

Emerging Programmatic and Technical Issues and Opportunities



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A lot can happen when you have sites *in perpetuity* . . .

- Legacy sites transferred to LM come with stakeholder concerns attached
- LM's scope increases as new sites transfer to the program
 - Scope is also increasing due to emerging issues
 - One issue is being addressed through LM's *Report to Congress on Defense-Related Uranium Mines*
- New risk scenarios are occurring adjacent to and within some LM site boundaries
- Aging site remedies and natural weather events affect the cost of maintaining some LM sites
- LM has a growing, international presence
 - It is the only national organization focused on post-closure management of former radiologically contaminated sites
 - Aspects of LM's mission are receiving increased attention from many nations



When sites are transferred to LM, so are public concerns about the health and safety of the sites

- Questions regarding the safety of LM sites should be expected and welcomed
 - Transitioned sites are of concern to generations of stakeholders who know little about the sites during their time in operation
 - Questions regarding health and safety are necessary to sustain stakeholder and DOE institutional knowledge of sites
 - Stakeholders value and expect prompt delivery of site information
- A continual challenge is distinguishing between effects to human health and the environment during operation of sites, versus effects from residual contamination after site cleanup.
 - Rocky Flats, most of which will soon be administered by the U.S. Fish and Wildlife Service, is an example...





In operation – 2001



Physical cleanup completion – 2005



Rocky Flats Site – 2013

Beneficial reuse of sites is important to the LM story, and a sign that most stakeholders accept that sites have been successfully cleaned up

■ Fernald Preserve, Ohio

- Former uranium processing facility; now a wetlands preserve
- U.S. Fish and Wildlife Service used the site to reintroduce the endangered American burying beetle

■ Weldon Spring, Missouri

- Re-establishment of native prairie
 - Ecotype nearly lost in Missouri when lands were cleared for farming

■ Durango, Colorado

- Uranium Mill Tailings Radiation Control Act (UMTRCA) disposal cell
- Soon to be a solar (energy) garden?

■ Rocky Flats, Colorado

- Transfer of remaining land to the U.S. Fish and Wildlife Service for a national wildlife refuge are occurring this year.



Fernald Preserve, Ohio



Durango, Colorado, Disposal Site

Long-term surveillance and maintenance (LTS&M) and site reuse are LM's current and future missions for its sites

- Visitors centers at Weldon Spring and Fernald tell the stories of legacy sites; before the Cold War, during operation of sites, cleanups, and today's LTS&M activities and beneficial reuses.



Fernald Preserve Visitors Center, Ohio



Weldon Spring Visitors Center, Missouri

Along with its new sites, LM has new issues to address, such as the status of defense-related uranium mines

- In 1978 UMTRCA authorized DOE to remediate abandoned uranium mill sites
 - LM currently responsible for 21 UMTRCA Title I sites
 - UMTRCA did not address abandoned uranium mines
- Atomic Energy Commission (AEC) was sole purchaser of uranium from mines in the U.S. from 1947 to 1966
- AEC continued to purchase ore until 1970
 - In 1996 uranium started being purchased for commercial purposes
- Most uranium mines, similar to other hard rock mines, were established under General Mining Law of 1872
 - No requirement to reclaim or remediate them.



An open-pit mine and pit lake near Lakeview, Oregon



Unsecured mine opening



The Report to Congress on Defense-Related Uranium Mines

- A large percentage of mines on public lands in western U.S.; population growth has reduced the number of mines considered “remote”
 - About 25 people die each year in the U.S. due to accidents at abandoned mines – *Safety hazards*
 - Residential risk scenarios are realistic, especially for mines on the tribal lands of the Navajo Nation and Pueblo Nations of New Mexico – *Potential radiological and toxicological health impacts*
- National Defense Authorization Act of 2013
 - DOE directed to prepare a report by July 2014 on location, status, risks, and impacts from estimated cost of mine clean up mines that sold ore to AEC; 4,211 mines have been identified
 - Extensive coordination with other federal agencies, and state and tribal nation abandoned land programs.
 - The report will **not** be a blueprint for a mine cleanup program; however, it will inform decisions makers.
 - No decision yet whether DOE would be responsible for mine reclamation and remediation.



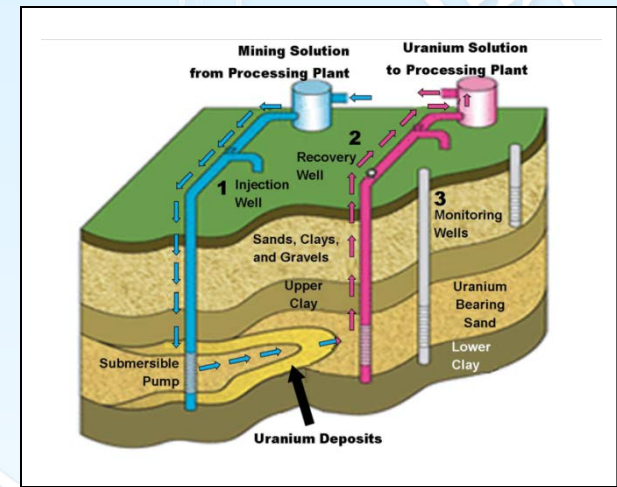
A timbered load-out trestle associated with a small adit in the Uravan mining area of Colorado.



Navajo hogan

Changing land use and risk scenarios around LM sites is more than just an abstract concept

- DOE Office of Environmental Management began implementation of risk-based closures in 1995
- Important caveat: risk scenarios can change with time. This caveat is not abstract. Changes are already occurring at LM sites.
 - ***In situ* recovery (ISR) or leaching of uranium:**
45 percent of uranium in the world and nearly all uranium produced in U.S. in 2013 was by ISR
 - ISR fields are being developed around Texas and Wyoming UMTRCA Title II mill sites that will eventually become LM responsibility.
 - DOE has no responsibility for ISR sites; however....
 - Water quality at ISR fields have not returned to pre-operation conditions; are there implications for compliance at adjacent LM sites?

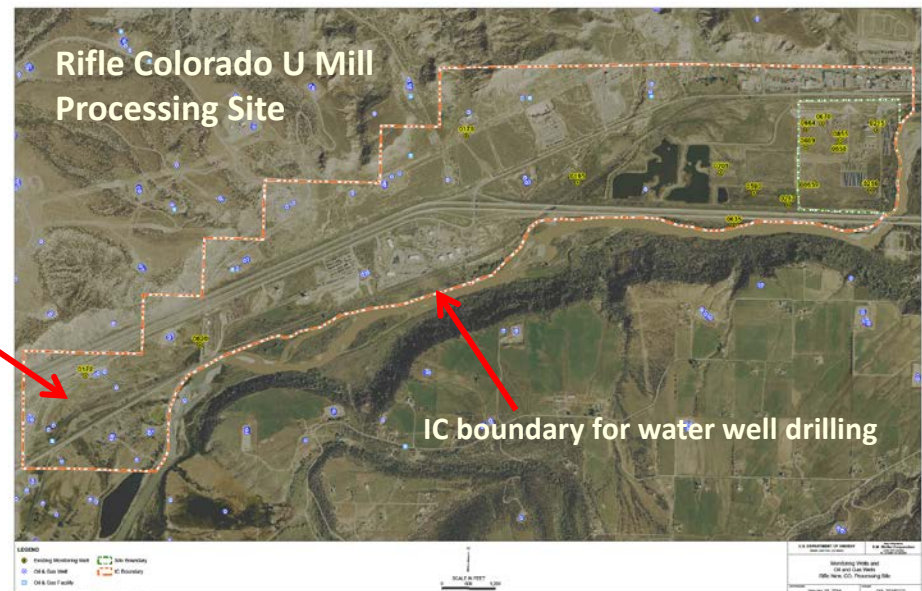


Smith Ranch ISR field adjacent to the Highland, Wyoming, UMTRCA Title II Disposal Site

Changing land use and risk scenarios around LM sites

■ Shale/oil and natural gas drilling

- Rifle, Colorado, UMTRCA Title I Processing Sites are an example of “split estates” for subsurface resources
- Administrative Institutional Controls (ICs) established at Rifle because of U and other contaminants in shallow groundwater at the former mill sites
- Subsurface rights for oil and gas were not acquired as drilling was not considered economical. Hydraulic fracturing techniques quickly resulted in natural gas drilling inside the IC boundary established for water development.
- Oil and gas a separate subsurface “right” in Colorado.



LM is meeting its goal to reduce LTS&M costs by two percent annually

- Emerging issues and solutions for continuing to meet goal
 - **Infrastructure Management** – Similar to an operating site; wells maintained and replaced, roads maintained, fences repaired
 - **Groundwater remediation** – Realistic approach to achievements (i.e., scope reduction as a significant way to control costs)
 - Groundwater remediation/sampling is largest subset of LTS&M costs
 - Contaminants introduced by uranium ore processing occur naturally in groundwater, particularly at UMTRCA sites in western U.S.; “naturally occurring contaminants” not well understood when some remedial goals were set
 - At Pinellas County, Florida, Site groundwater monitoring and modeling indicates dense nonaqueous-phase liquid, or DNAPL, plume is stable, which shows regulators that restricted covenants on groundwater use is a viable risk management strategy



Pinellas County, Florida, Site



Tuba City, Arizona, Disposal Site

LM is meeting its goal to reduce LTS&M costs by two percent annually (continued)

- Is there a need to control vegetation on rock-covered disposal cells?
 - UMTRCA legislation of 1978 shows how little was known about formation of soil and weatherization of rock in arid/semi-arid environments
 - Cells are changing, but not necessarily failing. In fact, landfill covers and new mine-waste cells are being built to use vegetation for water balance control.
- Eliminating work scope
 - Monticello, Utah: U.S. EPA Region 8 and State of Utah agreed in 2012 that bio-monitoring was no longer necessary.
- Low frequency, high impact natural events
 - 2010 – Riverton, Wyoming, UMTRCA site 100-year flood
 - 2013 – Weldon Spring, Missouri, Site tornado
 - Response to these types of events is not easily addressed in addressed in Life-Cycle Baselines. Should contingencies for uncontrollable events be established?



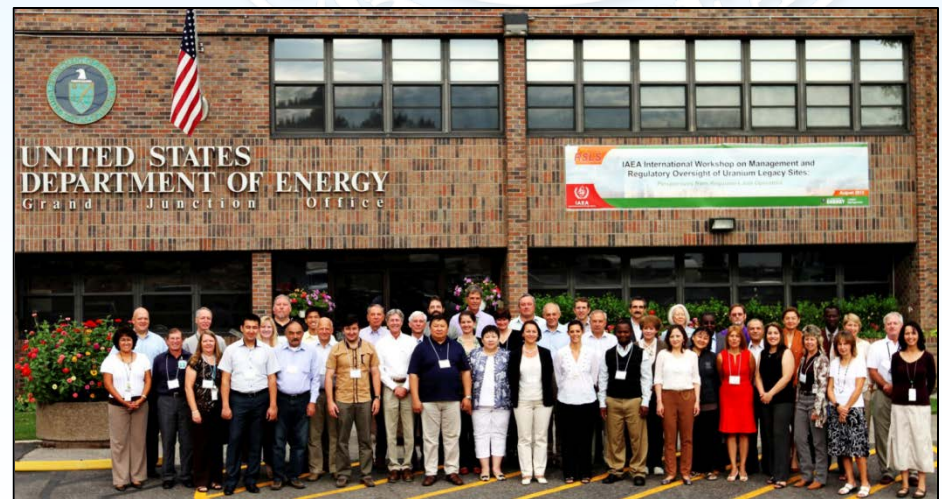
University of Arizona graduate student preparing plant tissue samples for laboratory analysis.



Tornado damage at Weldon Spring, Missouri, Site

LM's mission is gaining international interest.

- The Cold War left behind many “legacy” sites in central Asia and eastern Europe
- Recognition is necessary for assurance of post-closure care and periodic reevaluation of exposure pathways at remediated sites
- **International Atomic Energy Agency (IAEA): “Regulatory Supervision of Legacy Sites” program**
 - A workgroup lead by LM focuses on assessments and management of closed sites
 - Phased approach to remediation of large sites.
 - Full-scale remediation of large sites could take generations to complete in some countries
- IAEA developing training programs for small-scale uranium mine cleanup and reclamation
 - LM's experience reclaiming mines on DOE Uranium Leasing Program tracts in western Colorado is contributing to this IAEA program



IAEA workshop participants and LM personnel in front of the DOE Grand Junction office.

LM's mission is gaining international interest. (continued)



The reclaimed Radium No. 8 Pit Mine is located in DOE Uranium Lease Tract C-SR-11, near Slick Rock, Colorado.



DOE preparing a Programmatic Environmental Impact Statement for Uranium Leasing Program.

It is anticipated that reclamation/remediation of new mines in the future will be to risk-based standards.



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LM/international collaboration

- **Nuclear Energy Agency:** Program on “Records, Knowledge, and Memory across Generations”
 - LM contribution: Beneficial site reuse as an effective, passive institutional control strategy for geological disposal sites
- **WISMUT GmbH:** Largest uranium mine/mill tailings cleanup program in the world
 - Establishing a center for data information and records management similar to LM’s

Wismut guests toured the Grand Junction disposal site with LM staff and contractors. In the background is a remote telemetry system.



LM sites are never finished

- Current and future generations will continue to ask, “Is this site really safe?”
- Talk of “national sacrifice zones” has come a long way
 - Reuse at Fernald Weldon Spring sites are providing ecological benefits largely lost in their regions before DOE program
 - Site reuse can be a *de facto* institutional control if people value what a site has become
 - International visitors to LM sites have shown both skepticism and awe that reuse is occurring
- Concepts such as “rolling stewardship” are already part of LM’s mission
 - Effects of 100-year floods and tornadoes are relatively short-term, but they are to be expected at LM at sites when responsibility for them is in perpetuity
 - Technological advances (e.g., ISR and hydraulic fracking) have led to new, potential receptor scenarios
 - Retaining characterization data when sites were remediated as well as LTS&M records is important for evaluating changes and working with stakeholders to address them
- Uranium mines are a reminder that parts of the uranium cycle for DOE’s defense sites still need to be addressed

