in what is actually planned in cities."

Miller decided he was going to shift his focus to becoming an attorney. "Lawyers do not just legal work in law firms, but also do governmental work that involves their skills. They do plan in some of those capacities as well, so I decided to try that."

After finishing his undergrad studies at NYU, Miller went to law school and enrolled in a joint degree program with the Graduate School of Urban Planning. Miller finished his grad school program early, taking classes in environmental law and environmental research and finishing with two degrees, in law and urban planning, in three years.

From there, Miller did internships with environmental groups that worked on extending and revitalizing an old rail line in upstate New York. Miller eventually found an honors intern program through the law school placement office that had an opening.

"I didn't really want to leave New York. I was wedded to New York and wanted to be a part of its future. However, I was intrigued with how this program was described and that it was an evolving field with a lot of problems that needed to be solved," said Miller. "I applied and ended up getting in and moving to Washington, D.C., and Arlington, Virginia, and working in Germantown (Maryland) and Washington, D.C., for the Energy Research and Development Administration (ERDA)."

After working with ERDA for a month, Miller received a distinguished service award for his work. A month after that, ERDA was absorbed into what is now DOE. Miller's role continued with DOE's creation, primarily covering National

Environmental Policy Act documents and helping look at sites that had been closed out and what kind of records should be preserved.

"I think in total, I've served DOE for about 48 years," Miller said in a recent interview.

Over the years, Miller's role continued to transform. Not only did he serve as an advisor for LM and EM, but he also performed work in relation to property site transfer issues and per- and polyfluoroalkyl substances (PFAS) contamination. Miller also played a role in Feds Feed Family, mentoring interns, and various projects.

"My favorite thing about working within DOE is being able to share and learn. I love working with interns and sharing the best of the past and bringing that together with the future and solving problems and creating things," said Miller. "I also really love working with LM. They really value my work, and I enjoy working with LM leadership."

Miller's work within LM didn't go unnoticed. In September 2025, LM Director Carmelo Melendez awarded Miller with a Distinguished Service Award. Melendez presented the award with a letter thanking Miller for his service and for his continued "professionalism, unequivocal commitment, and expertise."

In addition to this, Miller has quite a few achievements he is proud of throughout the tenure of his career.

"I would probably say the things that stick out are the legislative work I've done with the reauthorization of CERCLA, which I received an award from the Reagan administration for, and helping create and develop the Formerly Utilized Sites Remedial Action Program," said Miller. "I'm also proud to have had the good fortune to mentor probably hundreds of students."

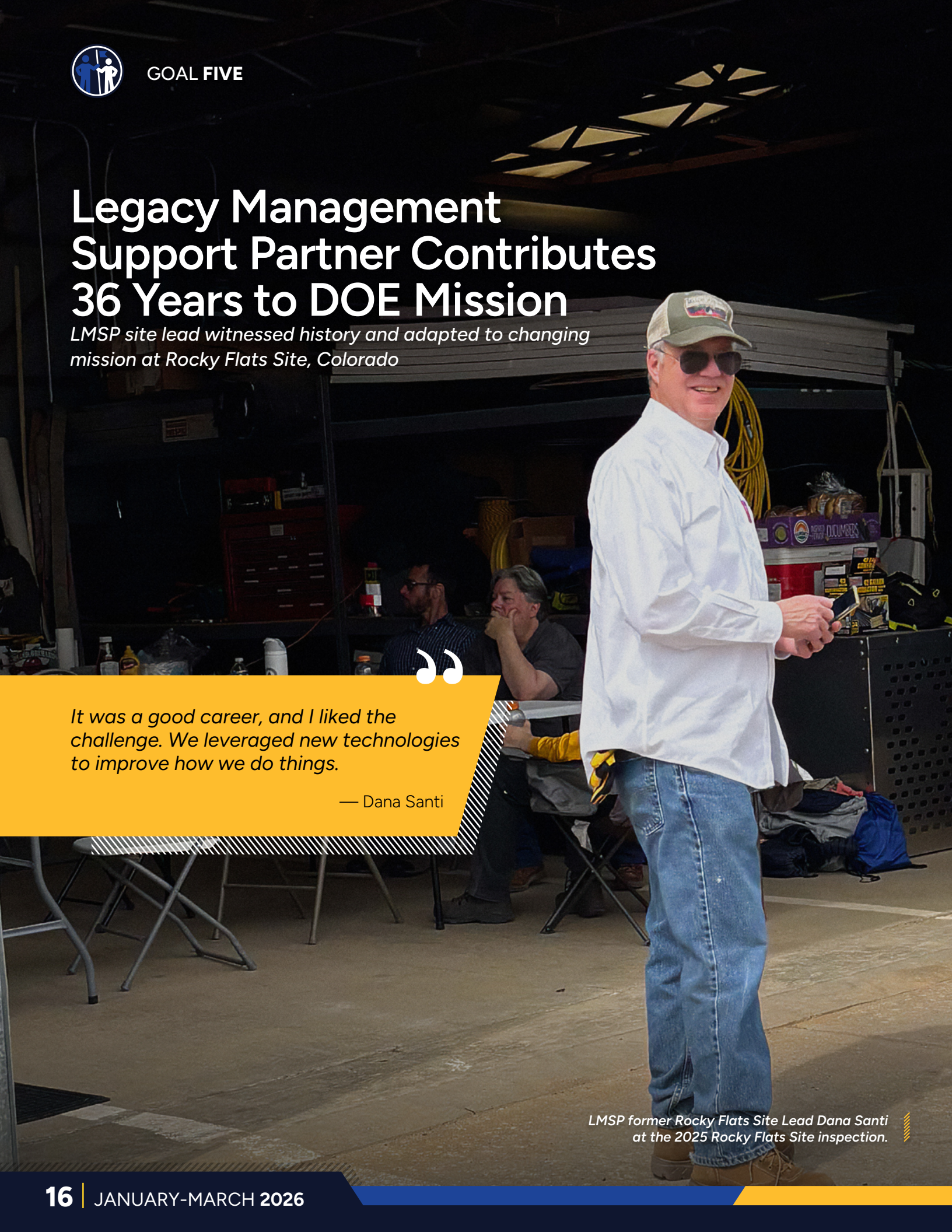
As for what Miller plans to do after retirement, he hopes to continue his work through volunteering and consulting, if the opportunity arises.

"I'm looking forward to a new phase of life, to have more time to pursue outside interests that I haven't had the time to do," he said.

Steven Miller | Former Deputy Assistant General Counsel for Environment

Legacy Management Support Partner Contributes 36 Years to DOE Mission

LMSP site lead witnessed history and adapted to changing mission at Rocky Flats Site, Colorado



> *It was a good career, and I liked the challenge. We leveraged new technologies to improve how we do things.*
>
> — Dana Santi

LMSP former Rocky Flats Site Lead Dana Santi at the 2025 Rocky Flats Site inspection.

When Former Legacy Management Support Partner (LMSP) and Rocky Flats Site Lead Dana Santi first set foot on Rocky Flats in 1984, little did he know that he would spend 36 years of his career as a U.S. Department of Energy (DOE) contractor with five different companies — 25 of those years at Rocky Flats.

Santi first heard about the Rocky Flats Plant from a friend while in graduate school at the Colorado School of Mines. He accepted a research position to support DOE's mission in September 1984. He was eager to learn in an environment rich in resources and technology.

In 1990, Santi moved into management as a first shift manager overseeing the repacking and shipping of solar ponds sludge to approved locations. Later, he managed several different research and development organizations with missions ranging from plutonium extraction and purification to stockpile reliability to decontamination and decommissioning.

When the Cold War ended, the plant stopped production and began environmental cleanup and closure. Santi transitioned his groups to align them with the changing mission. When the final cleanup and closure contract was issued in 1995, Santi took a project manager role to implement technologies to streamline cleanup and reduce costs. His final project before leaving Rocky Flats in 2000 was to work with Los Alamos National Laboratory to design, build, and deploy self-contained mobile standard waste box counters, known as Super-HENC (High Efficiency Neutron Counters). The device enabled Rocky Flats workers to package large pieces of equipment in standard waste boxes and test the equipment on the spot, which significantly reduced waste management and disposal costs.

Santi worked for a contractor's corporate office starting in 2001 as a senior chemical process engineer. As part of that role, he spent 10 years as the process engineer helping to design the Pit Disassembly and Conversion Facility (PDCF) at the Savannah River Site in South Carolina. The plan for the PDCF, which wasn't built, was to receive plutonium as the nation's inventory of surplus nuclear weapons pits was dissembled and convert the material into a form suitable for mixed oxide reactor fuel. In 2015, Santi was a member of the LMSP transition team, and a year later came back to the Rocky Flats Site, Colorado, full time to help with the Original Landfill stabilization project. The site looked vastly different from the plant Santi worked at years ago, and he relied on a few trees and a shed to orient himself.

Santi became the Rocky Flats site lead in 2020 and remained in that role until his retirement in June 2025. As site lead, he was responsible for supporting the DOE Office of Legacy Management's (LM) mission at the site. He oversaw water treatment systems, groundwater and surface water sampling, engineered cover inspections, and general reporting and documentation, and he ensured the site protected human health and the environment.

Dana Santi (right) is presented with a U.S. Department of Energy Career Achievement Award from LM Rocky Flats Site Manager Michelle Franke for his 36 years of service.

"It has been a pleasure working with Dana during his time as the Rocky Flats LMSP site lead, and I have learned so much from him," said Michelle Franke, LM Rocky Flats Site manager. "His leadership, dedication, and extensive knowledge of the site — combined with the expertise and commitment of the site staff — were instrumental in the successful execution of several major maintenance projects as well as effective management of routine site operations. I look forward to working with him periodically on select site projects and wish him the best in his next chapter."

Santi's favorite memories are the times when the team came together to complete a project. He is very proud of the site in its current state and enjoys seeing the wildlife thrive. To hear more about his thoughts on the Rocky Flats Site, click here to view a short video.

"It was a good career, and I liked the challenge," said Santi. "We leveraged new technologies to improve how we do things."

During retirement, Santi is looking forward to camping more with his wife and dogs in their RV, along with renovating his house, working on his Ford Mustangs, and building woodworking projects.

Scan the QR code to watch the Rocky Flats Insights from former Legacy Management Support Partner video: https://youtu.be/-PLY6mdcPFE

Geologist Retires After 41 Years With DOE

Jeff Price spent much of his career with LM Support Partner's Environmental Monitoring Group

Office of Legacy Management (LM) Support Partner Jeff Price has retired after 41 years of service to the U.S. Department of Energy (DOE).

Price, a geologist, began his career in 1984 at what was then the Grand Junction Projects Office in Colorado. He and his team supported the hydrogeological investigations group. They were responsible for geologic logging, aquifer testing, installing monitoring wells, and water sampling.

LM Director Carmelo Melendez thanked Price for his service under a number of different prime contractors over the decades.

"Your unique blend of qualified skills, extensive job knowledge, and diverse experience were essential to the Environmental Monitoring Group (EMO), where you maintained crucial groundwater treatment system infrastructure, well redevelopment, and water quality sampling," Melendez wrote. "Further, you consistently demonstrated a passion for inspiring, mentoring, and developing others to ensure the EMO mission remains strong, transparent, and contributes to building trust with our regulators, partner agencies, stakeholders, and local communities."

Melendez cited Price's outstanding leadership in the field of geology and environmental sampling and for his exemplary work as a site lead.

Price's work included the air sampling programs at the LM Field Support Center in Grand Junction and the Monticello, Utah, Disposal and Processing Sites as well as site lead responsibilities for the Green River Site in Utah, the Shirley Basin South Site in Wyoming, and the Gasbuggy Site in New Mexico.

"Collectively, your professionalism, unequivocal commitment, and expertise were instrumental in supporting environmental monitoring across nine different contracts and fulfilled a tremendous organizational need to characterize, delineate, remediate, and perform long-term stewardship at legacy defense sites nationwide," Melendez wrote. "In recognition of your outstanding career and service to the nation and the U.S. Department of Energy, the Office of Legacy Management extends its heartfelt gratitude for your invaluable contributions to our mission of environmental stewardship."

Price's colleagues honored him with a retirement party Nov. 19 in Grand Junction, some of whom worked with Price for decades. He said working alongside his EMO teammates was by far the most satisfying and enjoyable experience of his career.

"The EMO group is responsible for field work at remote sites, which includes sometimes lengthy road trips with three to four nights away from home and in all kinds of weather," Price said. "The work was sometimes a grind, but it creates great camaraderie with your fellow workers."

Price spent much of his professional life working outdoors at LM's sites in the southwest. He said he'll always remember the vivid sunsets at Monument Valley and the torrential monsoon rains at Tuba City, both in Arizona. The Shiprock site in New Mexico was prone to blinding dust storms, he said, and he recalls the blizzards he and his team would endure on the treacherous Red Mountain Pass in southwestern Colorado.

As he moves into his next phase of life, he will do so without his wife of 35 years, Robin. The two were beginning to formulate plans to travel in their retirement and making lists of things to see and do when Robin passed away.

In spite of his loss, Price said he's grateful for what he has, and he has much to be thankful for.

"What I have learned is that plans change," he said. "So now I'm going through a 'reboot,' if you will, and am currently living one day at a time. I have a good dog and a nice home on 40 acres, and both keep me busy."

> *Your unique blend of qualified skills, extensive job knowledge, and diverse experience were essential to the Environmental Monitoring Group.*
>
> — Carmelo Melendez

LM Site Manager Bill Frazier, left, presents a Lifetime Achievement Award to Jeff Price on behalf of LM Director Carmelo Melendez.

LM Updates Tribal Agencies on Plan to Address Contaminated Groundwater

Groundwater Compliance Action Plan meant to mitigate risk to human health and the environment

LM staff and LM Support Partners give a presentation in Window Rock, Arizona, on a Groundwater Compliance Action Plan that is being developed for LM's Monument Valley Site in Arizona.

Office of Legacy Management (LM) staff and the LM Support Partner recently updated Tribal offices on a Groundwater Compliance Action Plan (GCAP) that's being developed for the former Monument Valley Processing Site in Arizona.

> *It's important to keep the Tribal offices and local community involved. We need their informed feedback to succeed in our mission.*
>
> — Joni Tallbull

A GCAP documents the approach for demonstrating compliance with the groundwater standards in Title 40 *Code of Federal Regulations* Section 192. This includes developing a conceptual site model, defining groundwater protection standards, conducting a risk assessment, assessing corrective actions, and selecting a compliance strategy that is protective of public health and the environment.

The Jan. 14 meeting in Window Rock, Arizona, informed partners and stakeholders of the progress being made on the site's GCAP. Monument Valley is one of 10 LM sites for which a GCAP is being developed or updated.

During the Cold War, uranium ore from nearby mines was processed at a mill in Monument Valley. Contaminants from the milling operation infiltrated subsurface soils and groundwater. LM and its support partner are evaluating data to assess potential groundwater remedies.

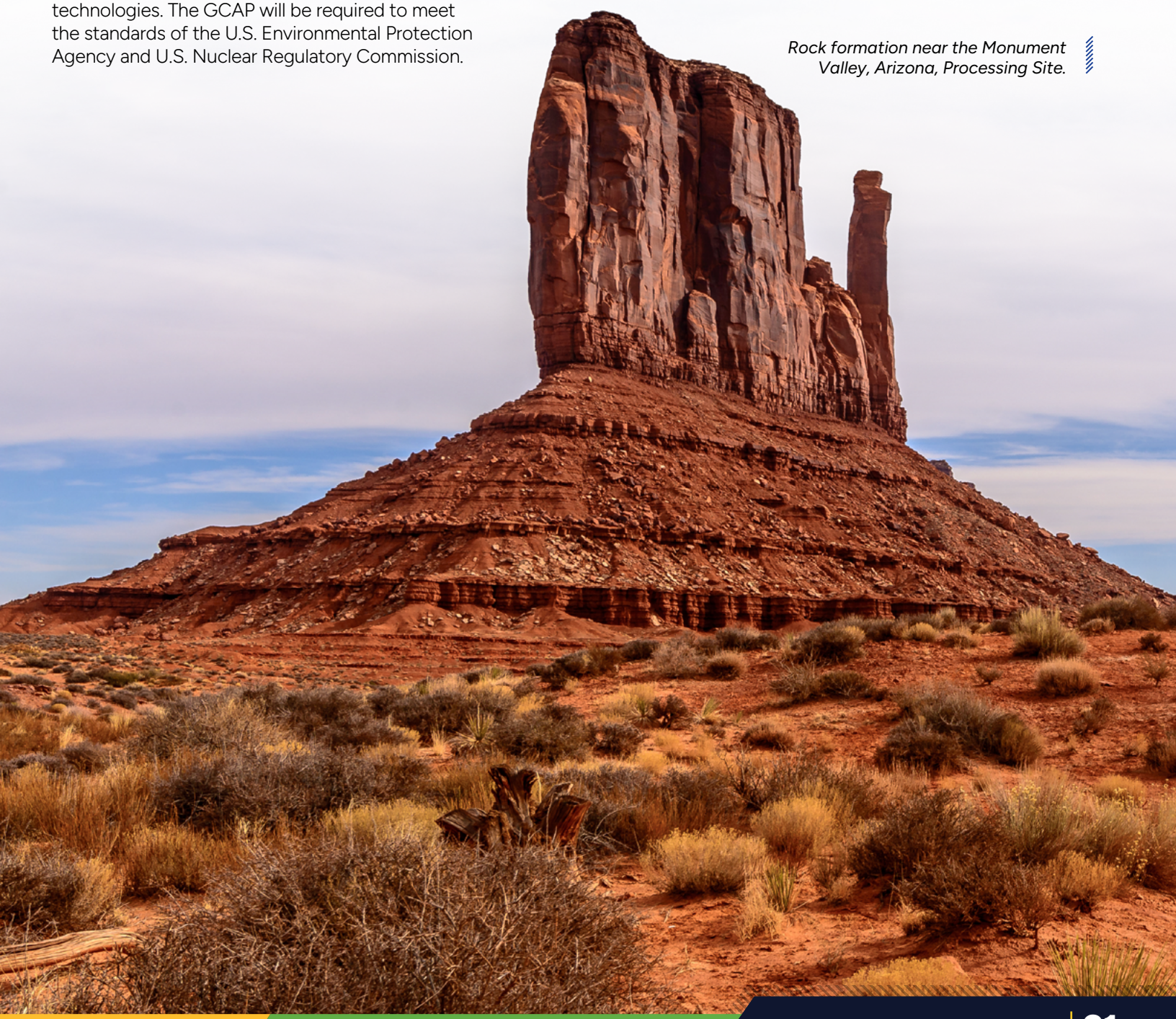
"We wanted to give a briefing and have a discussion with the Tribal offices regarding future actions at Monument Valley to make sure the accessible water there stays safe," said LM Site Manager Joni Tallbull. "It's important to keep the Tribal offices and local community involved. We need their informed feedback to succeed in our mission."

LM's strategy involves mitigating risks not only from uranium, but also other contaminants such as nitrate, with a focus on establishing a compliance strategy in alignment with groundwater regulations. The Monument Valley site is regulated under Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA). Surface water and groundwater protection at UMTRCA Title I sites encompasses two strategies: to contain the spread of contaminants to groundwater, surface water, and surrounding lands and to mitigate the threat to public health and the environment from groundwater contaminants.

With the GCAP being developed for Monument Valley, LM will identify a strategy that will be implemented, monitored, and adapted as needed over time to ensure protectiveness. The strategy may consist of one or more proven technologies. The GCAP will be required to meet the standards of the U.S. Environmental Protection Agency and U.S. Nuclear Regulatory Commission.

The *Ten-Year Plan to Address Impacts of Uranium Contamination on the Navajo Nation* (covering 2020-2029) outlines ongoing and future milestones for the site, including continuing to monitor groundwater, maintaining site infrastructure, and updating conceptual site models based on new data.

The strategy involves evaluating pilot studies and potentially adjusting the GCAP as needed based on the effectiveness of the current remedies, according to the 2022-2023 Ten-Year Plan update.



Rock formation near the Monument Valley, Arizona, Processing Site.

2026 Fernald Preserve Winter Bird Fest

Annual event underscores LM's dedication to community engagement and long-term stewardship

Families, feathers, and fun combined with bird lovers from greater Cincinnati, southeast Ohio, and nearby Kentucky to celebrate the second annual Fernald Preserve Winter Bird Fest.

Despite cold temperatures and some imposing weather, more than 700 visitors attended the opening weekend of the event at the Fernald Preserve, Ohio, Site, enjoying a menu of activities geared toward bird lovers of all ages.

"It's a great way to beat the cold and enjoy some really fun activities," said Cincinnati-area resident Maria Honsaker. She visited Bird Fest with her two daughters. "We love anything to do with nature, so we're having a great time!"

The annual Winter Bird Fest event and similar activities at the site are a valued part of the community programming at the Fernald Preserve Visitors Center and a key part of the site's commitment to engage and educate the community.

"Winter Bird Fest allows us to showcase the transformation the site has undergone — from a former uranium processing facility that underwent environmental remediation into an ecologically restored nature preserve that serves as a valued local resource for the community," said Brian Zimmerman, Fernald Preserve site manager.

The free week-long event offered an array of things to do for bird enthusiasts of all ages, ranging from engaging Family Day events, guided nature walks, and immersive birdwatching sessions to hands-on educational opportunities, special guest performances, and bird banding.

Throughout the week, attendees benefited from the expertise of individuals like Fernald Preserve Ecologist Brian Wulker, who presented a workshop on the Cornell University Lab of Ornithology's Merlin Sound ID tool for birding by ear.

Family Day featured Chris Rowlands, a noted artist and entertainer, who provided the kids with environmental education through songs and puppetry. He followed his performance with a workshop teaching the art of drawing birds.

Attendees Angie Rice and her daughters were all smiles after Rowland's mini concert. "We loved the performance.... It was so much fun. And it's great that the kids and I all leave this event learning something."

Other events throughout the week included a presentation featuring the tips and experiences of Connor Fox, a birder who achieved the monumental goal of finding over 600 species in the lower 48 United States in a single year.

A popular owl pellet dissection activity allowed participants to explore owl diets using microscopes and tweezers, and the week wrapped up on Valentine's Day with a virtual presentation by author Laura Erikson titled "The Love Lives of Birds," which discussed avian courting and mating habits.

Artist and performer Chris Rowland entertains and educates the audience with a little help from younger visitors.

The Fernald Preserve is an ecologically restored habitat that boasts 260 species of birds that stop over or winter at the site, with more than 100 species nesting there. Special feathered guests included waterfowl, shorebirds, and an impressive array of raptors, including owls, hawks, falcons, and eagles.

Birdwatchers at the Fernald Preserve Winter Bird Fest search above Lodge Pond.

The Fernald Preserve's commitment to hosting events like Winter Bird Fest underscores its dedication to community engagement and long-term stewardship. Having been transformed from a former industrial site into a valued community resource and nature preserve, the Fernald Preserve stands as a powerful example of how beneficial reuse and proactive environmental management protect both human health and the natural environment for future generations.

During cleanup efforts more than two decades ago, community members envisioned a future for the Fernald site that would effectively control residual contamination while creating an ecologically restored regional destination for educating future generations. Bird Fest helps fulfill that vision.

Winter Bird Fest is provided with the collaboration and support of event partners including the Audubon Society of Ohio, Midwest Native Plant Society, Oxbow Inc. Land Trust, Cincinnati Public Library (Bird Nerds and Children's Library), MetroParks of Butler County, Cardinal Land Conservancy, and the Northern Kentucky Bird Club.

Younger visitors enjoy stations featuring art and science activities.

Fernald Preserve Site Visitors Center Staff and Presenters:

Bird Fest would not have been possible without the participation of these dedicated presenters and activity leaders:

- **Neil Baker**
  Wildlife Research Technician,
  Ohio Division of Wildlife
- **Frances Boyens**
  Fernald Preserve Visitors Center Manager
- **Ash Conway**
  Educator and Birdwatcher
- **Reilly Earhart**
  Fernald Preserve Visitors Center
  Interpretive Specialist
- **Laura Erickson**
  Author
- **Connor Fox**
  Manager of West Chester Wild Birds
  Unlimited and Birdwatcher
- **Jim McCormac**
  Naturalist and Photographer
- **Carol Mundy**
  Radio Host, WKMV Cincinnati
- **Chris Rowlands**
  Artist and Performer
- **Jon Seymour**
  Board President, Oxbow Inc.
- **Jack Stenger**
  Cardinal Land Conservancy
- **Luke Thies**
  Fernald Preserve Visitors Center
  Interpretive Specialist
- **Wayne Wauligman**
  Board Member, Oxbow Inc.
- **Jordan West**
  Wildlife Photographer
- **Brian Wulker**
  Fernald Preserve Site Ecologist

WM SYMPOSIA 2026

The annual Waste Management Symposia provides the premier open forum for discussing and seeking safe, environmentally responsible, technically sound and cost effective solutions to the management and disposition of radioactive wastes and the decommissioning of nuclear facilities to enhance the transparency and credibility of the global radioactive waste industry.

The following articles summarize papers that LM and LM Support Partners presented at the 2026 Symposia.

For additional information visit: www.wmsym.org

GOAL **SIX**

Decoding the Depths:
LM's Innovative Approach to Groundwater Contamination

Ever wonder what happens beneath our feet, especially in areas where industrial activities once thrived?

Sometimes, these historical operations leave unwelcome legacies, like uranium seeping into our groundwater. This hidden challenge of groundwater contamination poses a significant hurdle for environmental management, demanding sophisticated and proactive solutions.

The Office of Legacy Management (LM), with its mission of environmental stewardship, is at the forefront of tackling these complex issues, ensuring the safety and sustainability of natural resources for future generations. LM's work in this field is not only crucial for ecological balance but also for public health and economic stability in affected regions.

The Silent Threat Beneath:
Understanding Groundwater Contamination

Groundwater is a vital resource, feeding our rivers, sustaining agriculture, and providing drinking water for millions. When this essential resource becomes contaminated, the consequences can be far-reaching and long-lasting. Uranium, a naturally occurring radioactive element, can become mobile in groundwater under certain conditions, posing risks to ecosystems and human health.

LM understands that effectively addressing this threat requires more than just reactive measures; it demands a comprehensive, forward-thinking strategy.

"We wanted to develop something that would be efficient but also continue LM's mission of protecting human health and the environment," said LM Support Partner Corey Wallace.

LM's approach goes beyond merely identifying contamination. This involves cutting-edge scientific investigation, clever computer simulations, and a commitment to protecting our environment for the long run. LM's goal isn't just cleaning up existing problems, but safeguarding underground water supplies for generations to come, turning past environmental challenges into lasting benefits for nature.

At the heart of LM's innovative strategy is an advanced simulation system — the "Pillars of Predictive Insight" — designed to give LM a clear and dependable understanding of how pollution behaves underground, especially when there's still some uncertainty. This system fine-tunes LM's complex underground water models, making sure the forecasts are both reliably accurate and reflect what truly happens in nature. This system includes Locations of Truth and Parameters of Truth.

Locations of Truth:

This cutting-edge method improves LM's computer forecasts by focusing on crucial observation spots within the underground water system. Instead of just gathering random samples, this approach carefully pinpoints key monitoring wells or areas where polluted water naturally exists, which have a big impact on how contaminants move.

LM's computer models are then checked against these spots, keeping only the simulations that correctly show the levels of uranium pollution and their changes over time in these essential locations.

"These spots aren't chosen randomly; they are picked specifically to confirm the model's ability to predict how pollution spreads where it matters most, like places we need to keep clean," Wallace said.

By making sure the models are accurate at these Locations of Truth, LM scientists become much more confident in understanding how pollution travels underground and where it might go in the future.

Parameters of Truth:

Working hand-in-hand with Locations of Truth, this method adds a strict check for what's physically and geologically possible in each model's settings. Computer models of underground water rely on many factors, like the initial amount of pollution or how much water flows into an area.

While some values for these factors might statistically seem right, they could actually go against what is known about the site's geology or what field tests reveal. This method removes any model runs where these calculated factors don't fall within realistic limits, based on actual site data and expert knowledge of underground water systems.

"This ensures that our models always reflect the real conditions underground, preventing seemingly correct but impossible scenarios from misleading our predictions," Wallace said.

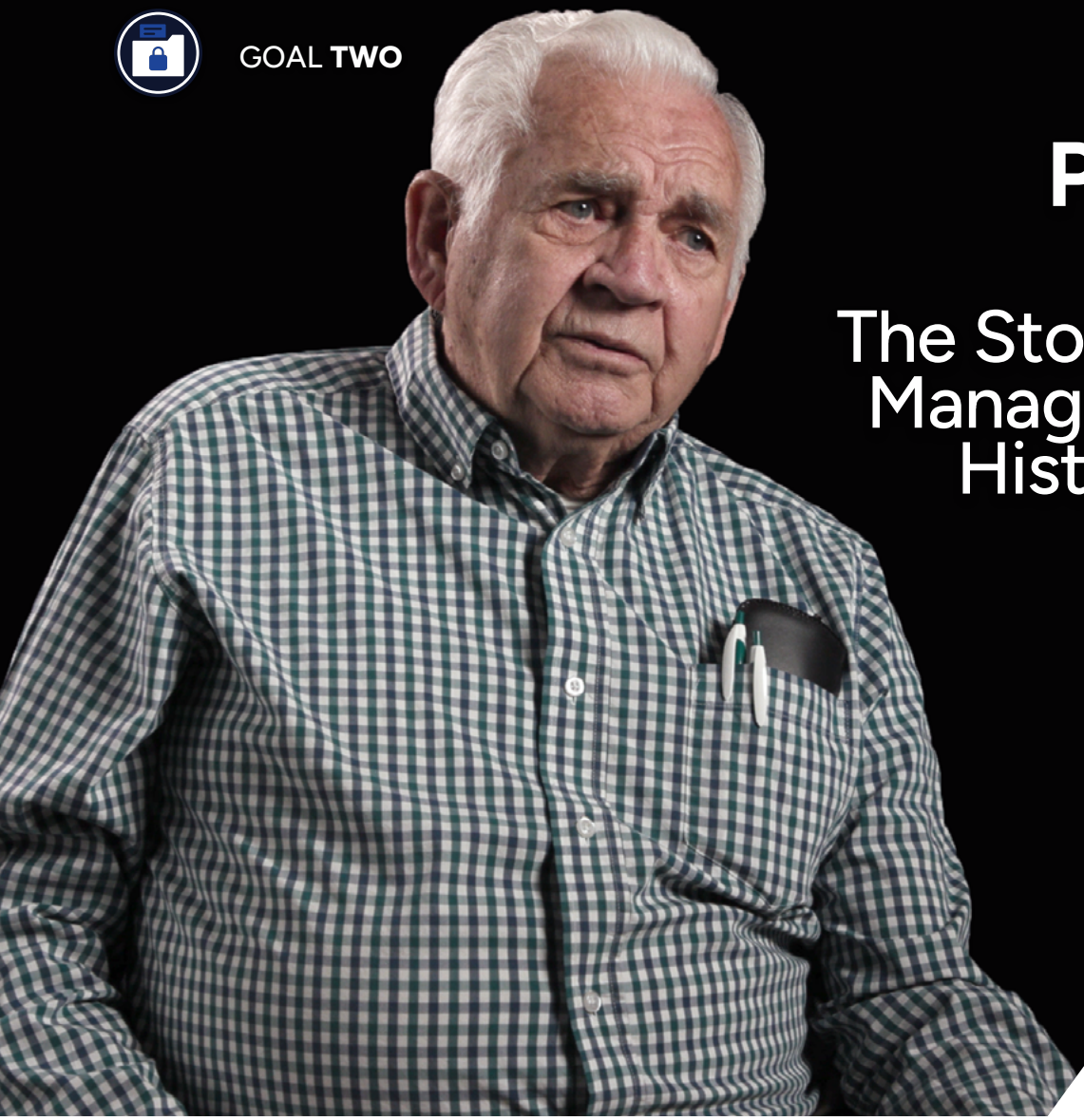
This approach moves beyond simply looking good on paper to ensure LM's forecasts are genuinely believable.

These advanced methods ensure that every decision is supported by solid science and real-world evidence, moving beyond guesses to concrete understanding, ultimately making predictions much more trustworthy.

Gunnison, Colorado, Disposal/Processing.

GOAL **TWO**

Preserving Our Past:
The Story of Legacy Management's Oral History Program



Still from an oral history with Ken Freiberg, former Rocky Flats Cold War Museum Board member.

Imagine a world where the rich history of the country's nuclear past, from weapons production to energy research, is just a collection of old papers.

That's a lot of important information, but what about the people who lived and worked through these times? Their stories, their insights, and their memories are just as valuable. That's where the Office of Legacy Management (LM) comes in with its Oral History Program.

LM oversees the long-term stewardship of former nuclear sites across the nation, making sure they're safe for people and the environment. But beyond the science and safety, LM also has a crucial job: to keep the history of these sites alive.

"This isn't just about historical records; it's about preserving the human side of these important places," said LM Program Analyst Padraic Benson.

At LM's interpretive centers, such as the Atomic Legacy Cabin in Colorado and the Fernald Preserve Visitors Center in Ohio, a unique program is unfolding. It's all about collecting personal stories from those who know these sites best: former workers, people from the local communities, and technical experts.

Why These Stories Matter

These oral histories give us a deeper understanding of how the sites operated, how they affected local communities, and the rules and regulations that guided their work.

"They fill in the gaps that official reports often miss, sharing personal experiences and feelings that bring history to life," Benson said. "By listening to these voices, LM makes sure that the experiences of those directly connected to these sites are saved for future generations."

Two Ways of Capturing History

LM uses two main approaches to gather these precious stories:

- **Formal interviews:**
  These are carefully planned conversations with specific individuals. Staff prepare questions, use high-quality recording gear, and make sure the setting is just right. The result? Detailed stories that become a permanent part of LM's historical archives. Snippets of these interviews may even appear in social media posts or articles.
- **Impromptu (spontaneous) interviews:**
  Sometimes, history happens unexpectedly. Visitors to LM's interpretive centers often share their own memories with staff. These informal chats are quickly recorded (audio only) and capture genuine, on-the-spot recollections. While less structured, they offer valuable snapshots of site history and make it easier for more people to share their experiences.

Making Sure It's Done Right

Whether an interview is formal or informal, LM follows industry standards. This means preparing thoughtful questions, building trust with the people sharing their stories, using the right recording tools, and always getting permission to share their experiences.

Still from a 2019 oral history video with Gustav "Bud" Franz, former Colorado Department of Health employee.

> *These oral histories reveal how decisions were made, what workplace culture was like, and how communities interacted with the sites.*
>
> — Padraic Benson

Still from a 2024 oral history with Madeline Ramos, former employee of the Puerto Rico Electric Power Authority.

Time is of the Essence

"As the generation of people who directly experienced LM sites gets older, there's a need to capture their stories before they are lost forever," Benson said. "These oral histories reveal how decisions were made, what workplace culture was like, and how communities interacted with the sites."

This knowledge is incredibly important for planning future programs, understanding the past, and for research. Beyond just archiving them, LM uses these interviews in videos and social media to share these powerful stories with a wider audience.

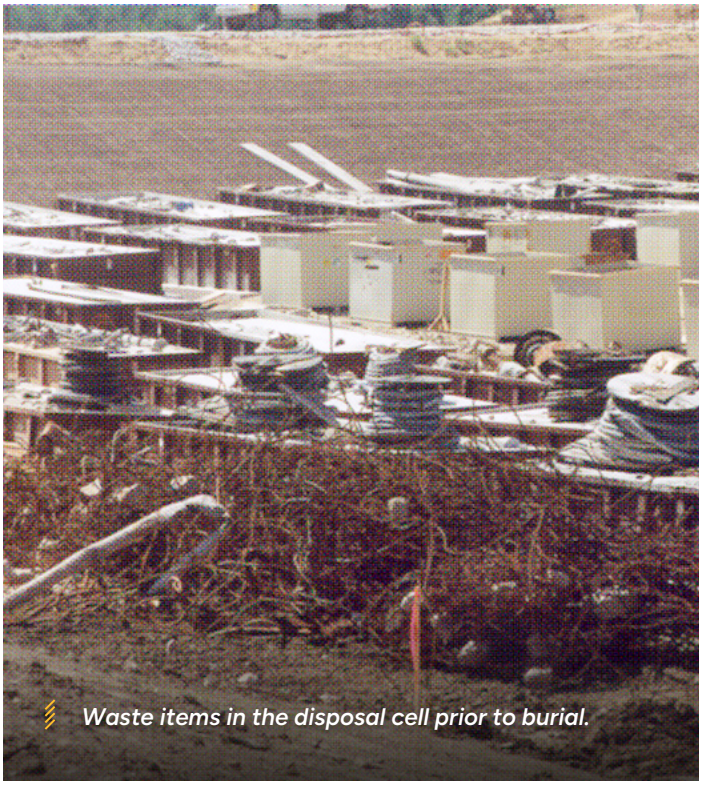
In the end, the personal stories shared by people connected to LM sites are just as crucial as the scientific data and historical objects LM preserves. By capturing and sharing these voices, LM not only honors the individuals who shaped its past but also builds a stronger connection with the public it serves for many years to come.

GOAL **ONE**

Weldon Spring Site Disposal Cell: A Quarter Century of Environmental Stewardship

The U.S. Department of Energy (DOE) Office of Legacy Management's (LM) Weldon Spring Site in St. Charles, Missouri, achieved a significant milestone this year by marking the 25th anniversary of its disposal cell.

"This is a huge achievement," said LM Site Manager Rebecca Roberts. "This is a testament to not only LM's work but also DOE's. With the innovative engineering design of the disposal cell and through a robust long-term surveillance and maintenance (LTS&M) program, DOE continues to demonstrate that the disposal cell is protective of human health and the environment, functioning as designed, and meeting all safety and environmental requirements after 25 years."



Waste items in the disposal cell prior to burial.

Historical Context:

From Military Production to Remediation

The Weldon Spring Site carries a multifaceted history, transitioning from a military production facility to a site requiring extensive environmental remediation:

- **1941-1945:** The U.S. Army operated the site to produce explosives, including TNT.
- **1956-1966:** The U.S. Atomic Energy Commission used the site for processing uranium, critical for atomic energy applications.
- **Post-1966:** The Army maintained the site in a vacant status for approximately two decades.
- **1986:** DOE began comprehensive investigations into widespread contamination stemming from both explosives manufacturing and uranium processing activities.

These investigations led to a pivotal decision: A comprehensive remediation effort was necessary to address the site's environmental legacy effectively.

Engineering the Solution:

The Disposal Cell Construction

The final phase of cleanup began in April 1997 with the groundbreaking for the disposal cell. This cell was meticulously engineered to encapsulate all chemical and radiological waste accumulated over a 16-year cleanup period. Its design incorporated stringent specifications to ensure long-term waste stability, minimize ground settlement over time, optimize use of internal space, and prevent radon gas emissions, a critical safety measure.

Within this expertly constructed cell, securely protected by multiple containment layers, are 1.13 million cubic meters (approximately 1.48 million cubic yards) of contaminated

soil, sludges, concrete, and other debris. This substantial volume is now permanently and safely isolated from the environment.

Two Decades of Proven Performance:

A Model of Effective Management

The disposal cell was officially completed in October 2001. Since 2003, DOE has maintained vigilant oversight through annual inspections and aerial surveys, integral components of the LTS&M program. These routine assessments enable:

- **Early identification of any subtle changes that could potentially affect the cell's long-term performance.**
- **Prompt remediation of minor issues, preventing their escalation.**
- **Continuous monitoring of collected leachate and analysis of groundwater samples from adjacent wells to confirm the continued absence of leakage.**

Inspections conducted over the past 25 years consistently demonstrate outstanding results. Observations are limited to minor weathering on the uppermost rock layer, the volume of leachate collected has shown a consistent decrease, and comprehensive groundwater monitoring confirms no evidence of contaminant release.

Groundwater samples are taken regularly and analyzed to confirm the cell is working as intended.

"This represents a significant and enduring achievement for environmental stewardship," Roberts said. "Everyone at Weldon and at DOE is excited to continue our work and protection of the environment for years to come."

As the disposal cell nears completion in 2001, workers construct the multicomponent cover.

> *This is a huge achievement.*
>
> — Rebecca Roberts

How Strategic Risk Management Drives Operational Excellence at DOE's Legacy Sites

Risk reduction is ongoing at the Shiprock, New Mexico, Disposal Site.

The Office of Legacy Management (LM) is a champion of safety and operational excellence. Across its facilities, from the initial setup of a site to daily operations and ongoing maintenance, LM faces unique challenges and potential risks. But here's the good news: LM is committed to proactively identifying, assessing, and mitigating these risks every step of the way.

"Our mission is crystal clear: protect public health and the environment. We do this by making smart investments in robust processes and proactive mitigation measures," said LM Quality Assurance and Risk Program Manager Jonathan Damiano.

The core mission is all about protecting public health and the environment. How? Through strategic investments in robust processes as well as appropriate and proactive risk mitigations. The big goal is to dramatically reduce the likelihood of adverse events or, if they do happen, minimize their impact. This forward-thinking approach isn't just a strategy; it's the very bedrock of LM's risk management philosophy.

A superstar tool in the risk management arsenal is the Hazard and Operability (HAZOP) study. This systematic method brings together a team of multidisciplinary experts to meticulously review each process step. They're looking for any potential deviations from the original design and what those could mean.

"HAZOP reviews aren't just a checkbox; they are a deep dive into our operations, ensuring potential issues are identified and mitigated," said Damiano.

These comprehensive strategies for risk reduction truly highlight the power of HAZOP reviews. Other vital assurance methodologies for equipment and systems include rigorous testing protocols and meticulous verification processes.

"These methods help LM pinpoint potential process disruptions, figure out their root causes, assess potential outcomes, and ultimately implement enhanced safety measures," Damiano said.

A key ingredient in the ongoing process of the Shiprock, New Mexico, Disposal Site's risk reduction is the amazing collaborative spirit of its diverse team of experts. This dedicated team conscientiously evaluated the water treatment system's design and even engaged directly with the manufacturer to integrate additional safeguards.

Ensuring the safety and effectiveness of contaminated groundwater treatment systems is a well-established best practice. When this principle is integrated with a focused HAZOP review, firmly grounded in sound engineering practices, it provides a comprehensive understanding that can be applied to water treatment operations on other LM sites.

GOAL **SIX**

How the Office of Legacy Management is Strengthening Ties and Weakening Divisions

Storytelling is the language of origin, history, mythology, and culture among many Native American peoples. The Hopi Tribe and the Navajo Nation — neighbors in Arizona — each have their own stories to tell; they are stories of beginning and not of ending. There is no sense of "closure" because life is a continuum. To that end, while their stories are unique, as are the individual Tribal members, their lives, memories, and experiences are shared.

Much is shared among the young people of the Navajo Nation and the Hopi Tribe. In the domain of education, for example, children from Navajo Nation and Hopi Tribe villages may attend the same schools up until high school, but then something changes. Good-natured competitiveness occurs between schools, and other means of division can come about.

Artist's rendering of the future interpretive exhibit at the Tuuvi Travel Center in Moenkopi, Arizona.

Over time, the street that separates the Navajo Nation community from the Hopi Tribe can become a divide, a ravine, a gulf that can stifle opportunity and betray cultures. However, things do not have to be that way. Over time, the U.S. Department of Energy (DOE) Office of Legacy Management (LM) has taken steps to increase engagement and strengthen partnerships between the Hopi Tribe, the Navajo Nation, and DOE. The foundation of these efforts is built upon recognizing that differences and divisions cannot withstand the diligent determination of a genuine desire for mutual benefit.

The Tuba City, Arizona, Disposal Site is somewhat unique; it lives in two cultural worlds. It is on the Navajo Nation and adjacent to the Hopi Reservation, which is wholly within the Navajo Nation.

This virtual colocation has many superimposed political boundaries that are no longer seen by many among the two nations as barriers. Instead of divisions, engagement has grown. While challenges can create opportunities for division, the challenges faced by the residents of Tuba City, Arizona, on the Navajo Nation, and nearby Moenkopi, Arizona, on the Hopi Reservation, are sources of engagement. LM has a presence in that dynamic relationship.

Visitors driving along U.S. Route 160 through Arizona may wonder about the name Tuba City and its origins and about the smaller farming community named Moenkopi on a mesa above a creek (the Moenkopi Wash). What is the history of these communities? Who founded them? How can people farm or raise livestock in the desert or on a mesa? What is the difference between Navajo culture and history and Hopi culture and history? How can people live in an area seemingly devoid of water and why would they choose to?

Many of those questions arise from a lack of understanding of the history and culture, the origin stories of the people who live there, and likely the more modern history of the role of the Hopi Tribe in World War II. People know about the Navajo code talkers, but may not be aware that there were Hopi code talkers, too. To answer these and other questions, a destination is planned on the Hopi Reservation in a travel center that will house an interpretive exhibit, striving to broaden knowledge, enhance respect, and generate enthusiasm.

LM will assist with the development of the interpretive exhibit. LM has demonstrated its commitment to the support of the Hopi Tribe community in many areas over the past 20 years, from the solar array that won a U.S. Environmental Protection Agency National Federal Facility Excellence in Site Reuse Award to the agreement to host two public meetings on the Hopi Reservation each year, an increase of 100%, as DOE seeks to increase community engagement, openness, and transparency.

In the vast horizons of Arizona, it is very easy for people to miss the small things that comprise the big things. People drive quickly and are impatient, and they miss scale and proportion. The interpretive exhibit will encourage people to slow down and engage and, in so doing, gain back time and perspective.

GOAL **SIX**

Cultivating Future Expertise in Radioactive Waste Management

The Office of Legacy Management (LM) is dedicated to the long-term oversight of radioactive waste sites. A key part of this commitment involves developing the next generation of experts through its Applied Studies and Technology (AS&T) Educational Collaboration (EC) initiative.

Connecting Education with Real-World Challenges

EC acts as a vital link between academic institutions and the practical needs of LM's mission. This initiative directly supports the U.S. Department of Energy's goal of advancing science, technology, engineering, and mathematics (STEM) education. By partnering with universities, LM offers guest lectures, specialized workshops, and direct mentorship opportunities. LM's main objective is to involve students in projects that ensure the safety and integrity of its sites while also identifying and recruiting promising scientific talent for the future.

> *This mutually beneficial arrangement helps mentors gain fresh perspectives and provides interns with essential professional skills.*
>
> — Ken Kreie

Growing the Internship Program: Building Tomorrow's Workforce

A centerpiece of EC is its highly successful internship program, which has shown significant growth and impact.

"The program offers undergraduate and graduate students invaluable hands-on learning in specialized areas such as hydrogeology, ecohydrology, geochemistry, ecology, and advanced remote sensing technologies," said LM Site Manager Angelita Denny.

2024 intern Jonathan Benslow installs sensors at the Monticello, Utah, Disposal Site.

"These internships are carefully designed in collaboration with experts from LM and the LM Support Partner, creating a dynamic and innovative learning environment," said LM EC Lead Ken Kreie. "This mutually beneficial arrangement helps mentors gain fresh perspectives and provides interns with essential professional skills."

Program Achievements Since 2022

Since 2022, EC has successfully mentored more than 20 interns. The interns' notable achievements include receiving professional recognition, pursuing advanced academic degrees, and securing employment. These positive outcomes highlight the program's effectiveness in preparing the future workforce crucial to LM's important mission.

Enhancing the Program and Sharing Best Practices

Managing a program of this scale requires continuous learning and adaptation. LM has gained valuable insights into project planning, matching internships with student abilities, and ensuring consistent mentorship. Key lessons learned that have helped LM improve the program include:

Mentor engagement leads to the best internship program outcomes.

- **Advance planning: Involving mentors early in defining project scope, tasks, and expectations greatly contributes to successful outcomes.**
- **Promoting curiosity: Encouraging interns to conduct initial independent research sparks intellectual curiosity and leads to more productive engagements with their mentors, fostering a sense of ownership.**
- **Highlighting career paths: Showing the direct connection between intern contributions and broader career objectives, even in emerging fields, boosts motivation and engagement.**
- **Effective mentorship: Direct mentor-intern interaction, typically around 10 hours per week, has been found to yield the best developmental results. This framework is flexible to accommodate varying schedules.**

"LM is committed to continually improving and adapting this program," Kreie said. "We consistently strive to enhance the intern experience and strengthen the future workforce dedicated to the complex challenges of radioactive waste management. LM looks forward to building on these successes to inspire the next generation to contribute to this vital national mission."

GOAL **ONE**

Decision Support Action Level Tool (DSALT) for Managing Erosion at Uranium Mill Tailings Disposal Sites

The Office of Legacy Management (LM) is entrusted with the long-term care of 27 uranium mill tailings disposal cells, with many more expected by 2060. These sites, governed by the Uranium Mill Tailings Radiation Control Act (UMTRCA), demand stability for centuries — 200 to 1,000 years — with minimal upkeep.

Recently, various erosional features, from surface depressions to internal piping, have emerged, posing risks to the integrity and regulatory compliance of these critical disposal cells.

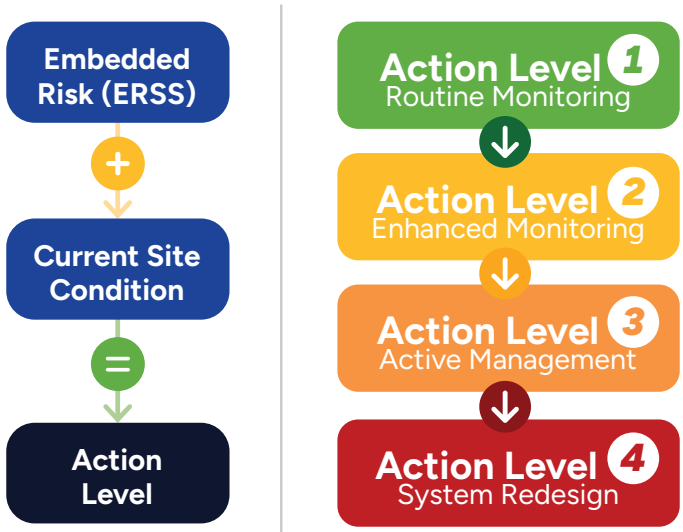
"Ensuring the lasting integrity of these sites is paramount, and these erosional challenges necessitate a proactive and innovative approach," said LM Site Manager Angelita Denny.

In response, LM's Applied Studies and Technology group developed the Decision Support Action Level Tool (DSALT). This comprehensive framework helps identify, evaluate, and manage erosional risks at UMTRCA sites. DSALT standardizes how LM assesses erosion, determines compliance thresholds, identifies and analyzes erosion features, evaluates ongoing erosional impacts, prioritizes repairs, and implements cost-effective mitigation strategies.

"DSALT provides a crucial standardized methodology, enabling us to manage risks proactively and secure the long-term stability of these vital sites," Denny said.

The DSALT framework has two main parts: the Erosion Risk Scoring System (ERSS) and assignment of site condition categories. These combine to determine a management action level (1-4), guiding responses from continued routine monitoring to complete redesign of a disposal cell cover or associated erosion control feature.

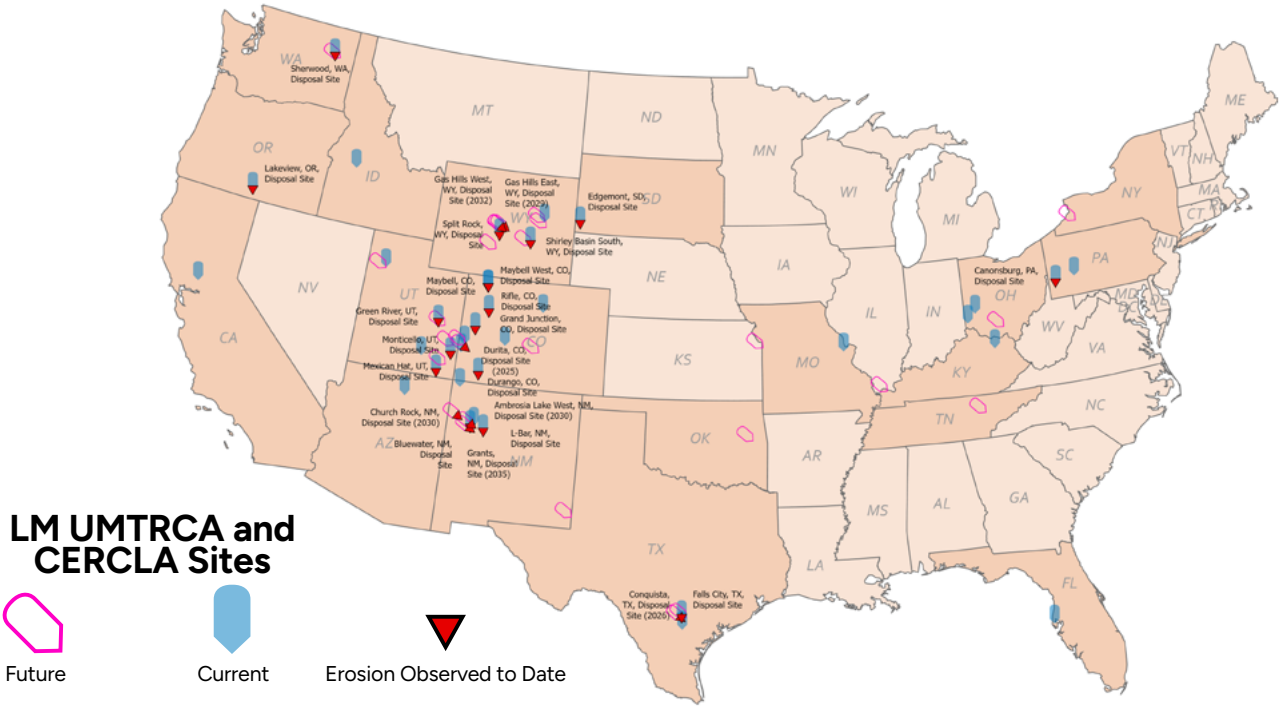
The ERSS is a standardized tool that scores disposal cell covers based on their inherent vulnerability to erosion. Unlike assessments of current damage, ERSS evaluates the site's embedded risk based on its design and location, independent of current conditions. It considers 11 key factors, including design details and assumptions, geomorphic setting, slope, riprap, soil characteristics, construction, and meteorology. Data is gathered from historical reports and site investigations, with each factor receiving a point value that contributes to an aggregate risk score.



"The ERSS offers a fundamental understanding of a site's vulnerabilities, empowering us to make informed decisions before significant issues arise," Denny said.

Site condition categories (A-D) reflect the severity of erosional damage observed during enhanced site inspections performed by trained experts. Condition A signifies minor damage requiring only routine monitoring, while Condition D indicates extensive damage potentially leading to tailings exposure and demanding active intervention.

"The integration of ERSS scores and site condition categories provides a clear strategic roadmap, ensuring our responses are both appropriate and timely," Denny said.



DSALT precisely defines when "active maintenance," as opposed to routine monitoring and upkeep, is required, aligning with LM's regulatory compliance mandates. Noncompliance occurs when active maintenance is needed to address erosion issues to meet established standards.

The framework's effectiveness is demonstrated at the UMTRCA Mexican Hat Disposal Site in Utah. Here, internal erosional piping within the cover triggered an Action Level 3 response, leading to subsurface investigations, enhanced monitoring, numerical modeling, and interim repairs. A targeted cover enhancement project is being considered to further reduce future erosion risks.

"The success at Mexican Hat underscores DSALT's practical utility in safeguarding our environmental legacy and ensuring strict regulatory compliance," Denny said.

Future plans include integrating DSALT findings with other disposal site risk registries and developing predictive models for erosional degradation. DSALT will also support incoming UMTRCA Title II disposal sites by informing pretransfer assessments and long-term surveillance planning.

"Looking forward, DSALT will be pivotal in ensuring a seamless transition for incoming Title II sites and robust, long-term stewardship for all UMTRCA sites," Denny said.

Beyond UMTRCA sites, DSALT's systematic approach has broad applicability. International radioactive waste management programs in Canada, Australia, and the European Union face similar long-term erosion challenges. The framework's objective scoring and standardized response protocols can be adapted for different regulatory environments, climates, and cover designs.

> *Ensuring the lasting integrity of these sites is paramount, and these erosional challenges necessitate a proactive and innovative approach.*
>
> — Angelita Denny

Mining waste facilities, hazardous waste containment systems, and other engineered barriers requiring long-term stability could also benefit from DSALT's risk-based prioritization. Its flexibility allows customization of scoring criteria and action thresholds to accommodate various waste types, regulations, and environmental conditions, while providing objective, technically defensible decision making.

"DSALT offers a scalable and adaptable solution for erosion management that can significantly benefit diverse waste management programs worldwide," Denny said.

The DSALT framework represents a significant advancement in UMTRCA disposal site stewardship, providing a scientifically sound and regulatory-compliant approach to erosion risk management. Its implementation supports LM's mission while optimizing resource allocation across an expanding portfolio.

GOAL **FOUR**

With Land-Use Requests on the Rise, LM's Strategies Evolve to Keep Pace

Interest is on the rise for reuse and development on LM-managed land, such as mineral leasing on Uranium Leasing Program tracts.

The Office of Legacy Management (LM) has an important job: to ensure that remedies remain protective after cleanup is complete. This means making sure that people and the environment are safe for the long term.

Each of LM's 103 sites has its own story when it comes to the land and its uses. Cleanup and maintenance at some of these sites will continue indefinitely, so LM needs strong plans and documents to manage these areas as a federal land steward.

More than half of the sites LM manages have limitations on their use. This means there are special rules, called "institutional controls" (ICs), to protect the remedy, people, and the environment from any remaining contamination.

"These ICs are put in place to ensure people aren't accidentally exposed to contamination and to protect cleanup efforts," said Bud Sokolovich, leader of LM's Asset Management team. Many of these rules also apply to land near LM sites.

LM has been receiving more land-use requests from other government agencies and landowners, particularly on parcels at or near LM sites. These requests involve new projects such as leasing mineral or oil and gas rights or asking to modify the existing land-use restrictions to allow for reuse such as energy development.

"This new situation requires LM to think carefully about how to handle these requests," Sokolovich said. "For example, some landowners were compensated by the U.S. government in exchange for land-use restrictions to protect human health and the environment. Now they are asking if those restrictions can be changed to allow other uses."

With these situations becoming more common, LM is working on better ways to manage these changes and promote beneficial use of its sites. LM leaders are trying to anticipate all contingencies and create efficient processes to move forward.

The different rules and regulations for LM sites mean that LM must always consider how to keep everyone safe and how to manage these sites for many years to come.

At Waste Management Symposia 2026, LM staff gave presentations on these key topics:

- **Overview of LM's institutional control programs.**
- **The unique characteristics of LM sites and nearby properties and how they might be used in the future.**
- **The various regulations and programs that might affect requests and decisions for these sites.**
- **Real-world examples from LM sites, showing the types of requests they receive and how LM is developing new tools and processes to adapt to these changing circumstances.**

GOAL **FOUR**

LM Navigates Complex Processes to Return Government Facility to Ohio Community

Have you ever wondered what happens to big government sites after their original purpose is fulfilled?

The process can be complex, but it often leads to exciting new opportunities for some communities, such as the Office of Legacy Management's (LM) site at Mound, Ohio, where components for nuclear weapons were once developed.

The Mound site, like many others managed by the U.S. Department of Energy (DOE), has a rich history. From 1994 to 2010, DOE's Office of Environmental Management worked diligently to clean up the site to standards suitable for commercial and industrial use.

Once cleanup of the Mound site was complete, most of it was given back to the local community for beneficial reuse, to be transformed into a now-growing business park.

To make this happen smoothly, the site was divided into smaller parcels as the cleanup progressed. These parcels were then transferred to the city and a nonprofit called the Miamisburg Mound Community Improvement Corporation (now known as the Mound Development Corporation, or MDC).

"It's a benefit to the community that a former government facility has since become an incubator for local small businesses," said LM Site Manager Tiffany Drake. "The current executive director of the MDC has worked tirelessly to develop new opportunities at the site. We couldn't have hoped for a better outcome."

This corporation was set up in 1994 specifically to manage the new Mound Business Park. An initial sales agreement was signed in 1998 and meant to last for 10 years, but it was extended until 2017, demonstrating LM's sustained commitment the success of this local development.

By the time that sales agreement expired, MDC had accepted approximately 94% of the 305-acre Mound site, meaning it was no longer owned by DOE. However, there was still an 18.56-acre piece of land that the city hadn't been interested in for a long time.

The Mound Business Park in Miamisburg, Ohio.

This area is known as Operable Unit 1/Parcel 9. Over time, with changes in local leadership, the city decided to revisit the idea of taking over this remaining parcel.

"This is where things got challenging," said Drake. "The original sales agreement had expired, and the previous procedure used for the transfer was no longer valid."

What followed was a multiyear process to finalize the transfer of this last parcel. It wasn't just about handing over deeds; it involved meeting specific property transfer rules outlined in Title 10 *Code of Federal Regulations* Section 770.

Additionally, the process required updating regulatory documents under the Comprehensive Environmental Response, Compensation, and Liability Act, ensuring all environmental requirements were still being met by revised plans.

"Throughout the process, two things stood out as absolutely vital: constant communication and collaboration and the willingness of all parties to make the transfer happen," Drake said. "Everyone involved — the regulators, the city, the MDC, and the internal teams at DOE — worked together closely. This continuous engagement towards a common goal was the key to making the transfer a success."

GOAL **ONE**

LM, Navajo Partners Work Together on Water Treatment Project in New Mexico

Workers install a water treatment unit at the Shiprock, New Mexico, Disposal Site.

The Office of Legacy Management (LM) and its partners on the Navajo Nation are working together to ensure safety at former uranium-processing sites and to protect public health and the environment.

One key project is at the Shiprock Disposal Site in New Mexico, which LM manages under the Uranium Mill Tailings Radiation Control Act (UMTRCA) with oversight by the U.S. Nuclear Regulatory Commission.

In 2023, LM released an Environmental Assessment that recommended removing the 11-acre evaporation pond at the site. This pond has been used for groundwater treatment at the Shiprock site for two decades. To replace the function of the evaporation pond, a new water treatment unit is being installed to adhere to an existing Groundwater Compliance Action Plan.

Back in 1996, the U.S. Department of Energy (DOE) and the Navajo Nation signed a Transfer of Custody Agreement. This agreement, supported by the Bureau of Indian Affairs, outlined DOE's responsibilities to protect human health and the environment at four former uranium-milling sites on the Navajo Nation.

In 2013, the U.S. Department of the Interior approved the Navajo Nation General Leasing Regulations. This gave the Navajo Nation the authority to manage its own leases and permits for various purposes, including agriculture, public relations, education, recreation, and residential uses on its lands. Following this, the Navajo Nation created the General Land Development Department (GLDD) to handle all leases and environmental reviews.

Since 2020, LM has been working with the Navajo Nation's GLDD to secure land interests and access for projects under the Transfer of Custody Agreement. For the Shiprock site specifically, LM previously had easement grants from the Bureau of Indian Affairs and the Navajo Nation for certain rights-of-way next to the site.

These easements covered a 20-year term to support the groundwater compliance strategy. With the Navajo Nation gaining new authority in 2013, LM needed to establish new agreements. These new agreements ensure LM has the necessary land interests, including rights-of-way and site leases, to support new construction and to effectively operate and maintain the protective measures already in place at the sites.

LM presenters at Waste Management Symposia 2026 discussed the unique aspects of these ongoing negotiations, focusing on the Shiprock site projects. Their presentations also covered the various Tribal and regulatory requirements and interactions with the Navajo Nation.

"This partnership between LM and the Navajo Nation shows a commitment to trust and responsibility," said LM Site Manager Joni Tallbull. "That will help LM fulfill its stewardship duties for these four sites."

A recent project at the Shiprock, New Mexico, Disposal Site upgraded the electrical system on-site.

GOAL FOUR

LM Tackling Issue of Aging Infrastructure at Former Uranium Milling Site

Tuba City, Arizona, Disposal Site.

Cleanup at the Office of Legacy Management's (LM) disposal site in Tuba City, Arizona, began in 1988 to address contamination left behind by decades of uranium processing during the Cold War.

The engineered disposal cell at the Tuba City site is managed under the Uranium Mill Tailings Radiation Control Act (UMTRCA), as are three other former mill sites on the Navajo Nation. These sites require long-term stewardship to protect human health and the environment.

Cleanup involved the removal of uranium mill tailings, contaminated materials, and mill infrastructure, which were then placed into the engineered disposal cell.

"Although surface remediation was completed in 1990, the site has experienced ongoing groundwater contamination from past milling operations," said LM Site Manager Bill Frazier. "Remediation started in 2002, and we're still keeping close track of groundwater conditions at the site."

Recent assessments at the site have shown a need for significant repairs and upgrades to the site's infrastructure.

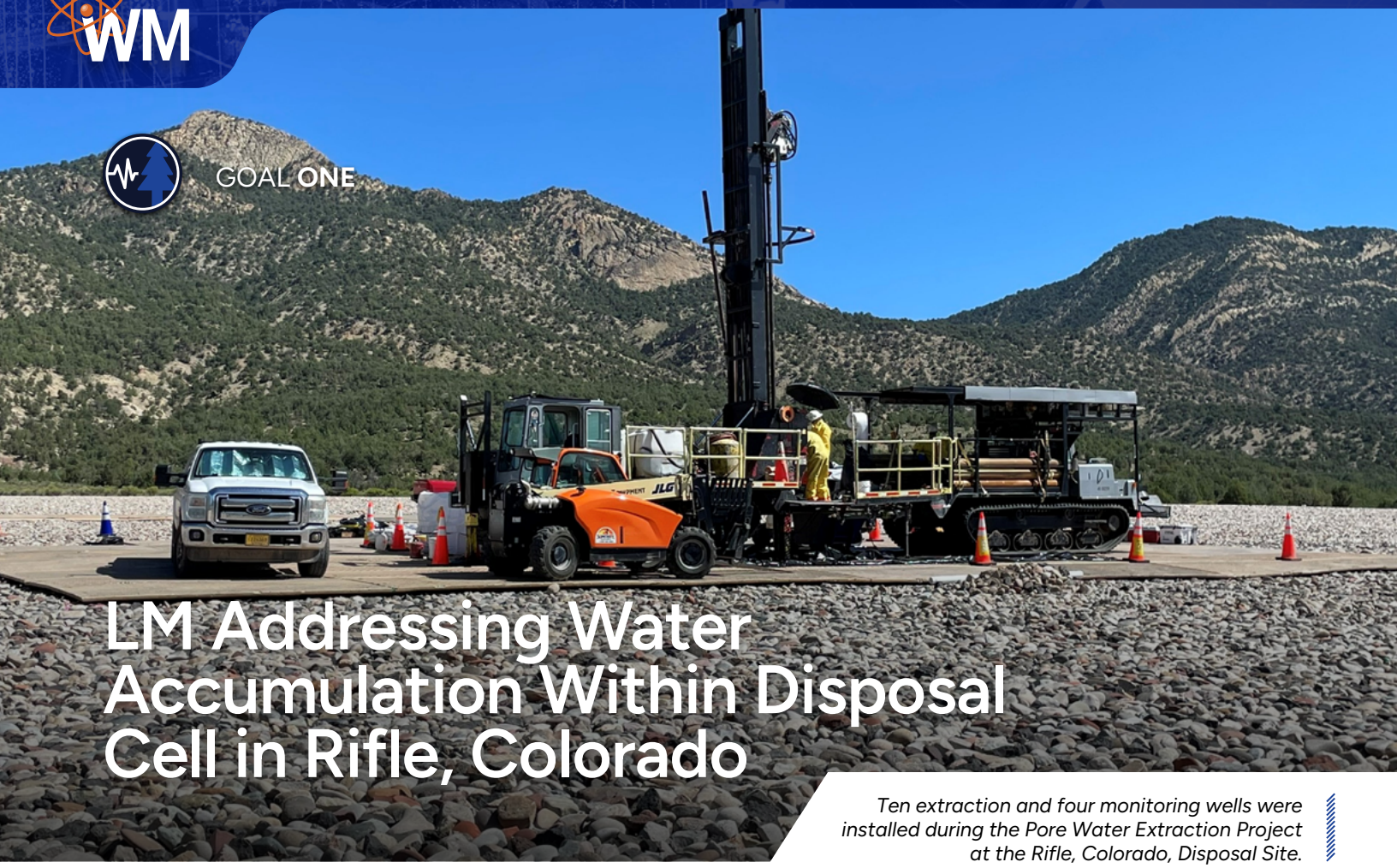
Conduit installation at Tuba City site.

In 2024, LM repaired and updated the electrical systems at the Tuba City site, replacing burned-out fuses with a new panel.

For instance, in 2024, LM updated the electrical systems at the Tuba City site to meet current safety and operational codes.

To assess the operation and condition of the aging site infrastructure associated with groundwater treatment, LM is conducting a Site Condition Assessment. This assessment will identify necessary repairs or improvements to the current groundwater remediation system and help LM determine whether the existing infrastructure can support a future upgraded treatment system.

While disposal cells are designed to be effective for a very long time — at least 200 years, and preferably 1,000 years — the other aging infrastructure at these UMTRCA sites presents unique challenges for maintaining compliance. By identifying and communicating these issues, LM aims to highlight the importance of proactive infrastructure maintenance and improve problem solving and solution implementation for the long-term care and management of these sites.



LM Addressing Water Accumulation Within Disposal Cell in Rifle, Colorado

Ten extraction and four monitoring wells were installed during the Pore Water Extraction Project at the Rifle, Colorado, Disposal Site.

The Office of Legacy Management's (LM) uranium mill-tailings disposal site in Rifle, Colorado, was built to safely contain about 3.7 million cubic yards of uranium tailings for at least 1,000 years. LM is responsible for the long-term care of the 71-acre disposal cell built between 1993 and 1996.

> *Although the project is complete, the operations and maintenance of the new extraction system is still in its early stages.*
>
> – Mary Young

The disposal cell was designed with a cover to isolate tailings, minimize radon emissions, and prevent water from rain or snow seeping through the cover system into the tailings. However, as the Rifle site approaches its 30th year, some unexpected challenges have come up that were not part of the original design.

One main concern is that water from the "slimes" (a type of waste material) within the disposal cell could potentially leak through the south side slope. This could release radioactive materials into the environment, erode the cover from within, or cause stability problems for the slope. Because of this, a system to collect and extract pore water was built as a temporary solution to manage water from the wet tailings.

As part of this collection system, a special high-density polyethylene (HDPE) liner was installed under a section of the cover on the south side in a bowl-like collection feature. Early predictions suggested that any water collecting against this liner would only be there for about 30 years and would never reach the top of the HDPE liner. In addition to the liner, standpipes were constructed in the cell to act as monitoring wells and extraction wells in case water did reach the liner action level — which happened in 2001. Extraction began and an evaporation pond was added in to hold the collected water.

Despite continuous efforts that have removed more than 7 million gallons of water, it continued to build up in the disposal cell's collection area.

"This was an unplanned challenge because initial models predicted that water accumulation at the base of the cell would be minimal and temporary," said LM Site Manager Mary Young. "The source of this ongoing water buildup is currently unknown. Water levels were getting close to the top of the HDPE liner and we needed to do something to remain in compliance and protect the integrity of the cell."

The original systems, including standpipes and the evaporation pond, were not enough to handle the amount of water accumulating. In 2024, as part of a project to extract pore water at the Rifle site, LM installed 10 new extraction wells, four monitoring wells, two additional modular evaporation ponds, and all necessary power and infrastructure.

This expansion aims to improve water extraction and management, ensuring the site meets regulatory standards and the disposal cell remains stable.

"Although the project is complete, the operations and maintenance of the new extraction system is still in its early stages. We've made progress in managing the water accumulation and no longer have less than an 18-hour response time if the system shuts down," Young said. "The system is also being fine-tuned to work as efficiently as possible."

Further evaluations will be conducted to pinpoint the source of the water accumulation and to develop a long-term solution based on these findings.

This pore water extraction project at Rifle was a new endeavor for LM, and many valuable lessons were learned throughout its implementation and operation. These insights are now being applied to other major projects within LM's portfolio, helping to improve future disposal cell designs and the management of other sites under LM's care.

Work on the Pore Water Extraction Project at the Rifle, Colorado, Disposal Site.

GOAL **ONE**

Florida Site is a Groundwater Cleanup Success Story

The Pinellas County Site in Largo, Florida, was once a key player in national defense, developing and manufacturing components for the nation's nuclear weapons complex.

The site has a long history of implementing innovative environmental restoration approaches, and as the U.S. Department of Energy (DOE) Office of Legacy Management (LM) addresses the last area with groundwater contamination, known as the Building 100 area, the innovation continues.

The site team has reached a major milestone in cleaning up contaminated groundwater in the Building 100 area using a method called bioremediation.

"The success we've had at the Pinellas site has been a team effort and is a testament to dedication, scientific expertise, and a forward-thinking approach to environmental challenges," said LM Site Manager Melissa Lutz.

The Challenge:

Inaccessible Materials

The Pinellas site faced a significant problem: Its groundwater was contaminated with harmful chemicals known as chlorinated volatile organic compounds (cVOCs) and 1,4 dioxane, a solvent commonly used in industrial cleaning processes. These contaminants stemmed from historical operations at Building 100, where leaking pipes and drum storage areas unfortunately left their mark.

The tricky part? The source of the contamination was inaccessible beneath the 11-acre occupied building, making traditional excavation of source material impossible. Past attempts at groundwater cleanup, such as a pump-and-treat system, proved insufficient, and the contamination footprint began to spread.

The Breakthrough:

Nature's Own Cleanup Crew

Facing this complex challenge, DOE teams turned to enhanced bioremediation. This innovation harnesses the power of naturally occurring microorganisms to break down pollutants into less harmful substances. These tiny organisms in the soil and water work tirelessly to neutralize threats.

From 2014 to 2019, experts injected a special blend of emulsified vegetable oil (to nourish the microbes) and specific beneficial bacteria (*Dehalococcoides mccartyi*) deep into the ground. These injections were carefully placed using specialized horizontal wells under Building 100 and through temporary vertical points in other affected areas.

Building 100 at the Pinellas County, Florida, Site.

"We were confident this method would be a success," Lutz said, "but we were so pleased at just how well it worked. The results exceeded expectations."

The bioremediation efforts paid off in a big way. Concentrations of cVOCs have plummeted, with many areas of the site experiencing drastically reduced levels. For example, while the site still experiences vinyl chloride (a breakdown product) at concentrations that exceed cleanup target levels, the once-widespread plume of contamination has shrunk noticeably.

A monitoring well inside Building 100, which historically showed the highest levels, now registers low concentrations of cVOCs. Another well on the eastern side of the building reported zero detectable cVOCs in March 2025.

Building on this achievement, independent scientists and engineers reviewed the groundwater bioremediation program in 2025. Their findings confirmed the LM team's success and paved the way for an even smarter future:

- **No more large-scale injections needed. The groundwork has been laid, and the natural processes have proven to be effective.**
- **Transition to enhanced attenuation: The site will target breakdown products through a highly effective and noninvasive strategy called "enhanced attenuation." This approach leverages natural breakdown processes, supported by rigorous monitoring, to continue the cleanup.**
- **Significant cost savings: This innovative transition isn't just good for the environment; it's also projected to save substantial resources, demonstrating LM's commitment to efficiency.**

> *We were confident this method would be a success.*
>
> — Melissa Lutz

Workers take samples at the Pinellas site.

This shift to enhanced attenuation is a testament to continuous learning and scientific advancement, aligning with guidance from the Interstate Technology and Regulatory Council. It involves fostering a "structured geochemical zone" where both oxygen-rich and oxygen-poor conditions work in harmony to tackle different contaminants efficiently — a strategy proven successful at other complex sites.

"The Pinellas County site stands as a powerful example of how scientific innovation, dedicated teamwork, and strategic planning can lead to exceptional environmental outcomes," Lutz said.

Workers inject emulsified vegetable oil and beneficial bacteria into the ground at the Pinellas County, Florida, Site.

GOAL **FOUR**

LM's Colorado Project Using Natural Methods to Improve Management of Disposal Cells

Native vegetation is planted by hand at the Rifle, Colorado, Disposal Site.

After installing a water extraction system at the mill-tailings disposal cell in Rifle, Colorado, in 2024 (see page 40), the Office of Legacy Management (LM) started a project called the Rifle Enhanced Cover Application Pilot Test (RECAP). The main goal of RECAP is to test more efficient ways to manage water using evapotranspiration (ET)-enhanced covers.

Such covers use plants and soil to naturally absorb and release water into the atmosphere, reducing the amount of water that seeps into the disposal cell. This is a more proactive and long-term solution than continuously pumping water out.

RECAP has three key objectives:

- **Understanding water sources:** This involves tracking where the water comes from, such as rain, drainage patterns, and subsurface water flows.
- **Tailoring solutions:** The project will incorporate the specific engineering and environmental conditions of the Rifle site.
- **Provide efficient strategies:** The team is looking for enhancements that can use existing facilities, keep costs down, and follow current regulations.

This approach builds on previous successes at another LM site, in Grand Junction, Colorado, where similar revegetation efforts reduced water percolation by 93%. This was achieved by boosting natural processes like soil storing water, plants growing, and water evaporating and transpiring.

The pilot test is comparing two main cover enhancement methods applied on individual 2.5-acre plots:

Seeds are spread across the Rifle disposal cell.

- **Revegetation alone:** This involves planting vegetation directly. It's a simpler method, but takes four to 10 years for the plants to fully establish and perform optimally.
- **Revegetation combined with void-filled riprap:** This method uses mixtures of gravel, sand, and soil applied to the existing rock cover along with revegetation. It's more complex, but is expected to show good results within two to five years.

LM is also using a control plot with the existing cover conditions, which is expected to have more water seep through, requiring ongoing water extraction.

To keep tabs on how well these methods work, the project uses a variety of monitoring tools, including soil moisture sensors, plant surveys, and advanced remote sensing with machine learning.

The desired outcomes from RECAP include a better understanding of the sources of pore water and how water moves through the cover, a better understanding of how the different methods improve water management, and identification of the most effective areas of the current disposal cell cover for large-scale application.

By significantly reducing the amount of water entering the disposal cell, these enhanced covers offer a resilient and sustainable alternative to the traditional method of pumping water out. This could change how similar disposal sites are managed in the future.

Ultimately, RECAP aims to shift towards a more hands-off, self-sustaining way of managing pore water. Unlike energy-intensive pump-and-treat systems, these ET-enhanced covers rely on natural processes that become more effective as the vegetation matures.

This could potentially eliminate the need for constant mechanical intervention, saving costs and reducing the burden of maintenance while still ensuring the site performs reliably.

GOAL **FOUR**

LM Using Biocontrol Methods to Reduce Harmful Impacts of Invasive Plant Species

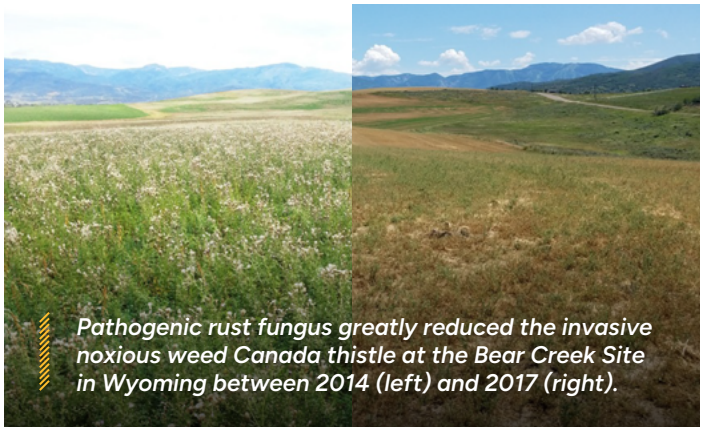
Integrated Pest Management (IPM) methods give the Office of Legacy Management (LM) an environmentally conscious way to combine various strategies to manage invasive species, especially at LM's sites in the west. Federal agencies are mandated to address invasive and noxious species on their lands.

Invasive and noxious species negatively impact native ecosystems at many of LM's long-term stewardship sites. An invasive species is defined as a nonnative species whose introduction causes or is likely to cause harm to human health, the environment, or the economy. Controlling these species also helps create more resilient and diverse ecosystems that are better able to withstand disturbances such as droughts and wildfires.

Biocontrol is a type of an IPM method that uses host-specific insects, mites, or fungi to control invasive plant species without harming native vegetation.

The primary goal of biocontrol is to suppress or control invasive plants, not to eliminate them entirely. While biocontrol agents take time to establish, once they do, they can be highly effective and provide long-term control.

Biocontrol is often used alongside other IPM methods such as mechanical, cultural, or chemical control. Its advantages include being more economical, effective in hard-to-reach areas, and capable of shifting ecosystems to a healthier state over time, especially when combined with cultural controls.



Pathogenic rust fungus greatly reduced the invasive noxious weed Canada thistle at the Bear Creek Site in Wyoming between 2014 (left) and 2017 (right).

LM and the LM Support Partner (LMSP) collaborate with the Colorado Department of Agriculture Conservation Services Division's Biological Control Program (Palisade Insectary) to distribute and monitor biocontrol agents for naturally controlling invasive and noxious weeds across several western states.

In 2025, host-specific biocontrol agents were released at six western LM sites. For example, two host-specific insects (the Russian knapweed gall midge and the Russian knapweed stem gall wasp) were released to control Russian knapweed (*Acroptilon repens*) at sites in Naturita and Slick Rock, Colorado, and at three Uranium Leasing Program tracts. Additionally, a host-specific biocontrol agent, pathogenic rust fungus (*Puccinia punctiformis*), was released at the Bear Creek Disposal Site in Wyoming to attack Canada thistle (*Cirsium arvense*) by invading its leaves and root system.

Before releasing any biocontrol agents, field assessments are conducted to evaluate potential target species, infestation characteristics, site conditions (such as the presence of nontarget species or wildlife habitats), and existing biocontrol agents. For instance, Canada thistle rust fungus was observed at the Rocky Flats Site in Colorado in 2023, having spread naturally from a neighboring property rather than being released there.

Similarly, at the Bluewater Disposal Site in New Mexico, in 2024, the field bindweed biocontrol agent *Aceria malherbae*, a microscopic mite, was observed significantly suppressing field bindweed by stunting its growth and reducing flower production. The ongoing success of these biocontrol agents will be monitored in the future.

LMSP ecologists monitored the 2025 release sites to assess establishment, impact on target species, and the recovery of native vegetation.

GOAL **ONE**

3D Software Allows LM Scientists to "See" Underground at Arizona Site

The Office of Legacy Management (LM) is using cutting-edge technology to give its scientists a virtual "look" underground at its Monument Valley Processing Site in Arizona, where a uranium mill once operated.

Even though the site's tailings piles were removed in 1992, contamination lingers in the groundwater, especially in the form of nitrates.

The main source of the nitrates was thought to be the soil under the former mill site. Between 1998 and 2016, U.S. Department of Energy teams cleaned these subpile soils using plants in a process called phytoremediation.

The idea was that these plants would cut off the contamination source and the nitrate plume in the groundwater would eventually shrink. The phytoremediation method was highly effective, reducing the nitrogen in those subpile soils by 80%.

However, even with those subpile soils mostly cleaned up, the nitrate plume in the groundwater kept growing. It was spreading over a larger area and getting deeper, and LM scientists were surprised to learn that the total nitrate in the plume actually doubled over a 22-year period.

"This told our team that our original understanding of the site — what we call the conceptual site model, or CSM — needed an update," said LM Monument Valley Site Manager Joni Tallbull. "There had to be another, previously unrecognized, source of nitrate."

To dig into the data, LM used 3D visualization software called Earth Volumetric Studio to create detailed models of the site. This allowed them to "see" the underground layers, the water table, and how the nitrate plume changed over time, all in 3D. This helped them see where the data was lacking and where they needed to investigate further.

They then conducted targeted field investigations, collecting sediment samples from various spots. They analyzed these samples for different chemicals, analyzed the soil constituents, and investigated how quickly contaminants could move through the soil. What they found was a game changer.

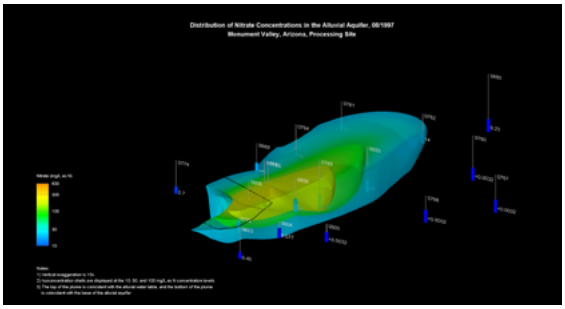
"We found discontinuous layers of clay deep in the ground, within the saturated zone where the groundwater is," Tallbull said. "These clay layers were holding a lot of ammonia, which was slowly but surely converting into nitrate, continuously feeding the expanding plume."

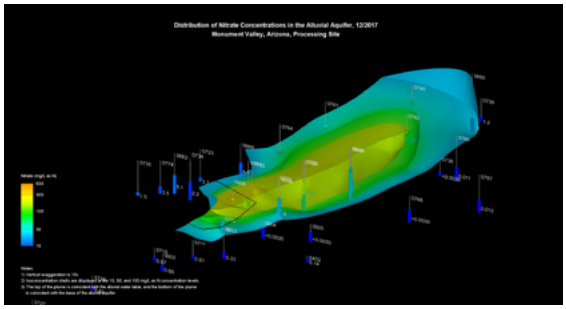
This "nitrification" process was found to be the persistent nitrate source that everyone had been looking for.

LM's analysis showed that the ammonia stored in these clay layers could actually double the amount of nitrogen in the nitrate plume over several decades.

"This was a huge discovery," Tallbull said. "It shifted the focus from the old subpile soils to these saturated zone clays as the main ongoing source of nitrate."

This project proved how using advanced 3D tools and targeted investigations can help LM better understand complex environmental problems and come up with more effective cleanup plans.





3D visualization software allowed the Monument Valley, Arizona, Processing Site team to see how the nitrate plume changed from 1997 (left) to 2017 (right).

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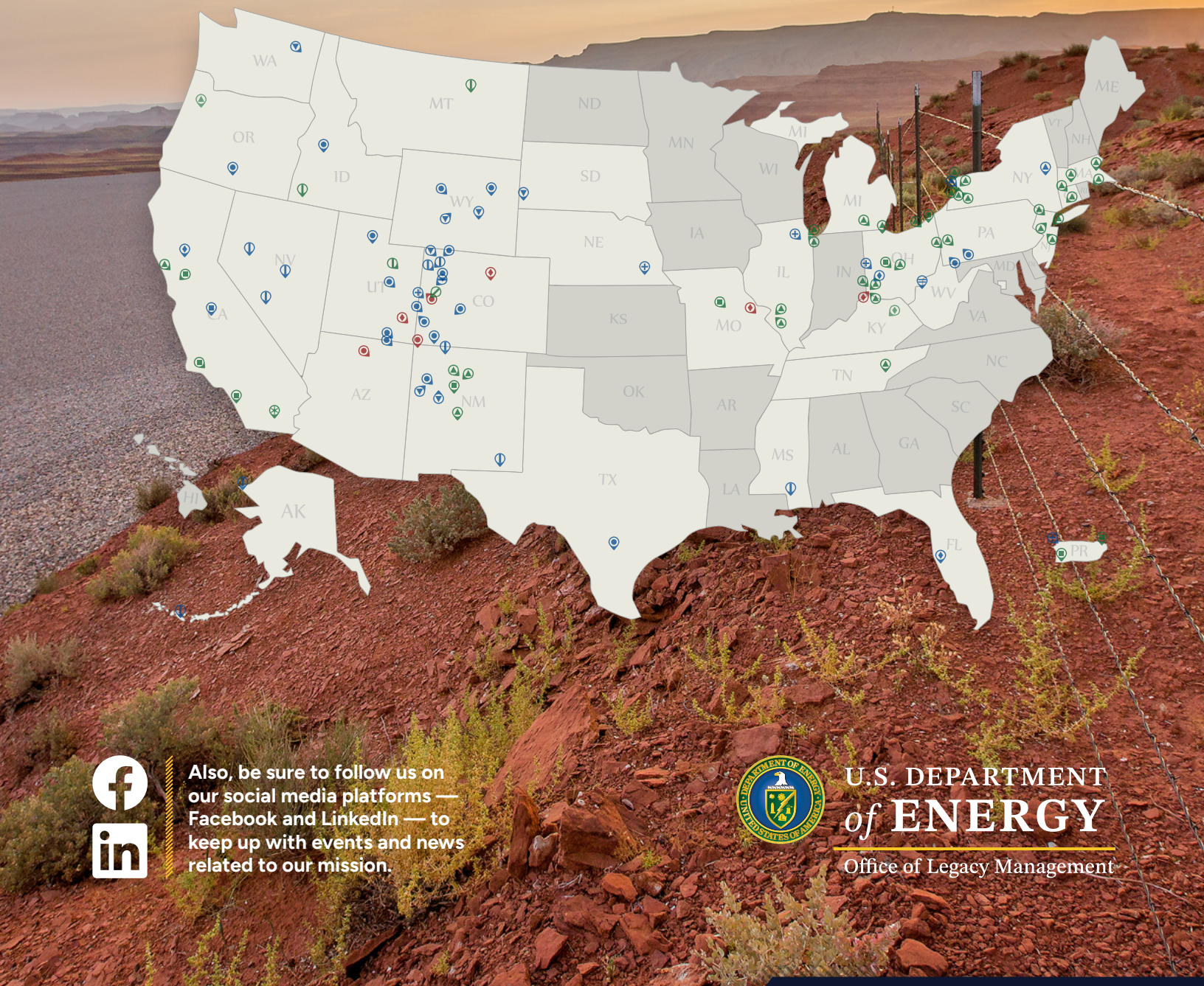

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