Assessment of Defense-Related Uranium Mines in the United States and Other US DOE Office of Legacy Management Domestic and International Uranium Initiatives – 15335

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ABSTRACT

US DOE's Office of Legacy Management (LM) has taken several initiatives to improve domestic uranium mining and milling operations in the United States and to contribute to the management of legacy uranium mining and milling sites around the world. Initiatives include completing the 2014 Report to Congress on Defense-Related Uranium Mines, managing the Title X Uranium and Thorium Program with the Office of Environmental Management, and assisting IAEA with uranium issues in member state countries.

The 2014 Report to Congress identified abandoned uranium mines (AUMs) in the United States that provided uranium ore to the US Atomic Energy Commission (AEC) between 1947 and 1970. The report identified AUM locations, reclamation/remediation status, radiological risks and other hazards, costs for reclamation and remediation, and potential prioritization schemes for mine cleanup. To develop reclamation and remediation cleanup cost estimates and assess risks, AUMs were grouped into six categories by tons of uranium ore produced, ranging from Small (less than 91 metric tons [100 tons]) to Very Large (greater than 453,900 metric tons [500,000 tons]). Radiological risk was calculated using the RESRAD computer code for five exposure scenarios: offsite resident, onsite resident, occasional visitor, recreational visitor, and mine reclamation worker.

Results indicate that 69 percent of the AUMs are in Colorado and Utah and 23 percent are in Arizona, Wyoming, and New Mexico; and that the majority of the AUMs (68 percent) were considered Small or Small/Medium production mines, producing less than 908 metric tons (1,000 tons) of uranium ore. Although New Mexico has fewer AUMs (247) than the other states in the Colorado Plateau region, AUMs in that state (primarily those in the Grants Mineral Belt) produced 45 percent of the 79.5 million tons of AEC-purchased uranium ore. About 50 percent of the AUMs are on public land managed by the US Bureau of Land Management; 435 AUMs are on the Navajo Nation.

Risk estimates for the onsite resident scenario (plausible on tribal and non-federal land) could result in an incremental cancer risk greater than 10^{-4}. Radon inhalation was the dominant contributor to radiological risk for the five exposure scenarios evaluated.

Different state and federal agencies are conducting cleanup of some AUMs under various remedial and legal authorities. Activities constituting mine "reclamation" may reduce radiological risks to humans to acceptable levels for many mines on federal public lands if the

occasional visitor and recreational visitor exposure scenarios are assumed. Addressing physical hazards (e.g., open shafts) at mines where conditions could cause serious injuries is typically a priority of public land management agencies.

At locations where mine-related groundwater contamination occurs, it is a significant contributor to cleanup costs. However, most Small and Small/Medium AUMs were likely developed above the water table, and some wet mines are located in areas where groundwater has high, naturally occurring levels of the same constituents (including radioactive elements) that are typically associated with uranium mines.

LM is also administering, with the US DOE Office of Environmental Management, the Title X program, which was developed by Congress to reimburse private companies (i.e., those that held active operating licenses prior to 1978) for a portion of their reclamation costs for mill sites that processed ore sold to AEC. LM recently updated the program guidance document and established internal protocols for annually auditing companies.

LM is assisting IAEA on two different initiatives: assisting developing countries with training on the basic steps to take to perform reclamation of uranium mines, and developing technical guidance and case studies related to safety and environmental assessments and post-closure management of uranium legacy sites as part of the IAEA Regulatory Supervision of Legacy Sites initiative.

INTRODUCTION

US DOE's Office of Legacy Management (LM) has taken several initiatives to improve domestic uranium mining and milling operations in the United States and to contribute to the management of legacy uranium mining and milling sites around the world. Initiatives include completing the 2014 Report to Congress on Defense-Related Uranium Mines, managing the Title X Uranium and Thorium Program with the Office of Environmental Management, and assisting the IAEA with uranium issues in member state countries.

REPORT TO CONGRESS ON DEFENSE-RELATED URANIUM MINES

Introduction

More than 150,000 abandoned or inactive hard-rock mines exist in the western United States, not including Alaska. Most of these mines were established under the General Mining Law of 1872, and reclamation was not required. Many mines are so old that owners cannot be traced, so potentially responsible parties cannot be identified. Abandoned uranium mines (AUMs) are a small subset of the large number of abandoned hard-rock mines. Limited funds are available to federal, state, and tribal government agencies to address these abandoned mines. As the population grows in the western United States, more people live near the mines, and recreational activities such as hiking, bike riding, and off-road-vehicle riding occur more frequently near the mines. AUMs have the same physical hazards as most other hard-rock mines plus the added risk of radiological exposure.

The National Defense Authorization Act for Fiscal Year 2013, signed into law on January 2, 2013, mandated that US DOE prepare a report on defense-related uranium mines that provided uranium ore for atomic energy defense activities of the United States.

LM was selected to develop the Defense-Related Uranium Mines Report to Congress (Report).[1] The Secretary of Energy signed off on the Final Report in August 2014. LM was established in 2003 to manage post-closure activities at former US DOE defense and uranium ore mill sites. LM is also responsible for administering the US DOE Uranium Leasing Program and its 31 uranium lease tracts, including reclamation activities.

Consistent with the 2013 legislation, LM consulted with representatives from other federal agencies, affected states and tribes, and the interested public. LM used existing conferences and forums, such as the 2014 WM Symposia Conference, to solicit feedback. During 2013, LM presented an overview of the project at five major conferences, to the Federal Mining Dialogue, and to several federal and tribal agencies. Participation in the forums was extremely valuable in developing relationships with pertinent contacts and gaining direct information. In addition, LM held two webinars in 2013 and 2014 to present a summary of the four topic papers (that were written to support the analysis summarized in the Report) to interested agencies and the public.

LM's Definition of Abandoned Uranium Mine

As LM did research for the Report to Congress, LM found that other agencies differ in their definition of a "mine." As a result, different agencies' inventories of abandoned mines vary, based on their definition. Many abandoned mine land inventories count individual mine features (e.g., an adit, a portal, or a waste rock pile). The number of AUMs identified by US DOE is much smaller than the number of features present at a mine site.

LM defines an AUM as a mine or complex developed to extract uranium ore for atomic energy defense-related activities of the United States, as verified by purchase of ore by US Atomic Energy Commission (AEC) or other means. AEC, a predecessor agency to the US DOE, was the sole purchaser of uranium ore from 1947 to 1966. AEC continued to purchase ore until 1970, while sales for commercial nuclear power and other non-defense purposes began in 1966.

An AUM may be a single feature such as a surface or underground excavation, or it may include an area containing a complex of multiple, inter-related excavations. An AUM may include associated mining-related features such as mine adits and portals, surface pits and trenches, highwalls, overburden or spoils piles, mine-waste rock dumps, structures, ventilation shafts, ore stockpiles and stockpile pads, mine-water retention basins or treatment ponds, close-spaced development drill holes, trash and debris piles, and onsite roads.

LM's definition of AUM does not include offsite impacts or features such as ore-buying stations, ore transfer stations, or ore used in structures, roads, and general fill. LM recognizes that offsite uses may result in potential risk to the public or environment, but LM adhered to the congressional direction of addressing only AUMs as defined above.

AUMs are a subset of abandoned mine lands (AMLs) that have been and are being addressed by various federal agencies (US Bureau of Land Management [BLM], US Forest Service, US Environmental Protection Agency [US EPA], US National Park Service), tribal and state-specific AML offices, and state offices with oversight of mining activities. A US Government Accountability Office report notes that more than 150,000 abandoned hard-rock mines are in the western United States.[2] US EPA has documented several investigations specific to AUMs.[3, 4] The US EPA reports identified approximately 15,000 locations associated with uranium in its database and noted that more than 4,000 mines had documented uranium production.

- Even if all uranium mines are considered, they amount to less than 5 percent of all hard-rock mines.
- However, on the Colorado Plateau, in the “Four Corners” region (Arizona, Colorado, New Mexico, and Utah) of the United States, the majority of abandoned mines were mined for uranium (and vanadium).

Figure 1 provides an overview of the location of AUMs in the United States in relation to the main mining districts.

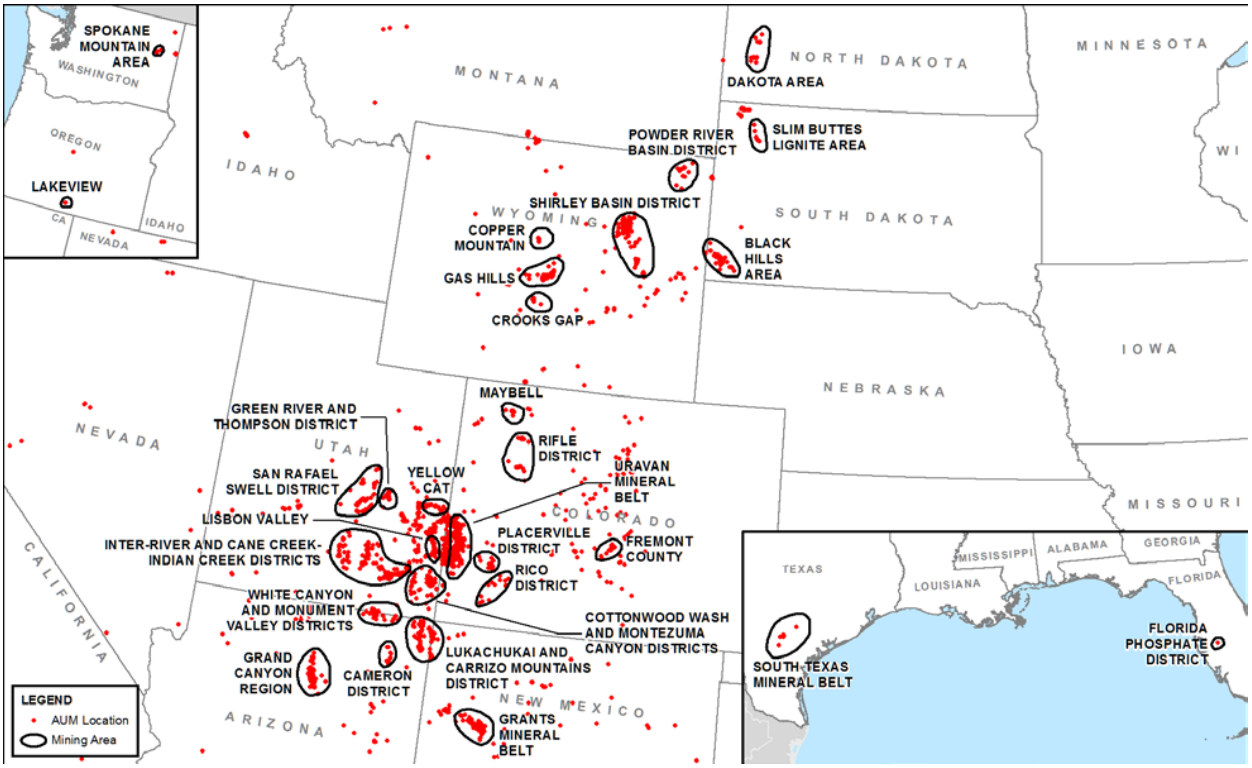


Fig. 1. Location of AUMs in the United States in Relation to Mining Districts.

Geology of Uranium Deposits in the United States

The major uranium-producing regions in the United States (AUM locations shown in red) are shown in Figure 1.

Most uranium deposits formed when oxidizing groundwater leached the metallic element from igneous rocks and transported it to reducing environments where it then precipitated and became concentrated. Geologic units with uranium typically contain carbonaceous material and humates.

Four major types of US deposits are roll-front (south Texas and Wyoming), tabular sandstone (Grants Mineral Belt in New Mexico and Uravan Mineral Belt in Colorado and Utah), solution-collapse breccia pipes (Grand Canyon Region of the Colorado Plateau), and volcanic (Lakeview).

The increasing need for uranium prompted AEC to investigate unusual sources, including phosphate mines in Florida and lignite in the Dakotas, where uranium is a byproduct.

Methods Used to Develop the Report to Congress

Because the report was requested within 18 months, US DOE largely relied on existing information from federal, state, and tribal AML programs. The AEC production tables listed 4,140 mining records, which included claims, leases, and permitted mines located on federal, state, tribal, and private lands.[5] Through review of the other agency records containing latitude and longitude coordinates, an additional 85 mines that could be considered defense-related were added (all on the Navajo Nation), making a total of 4,225 mines in the US DOE database. This number is subject to change as information continues to be gathered from other sources or as issues, such as duplicate mine claim names listed in the AEC database, are investigated.

For purposes of estimating costs, evaluating risk, and describing the distribution of AUMs across the country, AUMs were subdivided into six categories based on the total amount of ore produced and sold to AEC:

- Small: <91 metric tons (<100 tons)
- Small/Medium: 91 to 908 metric tons (100 to 1,000 tons)
- Medium: 908 to 9,078 metric tons (1,000 to 10,000 tons)
- Medium/Large: 9,078 to 90,780 metric tons (10,000 to 100,000 tons)
- Large: 90,780 to 453,900 metric tons (100,000 to 500,000 tons)
- Very Large: >453,900 metric tons (>500,000 tons)

Data on the number and size of features of different AUM production-size categories were based on US DOE's reclamation of 161 Uranium Leasing Program sites, records on 182 BLM sites that US DOE helped reclaim in western Colorado, and visits to 84 mines in 11 mining districts in the western United States. From this information, US DOE was able to define an average number and size of mine features for estimating reclamation and remediation costs and developing risk scenarios. A range was developed for each attribute (e.g., the range for the volume of a waste rock pile at Small category mines was set at 32–43 metric tons [35–47 tons], while the range for Large category mines was set at 97,135–181,560 metric tons [107,000–200,000 tons]). This allowed US DOE to develop a range of costs for each production-size category, acknowledging that mine cleanup costs can vary significantly based on these factors.

Gamma and radon measurements were made during the mine visits. Radon data is available for less than 1 percent of the AUMs identified. The measurements were useful in validating

assumptions for the risk models and also in showing the wide range of data (e.g., the collected radon data ranged from 0 to 118 working levels) and potential radiological hazards.

Estimating Costs of Reclaiming and Remediating Mines

A bottom-up cost estimate was developed for five of the six production-size categories. Costs were based on equipment rates from estimating software, average Davis-Bacon wage rates from the five states with the most mines (Colorado, Utah, Arizona, Wyoming, New Mexico), and costs from BLM handbooks.

Cost ranges were established by incorporating ranges for several variable elements, such as the number of mine features and the distances to sites for hauling topsoil and materials in a remediation scenario. The cost estimates were compared to the historical costs of reclaiming or remediating mines in multiple production-size categories.

MAJOR FINDINGS

US DOE counted 4,225 AUMs that provided uranium ore for defense purposes between 1947 and 1970. About 68 percent of these were Small or Small/Medium mines that produced less than 908 metric tons (1,000 tons) of ore. The ore was produced from a variety of ore bodies and rock types. Table I is a summary of AUMs by production-size category and state location. About 90 percent of the mines are located in the four states of the Colorado Plateau region (Arizona, Colorado, New Mexico, and Utah) plus Wyoming. However, most of the production was from Very Large mines in New Mexico, where more than half of the Very Large mines are located. Mines in New Mexico produced 46 percent of the 75.9 million tons of ore purchased by AEC, exceeding that produced from mines in Colorado, Utah, and Wyoming combined.

Nearly half of the mines are located on federal public lands managed by BLM. Another 10 percent are on land managed by other federal agencies (e.g., the US Forest Service). About 11 percent of the mines are on tribal lands. Mines are located on lands of seven tribal nations, although over 90 percent of mines on tribal lands are in the Navajo Nation. It was determined that 564 (13 percent) of the AUMs are located on state, county, and private lands. Insufficient information was available to define land ownership for 657 mines (16 percent of the total) primarily due to limitations in the databases used and not having longitude/latitude locations for many of the mines.

Table I. Summary of AUMs by Production-Size Category and State

State	Total		Small	Small/ Medium	Medium	Medium/ Large	Large	Very Large	Unknown Size
	No.	Percent	No.	No.	No.	No.	No.	No.	No.
Alaska	1	0.02%	0	0	0	1	0	0	0
Arizona	413	9.8%	162	110	83	28	4	1	25
California	26	0.6%	21	3	2	0	0	0	0
Colorado	1,539	36.4%	621	378	348	167	22	3	0
Florida	1	0.02%	1	0	0	0	0	0	0
Idaho	7	0.17%	1	2	4	0	0	0	0
Montana	19	0.4%	10	8	1	0	0	0	0
Nevada	24	0.6%	12	8	3	1	0	0	0
New Jersey	1	0.02%	1	0	0	0	0	0	0
New Mexico	247	5.8%	78	39	40	33	17	19	21
North Dakota	14	0.3%	2	2	5	3	0	0	2
Oklahoma	2	0.05%	2	0	0	0	0	0	0
Oregon	4	0.09%	1	0	2	0	1	0	0
Pennsylvania	1	0.02%	0	1	0	0	0	0	0
South Dakota	155	3.7%	71	35	34	13	2	0	0
Texas	29	0.7%	6	4	8	8	3	0	0
Utah	1,380	32.7%	788	278	190	100	17	5	2
Washington	17	0.4%	0	11	3	2	0	1	0
Wyoming	319	7.6%	135	57	61	42	16	8	0
Unknown Location	**26**	0.6%	24	2	0	0	0	0	0
Total	4,225	100%	1,936	938	784	398	82	37	50

Existing federal, state, and tribal AML programs have established priorities for abandoned mine cleanups (which include uranium mines); consequently, US DOE did not establish a separate prioritization scheme for the Report to Congress. Common to most prioritization methods are risk-based approaches, which include a consideration of physical hazards, environmental hazards (i.e., contaminants), accessibility, and cleanup status. Some agencies consider radiological hazards to be a type of physical hazard from a prioritization standpoint. However, most agencies include radiological contamination as an environmental hazard and consider it separately from physical mine features.

In their mine reclamation efforts, public land management agencies such as the US Forest Service and BLM [6] have put a higher priority on addressing physical hazards than on addressing radiological hazards. This prioritization is because their land is not typically used for residential purposes but rather for recreation such as camping limited to a 2-week period.

Different agencies have made varying levels of progress on reclamation and remediation of abandoned mines in the United States, and the cleanup status of only 15 percent of AUMs could be confirmed. Three AUMS are on US EPA's National Priorities List, of which two are in the

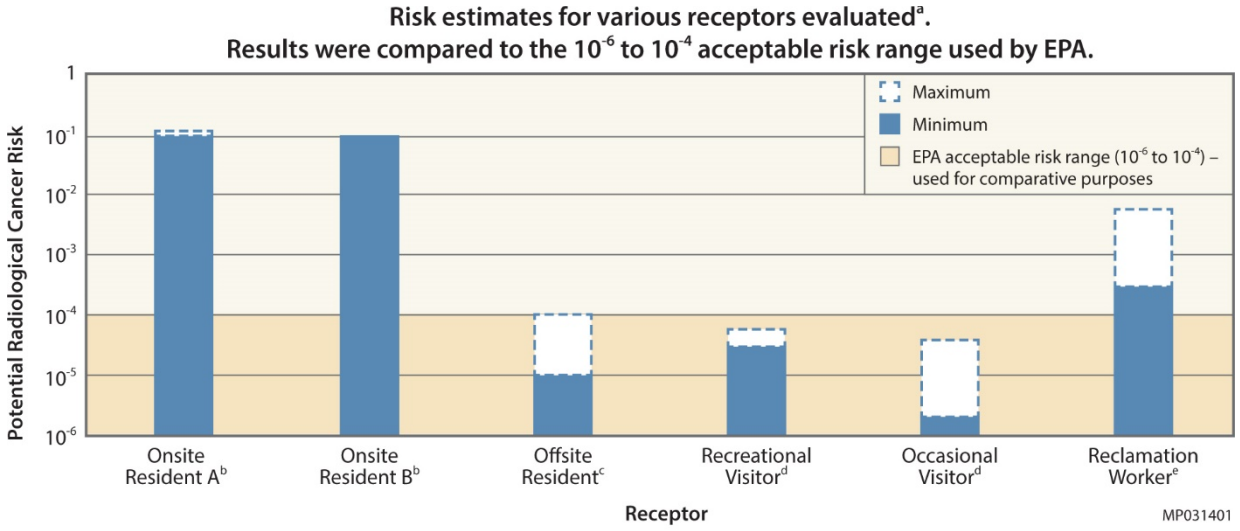
Very Large production-size category. US EPA and other federal agencies are using their CERCLA authority to find parties responsible for the cleanup of abandoned uranium mines (e.g., San Mateo Mine in New Mexico, Skyline Mine in Utah).

Radiological Risk and Physical Hazards

Historically, a primary objective of mine reclamation has been to eliminate physical hazards. At the same time, the value of reclamation in reducing public exposure to radon emanation at AUMs has not been well documented. After completion of reclamation to mitigate physical hazards and reduce radon emanation, most AUMs on public lands would have no unacceptable radiological human health risks, given the degree to which total radiological risk is a function of radon exposure. Unreclaimed AUMs pose the greatest physical hazards, and all AUMs, regardless of size, can have physical hazards that may pose serious risks.

The greatest risk for all receptor scenarios evaluated is radon (indoor radon inhalation for residential receptors and outdoor radon at mine adits and portals for nonresidential exposures).

A summary of the risk calculations for the Report to Congress are shown in Figure 2. Radiological risk was calculated using the RESRAD computer code for five exposure scenarios: offsite resident, onsite resident, occasional visitor, recreational visitor, and mine reclamation worker. The risk calculations indicated that potential risk for two of the five scenarios (i.e., onsite resident [both A and B] and the unprotected reclamation worker) exceed 10^{-4}, which is the upper end of US EPA's acceptable risk range. The risk range for onsite residents A and B is up to 10^{-1}, or one in ten.



[a] Based on an assumed average mine for the Small to Large mine production-size categories.
[b] Based on an exposure duration of 30 years for an onsite resident.
[c] Based on an exposure duration of 30 years for an offsite resident at a 100-meter distance from a mine or mine contamination.
[d] Risk estimates for the recreational visitor and occasional visitor assumed a two-week and 1-hour exposure duration, respectively, and are primarily due to the inhalation-of-radon pathway at adits.
[e] With no worker protection assumed for an exposure duration of 20 days per mine.

Fig. 2. Risk Estimates for Various Receptors Evaluated.

Mines where safety hazards (e.g., open shafts) have not been reclaimed continue to pose significant safety risks. When all types of mines are considered, the federal government estimates that about 25 people are killed each year in accidents at abandoned mines.

Impacts of Mines on Water Resources

About 1 percent of the abandoned uranium mines are located near "impaired water" (streams, lakes, and reservoirs) as defined in section 303(d) of the Clean Water Act. Another 1 percent of mines are located near or upstream of US Geological Survey National Water Information System (NWIS) sites that have elevated levels of groundwater contaminants. For both Section 303(d) impaired waters and NWIS sites, it could not be determined whether the uranium mine was the source of the contaminants of concern, because mines for other commodities are located in the same area.

Some AUMs have impacted groundwater, which can be a significant part of total cleanup cost. Other AUMs are in areas of high, naturally occurring metal constituents in groundwater, including uranium. Some of these AUMs may have impacted groundwater, but in those instances, the background levels of constituents need to be accounted for in establishing cleanup standards.

Information provided by US EPA noted that many uranium mines in the Grants, New Mexico, Mining District operated as wet mines. Over their years of operation, water was pumped to the surface and discharged into nearby drainages, resulting in significant re-saturation and, in places, contamination of the shallow alluvium and underlying bedrock aquifers. Due to limited time, US DOE did not conduct site-specific evaluations of groundwater and surface water. Also, some of the uranium mines in the Grants Mining District did not produce ore purchased by the AEC (e.g., Northeast Church Rock, which operated post-1970), so they were not part of the study.

Cost of Reclamation and Remediation

Design assumptions were made to provide separate remediation and reclamation estimated cost ranges for each production-size category. Some of the primary factors that varied were (1) mobilization of contractors from different cities, (2) distances to move contaminated material offsite, and (3) the type and complexity of the cover system for a repository. Costs for Very Large mines were not estimated because they all either (1) have undergone or are undergoing reclamation or remediation or (2) have a reclamation bond in place. Historical remediation costs for mines of this size vary dramatically, ranging from $6 million to $200 million. Table II provides estimates of the range of reclamation and remediation costs by mine production-size category.

Reclamation and remediation were defined as follows:

- Reclamation: Physical hazards are mitigated by closing portals, adits, and vent holes and stabilizing and covering the waste-rock piles.
- Remediation: Actions are taken to address contaminated soils, mine-related structures (in some cases), surface water, and groundwater so that the site reaches a risk-based cleanup standard under CERCLA and the National Contingency Plan.

Table II. Mine Reclamation and Remediation Costs per Site in Each Production-Size Category

Tons of Ore Produced	Mine Production-Size Category	Range of Reclamation Costs	Range of Remediation Costs
0–91 metric tons (0–100 tons)	Small	$10,000–$70,000	$10,000–$80,000
91–908 metric tons (100–1,000 tons)	Small/Medium	$10,000–$80,000	$20,000–$100,000
908–9,078 metric tons (1,000–10,000 tons)	Medium	$50,000–$250,000	$110,000–$840,000
9,078–90,780 metric tons (10,000–100,000 tons)	Medium/Large	$270,000–$730,000	$2,500,000–$6,500,000
90,780–453,900 metric tons (100,000–500,000 tons)	Large	$560,000–$1,400,000	$4,900,000–$15,400,000
>453,900 metric tons (>500,000 tons)	Very Large	Not Estimated	Not Estimated

Note: The range of remediation costs includes the cost of reclamation. The two columns should not be added together to get a total cost for reclamation/remediation.

Based on the definitions of reclamation and remediation used in the Report to Congress, for Small and Small/Medium mines, the reclamation costs for a given mine can be less than 20 percent of the cost of remediation for the same mine.

For reclamation or remediation of mines to remain effective, long-term monitoring and maintenance (LTM&M) may be necessary. The research showed that LTM&M has been performed for an extended period at only a few mines.

Conclusions

If there is a potential for residential use at a mine site or for living on a contaminated area near a mine (depending on the level of contamination), such as on tribal or private land, the potential human health risks would indicate that remediation and/or implementation of use restrictions may be required. Otherwise, reclamation of all physical hazards may be the preferred approach. According to the Report to Congress, reclamation that includes stabilizing (particularly if designed to be permanent), covering the waste pile with clean fill, and sealing mine openings where radon emissions can be concentrated, could lower human radiological health risk by reducing radon and gamma exposure.

Next Steps

Additional information will better define the scope and size of future cleanup action for mines. US DOE plans to continue to collect field data in cooperation with other federal agencies (e.g., BLM). In addition, in consultation with US EPA, US DOE will continue its study of mines on the Navajo Nation by collecting additional information on the role of other government agencies,

groundwater, uranium production levels, and by continuing its discussion of past and present potential health impacts, existing prioritization systems, and potential funding sources.

TITLE X PROGRAM

From 1942 through 1970, the US Army's Manhattan Engineer District and the AEC entered into several contracts with commercially operated mills to purchase uranium concentrate in support of the United States' defense programs. Due to the limited knowledge of the hazards created by the resulting milling-process waste, those contracts did not include provisions for managing and remediating the waste materials. Between 1975 and 1979, studies of the environmental impacts of uranium mill tailings were conducted, revealing potentially significant health hazards. As a result, in 1978 Congress enacted the Uranium Mill Tailings Radiation Control Act (UMTRCA). Under UMTRCA, US NRC regulates the mill tailings and other byproduct material remaining at "active" processing sites (i.e., sites with active licenses under the Atomic Energy Act of 1954 [AEA] on or after January 1, 1978). AEA provides US NRC and any Agreement State (pursuant to a discontinuance agreement with US NRC) with the authority to approve a plan for remediating an "active" site, as developed by the site licensee. LM has responsibility for long-term surveillance and maintenance (LTS&M) of UMTRCA sites where remediation has been completed.

In 1979, US DOE and the US Government Accountability Office reported to Congress that federal assistance should be provided to the "active" site licensees to defray a portion of the costs to remediate mill tailings remaining at the sites. Title X of the Energy Policy Act of 1992 (Title X) authorizes US DOE to provide that federal assistance. US DOE, in turn, published Title 10 *Code of Federal Regulations* Section 765 (10 CFR 765) on May 23, 1994, to establish the requirements and procedures under which it implements the Title X cost reimbursement program. Congress has amended the original legislation four times since the Energy Policy Act was enacted on October 24, 1992, and US DOE revised 10 CFR 765 on June 3, 2003, to reflect those changes in the legislation. There are 13 uranium licensees and one thorium licensee eligible for Title X funding. Remediation is complete on three of the sites, while the remaining 11 are still in active remediation and eligible for claim reimbursement.

The Title X claim review and audit function was transferred from the US DOE Office of Environmental Management (EM) to LM in 2011. Under the Title X Program, LM receives claims from the licensees annually and then conducts technical reviews and financial audits of the claims to determine the amount allowable for reimbursement. EM reimburses each licensee (when funds are available), and tracks amounts paid, disallowed, and owed.

When a claim is submitted, LM reviews the claim from a technical perspective, which includes a site visit to observe remediated areas and verify that work was performed as stated in the claim. In addition, LM reviews approved remediation plans to ensure the work was within the scope of the approved plan. LM has worked with both the EM Consolidated Business Center and the Defense Contract Audit Agency to assist in the financial review and auditing function.

Funding for Title X is appropriated from the Uranium Enrichment Decontamination and Decommissioning Fund. Funding is not appropriated every year, so US DOE is responsible for tracking approved claims that are not reimbursed.

US DOE has developed guidance documents to Licensees on submitting complete and accurate cost reimbursement claim packages and to outline the related review and audit process. The 1995 *Guidance for Preparation of Reimbursement Claims under Title X of the Energy Policy Act* document was updated in 2014 to reflect changes in the law and changing responsibilities in US DOE. Other updates in the document include the following:

- Changes in the amount reimbursed to uranium licensees per dry short ton of federal-related byproduct material (from $5.50 to $6.25, inflation adjustment).
- An increase in the authorized aggregate reimbursement for both uranium and thorium to $715 million (which includes a $365 million limit for thorium licensees).
- Identification of generally accepted accounting principles that licensees should use in preparing claims. Consequently, claims must present supporting cost reimbursement backup documentation that is reliable, complete, and consistent.
- Examples of past financial and technical reviews.
- More detail regarding the technical review.

The responsibilities for the Title X program align well with LM's mission for performing LTS&M at uranium mill tailings sites transferred to LM under Title II of UMTRCA. Three of the sites are already part of the LTS&M program, and LM will eventually take responsibility for the other nine uranium sites after remediation is complete and their license is terminated. Additionally, LM may manage the records for the one thorium site in the Title X Program. For the sites still to transfer, LM's participation in the Title X Program gives it an early view of what types of responsibilities it might have for the sites in the future.

INTERNATIONAL SUPPORT

LM is assisting the IAEA on several different initiatives. Primarily these involve (1) developing training for countries on the basic steps to take to perform reclamation of uranium mines and (2) developing technical guidance and case studies related to safety and environmental assessments and post-closure management of legacy sites. LM is using its valuable knowledge gained from managing 89 legacy sites, including 27 former uranium mills and several sites that were directly part of the federal government's nuclear weapons program.

LM cohosted with IAEA an international workshop on uranium legacy sites in 2012 in Grand Junction, Colorado, as part of the IAEA International Initiative on Regulatory Supervision of Legacy Sites (RSLS). More than 30 visitors from 20 countries attended the 4-day workshop. The IAEA "Workshop on Management and Regulatory Oversight of Uranium Legacy Sites: Perspectives from Regulators and Operators" was part of an IAEA objective to help "member state" countries develop effective programs to oversee remediation and provide post-closure care of contaminated sites. The first phase of RSLS (2010 to present) has focused on uranium legacy sites (e.g., mills and mines), since more than 80 percent of the participating member states have these types of sites. Participants were taken on a tour of four uranium mill tailings disposal cells, one site undergoing active remediation (Moab, Utah), and the only active uranium processing

mill in the United States, which is in Blanding, Utah. Many of the visitors were from countries in Central Asia, which were once part of the Soviet Union, and their mines were major sources of uranium for the Soviet Union during the Cold War. The workshop included participants from Canada, Australia, Russia, France, and Germany who made presentations on the regulatory framework and cleanup of legacy sites in their countries. LM made presentations on LTS&M issues and lessons learned, reuse of former contaminated sites, institutional controls, and managing records. LM is also working with the IAEA to cohost another workshop in Grand Junction in 2015.

LM continues to support IAEA by attending workshops in Vienna, Austria, to develop technical documents and training, and by accompanying IAEA on site tours of legacy uranium sites. LM is helping IAEA prepare training for the RSLS Review of Remediation Plans and Activities for Uranium Mining and Milling sites. Training modules developed by LM include:
(1) Decommissioning and Soil Remediation, (2) Management and Disposal of Wastes,
(3) Geotechnical Engineering, and (4) Long-term Care and Surveillance. These modules will be part of a 5-day course aimed at member states that do not have regulatory programs in place to manage uranium sites.

LM also has provided case studies that are being incorporated into an RSLS Technical Document, including the following topics:

- Keeping the Grand Junction, Colorado, disposal cell open to receive mill tailings from vicinity properties after the government-sponsored program ended
- Investigation of naturally occurring contaminants at the Many Devils Wash located near the Shiprock, New Mexico, uranium mill tailings site
- Objectives in establishing the US DOE Office of Legacy Management for post-closure management of legacy sites
- Process for evaluating and approving reuse (for solar photovoltaic panel installation) at the Durango, Colorado, uranium mill tailings disposal cell site
- LM public relations policy of continuing to engage stakeholders years after cleanup has ended
- The inventory of abandoned uranium mines in the United States that provided ore for weapons production that was summarized in the Report to Congress on Defense-Related Uranium Mines.

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