




Fox Group – Horseshoe Group, Colorado

DRUM PROGRAM MIDYEAR PROGRESS REPORT

January 1-June 30

2022



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Introduction

The *Defense-Related Uranium Mines Report to Congress* (DOE 2014b) (Report to Congress) identified the potential physical and environmental risks posed by legacy abandoned uranium mines in the United States. This set of mines provided uranium ore for defense-related atomic energy activities from 1947 to 1970. To help quantify this remnant risk, the U.S. Department of Energy (DOE) Office of Legacy Management (LM) was authorized to initiate the Defense-Related Uranium Mines (DRUM) program in fiscal year (FY) 2017. DOE subsequently established a five-year campaign to carry out verification and validation (V&V) fieldwork at approximately 2,500 legacy mines on public land. Most of this land is managed by the U.S. Forest Service (USFS), the U.S. Bureau of Land Management (BLM), or the National Park Service (NPS) for multiple uses but primarily for public recreation. The DRUM team documents the information collected about a mine in a mine-specific V&V report, which later serves as the basis for evaluating the risks posed by a group of mines, as presented in a risk roll-up report.

This midyear report describes DRUM program accomplishments and achievements for the reporting period of January 1, 2022, through June 30, 2022. The information presented in this report is stored in a continuously updated database and represents data that were queried on July 1, 2022. The report also provides information regarding progress on Campaign 1 (public land) and Campaign 2 (tribal land) and the program's overall progress since its initiation in July 2017. This additional information provides context for the reporting period's accomplishments.

DRUM Progress Summary

The DRUM program's sixth field season began on March 7, 2022. The primary focus has been on BLM-managed land in southwestern Colorado and southeastern Utah and USFS-managed land in southwestern South Dakota. During the reporting period, LM completed 151 field V&V mine visits. To date, LM has completed V&V field activities at 1,942 mines and conducted V&V work at 1,613 mines on public land.

During the reporting period, LM completed 156 mine-specific final V&V reports. Cumulatively, LM has completed 1,825 final V&V reports: 1,533 for mines on public land, 243 for mines on mixed-ownership land, 48 for mines on state-managed land, and one on private property. LM has finalized all reports from the prior field seasons through March 2022.

The DRUM program supports LM's strategic goal of "protect[ing] human health and the environment" (Goal 1) and its strategic objective to "address the environmental legacy of defense-related uranium mining and milling sites" (DOE 2020a).

Significant DRUM program accomplishments during the reporting period include:

- Preparing risk roll-up documents recording the risk rankings for mines within identified V&V project areas. Project areas comprise localities, land management agency field offices, or other logical geographical groupings by land management agencies. Risk roll-up reports completed during the reporting period cover 376 mines for which V&V reports were finalized before and during the same reporting period. The following is a list of the areas for which risk roll-up reports were completed between January and June of 2022:
 - o The Mexico Group Locality (seven mines) in western Colorado on BLM-administered land and mixed-ownership BLM-administered land and private property (DOE 2022aa).

- o The Gypsum Gap Locality (six mines) in western Colorado on BLM-administered land (DOE 2022r).
- o The Circle Cliffs Locality (19 mines) in central Utah on BLM-administered land (DOE 2022l).
- o The Circle Cliffs Locality (five mines) in central Utah on USFS-administered land (DOE 2022m).
- o The South Deerneck Mesa – Dry Valley Locality (11 mines) in eastern Utah on BLM-administered land (DOE 2022cc).
- o The Little Rockies Locality (19 mines) in central Utah on BLM-administered land (DOE 2022x).
- o The Wild Steer Locality (eight mines) in western Colorado on BLM-administered land (DOE 2022ff).
- o The Spud Patch Group Locality (25 mines) in western Colorado on BLM-administered land and mixed-ownership BLM-administered land and Uranium Leasing Program (ULP) lease tracts (DOE 2022dd).
- o The North San Rafael Locality (14 mines) in central Utah on BLM-administered land and mixed-ownership BLM-administered and School and Institutional Trust Lands Administration (SITLA)-administered land (DOE 2022bb).
- o The Legin Group Locality/Bishop Canyon (33 mines) in western Colorado on BLM-administered land and mixed BLM-administered land and ULP lease tracts (DOE 2022t).
- o The Upper Group Locality (17 mines) in western Colorado on BLM-administered land and mixed-ownership BLM-administered land and ULP lease tracts (DOE 2022ee).
- o Manti-La Sal National Forest/Moab Ranger District (30 mines) in eastern Utah on USFS-administered land (DOE 2022z).
- o The Carpenter Ridge Locality (four mines) in western Colorado on USFS-administered land (DOE 2022k).
- o The Henry Mountains and San Rafael Swell Districts (14 mines) in central Utah on SITLA-administered land (DOE 2022s).
- o The Lower Group Locality (13 mines) in western Colorado on BLM-administered land and mixed-ownership BLM-administered land and ULP lease tracts (DOE 2022y).
- o The Empire Group Locality (eight mines) in western Colorado on BLM-administered land (DOE 2022p).
- o The Elk Ridge Locality (36 mines) in eastern Utah on USFS-administered land (DOE 2022o).
- o Grand and San Juan Counties (30 mines) in eastern Utah on SITLA-administered land and mixed-ownership BLM-administered and SITLA-administered land (DOE 2022q).
- o The Little Gyp Locality Central (25 mines) in western Colorado on BLM-administered land (DOE 2022u).
- o The Cottonwood Wash Locality (21 mines) in southeastern Utah on BLM-administered land (DOE 2022n).
- o The Little Gyp Locality North (eight mines) in western Colorado on BLM-administered land (DOE 2022v).

- o The Little Gyp Locality South (23 mines) in western Colorado on BLM-administered land (DOE 2022w).
- Preparing or revising the following Field Operations Plans that describe reconciled mine locations and provide guidance for a logical approach to field V&V work in specific geographic areas:
 - o *Defense-Related Uranium Mines Field Operations Plan for the Remaining Sites in Utah* (DOE 2022g) covering 42 mines.
 - o *Defense-Related Uranium Mines Field Operations Plan for Remaining Sites in Colorado* (DOE 2022b) covering six mines.
 - o *Defense-Related Uranium Mines Field Operations Plan for Utah Statewide Mining Districts, Utah* (DOE 2022j) covering 44 mines.
 - o *Defense-Related Uranium Mines Field Operations Plan for Green River Mining District, Utah* (DOE 2021) covering 26 mines.
 - o *Defense-Related Uranium Mines Field Operations Plan for the Western AUM Region, Navajo Nation, Arizona* (DOE 2022i) covering 57 mines.
 - o *Defense-Related Uranium Mines Field Operations Plan for the North Central AUM Region, Navajo Nation, Arizona* (DOE 2022e) covering 44 mines.
 - o *Defense-Related Uranium Mines Field Operations Plan for the Northern AUM Region, Navajo Nation, Arizona, New Mexico, and Utah* (DOE 2022f) covering 76 mines.
 - o *Defense-Related Uranium Mines Field Operations Plan for the Central AUM Region, Navajo Nation, Arizona* (DOE 2022c) covering six mines.
 - o *Defense-Related Uranium Mines Field Operations Plan for the Eastern AUM Region, Navajo Nation, New Mexico* (DOE 2022d) covering 17 mines.
 - o *Defense-Related Uranium Mines Field Operations Plan for the Southern AUM Region, Navajo Nation, Arizona* (DOE 2022h) covering five mines.
 - o *Defense-Related Uranium Mines Field Operations Plan for National Park Service Sites* (DOE 2020b) covering 44 mines.
 - o *Defense-Related Uranium Mines Field Operations Plan for the Black Hills and Northern Rockies Region* (DOE 2019) covering 125 mines.
- Receiving data from safeguarding projects and uploading the data into the DRUM program database from the following project locations:
 - o Grants District, New Mexico (17 safeguards).
 - o Buckmaster Draw Area, Phase II (110 safeguards).
 - o Red Canyon (88 safeguards).
 - o Bald Eagle BC (12 safeguards).
 - o Long Park Locality (76 safeguards).
 - o Klondike Ridge/Courthouse Wash Mining Locality (24 safeguards).
 - o Martin Mesa Locality (21 safeguards).

- Uploading file geodatabases to the BLM electronic file transfer site, including spatial data for all DRUM mines visited during the 2021 field season on lands managed by BLM in Colorado, New Mexico, Utah, and Montana.
- Performing reclamation work in cooperation with the Colorado Division of Reclamation, Mining, and Safety and Boulder County at the Fair Day mine in the Arapaho-Roosevelt National Forest near Jamestown, Colorado. LM completed the reclamation work, and this was the first DRUM safeguarding project conducted on USFS-managed land.
- Working with BLM to incorporate additional hazardous mine features that are near the Manti-La Sal National Forest safeguarding project to produce a cost-effective mobilization and increase the number of features safeguarded.
- Conducting training during the winter months for DRUM personnel to prepare for the 2022 field season, including Wilderness First Responder training, redesigned trailer towing training, and field training in the Yellow Cat Locality.
- Participating in collaboration meetings with LM and the NPS Capitol Reef National Park and Canyonlands National Park teams to discuss plans for the 2022 field season. The attendees discussed V&V field tasks, program objectives, potential requirements for National Environmental Policy Act (NEPA) evaluations, and the DRUM program's interagency agreement for supporting this NPS collaboration. There are 44 DRUM mines on NPS-managed lands.
- Participating in meetings with the Navajo Nation Environmental Protection Agency and the Navajo Abandoned Mine Lands Reclamation Department (NAMLRD), U.S. Environmental Protection Agency (EPA) Region 2, LM, and an LM Strategic Partner (LMSP) working group to determine the DRUM V&V work processes and develop the Navajo Nation V&V Work Plan (DOE 2022hh). Efforts with the working group included:
 - o Presentations of draft V&V Work Plan sections and the DRUM Field Operations Plan for the North Central AUM region.
 - o Preparation of maps of Navajo Nation shared data and DRUM mines on Navajo Nation lands.
 - o Conducting a V&V demonstration at the Moqui Jug (LM ID 2621) mine and tour of three DRUM mines and three Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) mines on Navajo Nation lands.
 - o Participation in an NAMLRD site visit to Red Mesa, Arizona, where NAMLRD demonstrated reclamation techniques at multiple DRUM mines on Navajo Nation lands.
 - o Submitting a draft Navajo Nation V&V Work Plan.
 - o Receiving written concurrence from the Navajo Nation for DRUM V&V work at 205 mines on April 13, 2022.
 - o Authorization of a five-year cooperative agreement with NAMLRD, which provides NAMLRD with \$800,000 per year to assist the DRUM program by providing technical review of Navajo Nation land campaign documents, Navajo Nation public outreach and translation service, training equipment, and safeguarding of hazardous mine features.
 - o Meeting with NAMLRD and U.S. Bureau of Indian Affairs (BIA) Navajo Regional Office representatives to discuss environmental review and NEPA requirements for DRUM V&V work. LM is performing the NEPA review and will seek concurrence from BIA before beginning V&V work.

- Participating in meetings with the Pueblo of Laguna to identify the scope of DRUM V&V work and to discuss a V&V Work Plan specific to the nation. Additional efforts with the nation include:
 - o Discussion with Pueblo of Laguna technical staff regarding Tribal Historic Preservation Office (THPO) consultation and ensuring that environmental requirements for V&V work on the Laguna Pueblo are met before work begins.
 - o Meeting with Pueblo of Laguna THPO representatives to provide an overview of V&V activities, inform THPO representatives of the limited potential for V&V work to impact cultural and historical resources, if present, and give guidance for the THPO review of the DRUM program’s environmental compliance documents.
 - o Meeting with Pueblo of Laguna environmental specialists from the Environmental and Natural Resources Department to discuss the steps needed to complete V&V activities at three mines on their land. The Pueblo of Laguna agreed to adapt the Navajo Nation V&V Work Plan to meet their specific needs.
 - o Initiation by LM of the National Historic Preservation Act (NHPA) Section 106 consultation process with the Pueblo of Laguna’s THPO. The NHPA Section 106 consultation outlines mitigation efforts to preserve cultural and historical resources, if present, during V&V activities, which are targeted for the week of August 22. LM would mitigate the potential for adverse effects by utilizing a qualified archaeologist to monitor V&V work activities and provide guidance while in the field. Additionally, V&V work will utilize an aggressive Pause/ Stop Work Procedure that would be implemented in the unlikely event that unexpected cultural materials are identified during ground-disturbing activity.
- Participating in discussions with the mineral resources administrator for the Tohono O’odham Nation Natural Resources Department concerning the DRUM mine within the boundaries of the Nation. LM requested assistance and participation from the Tohono O’odham Nation council chairman to inventory and sample the mine later in 2022. This request formalized the ongoing collaboration and coordination, and the DRUM field team will work with the Nation to inventory and safeguard the mine.
- Publishing the *Defense-Related Uranium Mines Annual Report, January 1–December 31, 2021* (DOE 2022a), providing details on 2021 program activities and accomplishments, project planning for 2022, and an updated program timeline. This is a contract deliverable.
- Updating the *Defense-Related Uranium Mines Verification and Validation Work Plan* (DOE 2022gg) for Campaign 1 to reflect approved revisions, deviations, and operation experiences from the previous field season. This is a contract deliverable.
- Updating the *Defense-Related Uranium Mines Quality Assurance Program Plan* (LMS/DRM/S15867).
- Participating in multiple meetings and coordinated efforts with Freeport-McMoRan Inc. and ULP about planned 2022 safeguarding projects in specific geographic areas including: the Atkinson Mesa Locality, the Carpenter Flats and Wray Mesa Localities, the Carpenter Ridge and Roc Creek Localities, the East Calamity Mesa Locality, the Outlaw Mesa Locality, the Spud Patch Group Locality, and Bishop Canyon in Colorado and Manti-La Sal National Forest, Kane Creek, and the Brumley Ridge Locality in Utah.
- Surpassing the contract deliverable — “Complete 500 V&V field visits” — on March 31, 2022. The field teams visited a total of 507 DRUM mines for the 2021 LMSP contract period.

- Submitting the contract deliverable — “For each mine V&V completed during the field season, the database will be fully populated, quality checked, and corrected throughout the year with a final update at the end of the performance period” — on January 11, 2022.
- Submitting the contract deliverable — “Complete V&V reports for field activities conducted through October 31, 2021” on March 3, 2022. The DRUM team submitted 465 V&V reports to LM for the period ending October 31, 2021. This deliverable was submitted three weeks ahead of schedule.
- Submitting monthly the contract deliverable — “Report monthly to communicate active, settled, and potential future litigation related to DOE, potential liabilities for DOE, and other uranium mining related lawsuits that may directly or indirectly affect or change LM’s programs related to uranium mines and mills.”
- Sending proposal letters to three tribal communities (the Pueblo of Zia, the Pueblo of Zuni, and the Hualapai Tribe) seeking approval and assistance to inventory and sample DRUM mines on their lands as soon as practical in calendar year 2022 or 2023.
- Finalizing all V&V reports for the 2021 field season on March 30, 2022 (507 total).
- Participating in Colorado’s Hard Rock Advisory council and providing the council members with an update on the DRUM program’s progress in Colorado, including inventory, safeguarding plans, and progress on and administration of the DRUM program’s cooperative agreement with the Colorado Division of Reclamation, Mining, and Safety.
- Completing requests for DRUM file geodatabases and DBF files for hazards associated with risk roll-up reports, including the reports for the Placerville District, the Spring Creek Mesa Locality, the West Calamity Mesa Locality, the Flat Top Mesa Locality, the Tenderfoot Mesa Locality, the Rim Rock Blues Locality, the Starlight Group Locality, the Wedding Bell Locality, and the Bachelor Draw Locality.
- Hosting two of the quarterly meetings of the Abandoned Uranium Mines Working Group. More than 50 participants from across the government received feedback on the Navajo Nation Resources and Development Committee work session, updates on coordination activities with the NPS Abandoned Mineral Lands program for inventorying NPS mines, a presentation on applied high-pressure slurry ablation technology for recovery of uranium and vanadium from mining waste rock, and updates on inventorying and safeguarding programs.
- Presenting on aerial gamma radiation surveys of DRUM mines in Wyoming for the International Atomic Energy Agency during the week of May 16-20, 2022. The Wyoming sites were surveyed in 2021, and analysis of the results was completed this calendar year.
- Assessing two DRUM mines on the Spokane Indian Reservation. The LM project manager informally discussed findings with the Spokane Tribe of Indians counterpart and delivered information requested during a May tribal consultation between the Spokane Tribe of Indians and LM concerning DRUM database information, records, references, and maps.
- Mobilizing field teams to Montana for V&V work at the final four mines from BLM’s 2021 request to expedite DRUM fieldwork in the Pryor Mountains. The expedited DRUM fieldwork will help facilitate a BLM recreation trail project.
- Hosting a reporter from the KZMU-FM radio station to observe inventory and sampling activities at a nearby mine in Moab, Utah. LM’s DRUM project manager and a Public Affairs representative were present to help facilitate inquiries.

- BLM Montana/Dakotas released a video associated with DRUM V&V work that occurred in early June. The video describes the DRUM program and highlights its partnerships ([BLM Montana-Dakotas 2022](#)).

During the 2020 and 2021 fieldwork seasons, V&V activities focused in areas with a high density of mines. Likewise, in 2022, the DRUM program is focused on completing Campaign 1 V&V work in mining districts in Colorado, Utah, and South Dakota, where the highest remaining concentrations of DRUM mines are located.

Also, in 2022, LM initiated discussions with multiple EPA regional offices and tribal agencies regarding Campaign 2 V&V activities on tribal land. The specific V&V methodologies of the campaign are in the development and consultation stage with tribal abandoned mine lands (AML) programs and EPA. The DRUM program, with funding from CERCLA, previously identified 191 mines on Navajo Nation lands and removed them from the list of mines at which V&V activities are planned. Most DRUM mines identified for V&V work in Campaign 2 (205) are on Navajo Nation lands. V&V fieldwork on mines in the Northern AUM region — specifically in the Cove, Round Rock, and Tolikan (Sweetwater) Chapters of the Navajo Nation — will begin in October 2022. LM is scheduled to complete V&V fieldwork at the three mines on Pueblo of Laguna land in August 2022.

During this performance period, multiple meetings have occurred between LM and the Navajo Nation working group. The purpose of the meetings was to (1) evaluate the DRUM V&V work processes and (2) develop the Navajo Nation V&V Work Plan and Field Operation Plans. Activities included presentations of individual sections of the V&V Work Plan, a presentation of the North Central AUM Field Operations Plan, and the preparation of maps derived from Navajo Nation shared data. In May 2022, LM hosted a V&V field demonstration for the Navajo Nation working group at the Moqui Jug mine (LM ID 2621). During the same field trip, NAMLRD hosted a tour of three DRUM mines and three CERCLA mines on Navajo Nation land. LM has received written concurrence from the Navajo Nation on conducting V&V work at 205 mines on Navajo Nation land.

LM previously completed partnerships and interagency agreements with BLM, USFS, and NPS but updated them to support continued program collaboration and better facilitate mutual safeguarding objectives. This allows for DRUM-related expenditures by those agencies.

LM and partner agencies are prioritizing safeguarding physical hazards, primarily mine entries, identified by the DRUM program. LM teams with partner agencies, state and tribal AML programs, and Bat Conservation International (BCI), a nonprofit, to safeguard DRUM mines. LM provides funding to allow partners to complete these safeguarding projects and provides project management oversight to ensure safeguarding is fiscally efficient, preserve project timelines, and effectively prevent public access to hazardous features, while preserving wildlife habitat within mine features. LM completed five projects in Utah, four in Colorado, and one in New Mexico using this model.

DRUM Return on Investment

The Report to Congress identified 4,225 potential mines on federal, state, and tribal land and private property. Of these, the report estimated that 2,500 mines were on public land. Although all the potential liabilities related to these mines are not explicitly spelled out, the Report to Congress

estimated that 80% of these mines would require safeguarding (referred to as “reclamation” in the report) and 20% would require environmental remediation work. Safeguarding involves mitigating mining-related physical hazards, generally by constructing barriers to human access at entries to underground mines. Reclamation is the process of restoring essential geomorphic functions at previously mined locations. This process may include recontouring waste rock piles and other mining-related disturbances to minimize erosion potential and blend the mine site with the adjacent undisturbed landscape. Remediation of abandoned uranium mines typically involves isolating contaminants or pollutants from the surrounding environment, generally by consolidating waste materials and performing environmental restoration work.

The Report to Congress estimated that mines that exhibit threats to human safety would require an average of three safeguards each at an estimated cost of \$18,000 per constructed safeguard, or an average unit cost of \$54,000 per affected mine. The Report to Congress estimated that the mines that require remediation under the CERCLA to alleviate environmental concerns may require an average unit cost of \$1,300,000 per mine. LM calculated the estimated cost to remediate mines using data from Table 4 of the Defense-Related Uranium Mines Cost and Feasibility Topic Report (DOE 2014a). LM multiplied the maximum remediation cost for each mine size category by the percentage of mines in that size category to derive the estimated cost per mine of \$1,300,000 (rounded).

Applying the unit cost estimate from the Report to Congress for safeguarding a physical hazard to the estimated total number of DRUM mines on public land suggested a total safeguarding cost of \$108,000,000. Applying the unit cost estimate from the Report to Congress for remediation work to the total estimated number of DRUM mines on public land suggested a possible remediation cost of \$650,000,000. Implementation of DRUM Campaign 1 (V&V work at mines on public land) and the screening of these mines for potential risks to human health and safety allowed the program to substantially reduce these potential cost estimates.

The DRUM program reduces potential costs and liabilities in two ways: (1) removing duplicate mining records from the DRUM program database, thereby decreasing the estimated total number of existing mines and (2) applying risk-screening results to refine the estimated amount of physical and environmental risks based on observed conditions at the mines. To date, LM removed 1,140 duplicate records from the database, clarifying the actual number of existing mines, eliminating potential risk associated with the mines removed from the database, and decreasing the overall estimated potential risks.

Following reconciliation, the number of mines in the DRUM program database at the end of the reporting period shows that 1,980 mines are on public land (Campaign 1). This number will fluctuate until the public land campaign is completed. Analysis of site risk-screening evaluations completed to date shows that approximately 64% of mines will require safeguarding for physical hazards compared to the 80% estimated in the Report to Congress. The Report to Congress estimated that an average of three safeguards per mine would be required at mines where hazardous entries were identified. DRUM program field inventory information appears to generally validate this assumption. These updated estimates result in a safeguarding cost reduction of approximately \$39,582,000 (Table 1).

DRUM fieldwork completed to date suggests that approximately 10% of the mines could require further analysis via the CERCLA process. When implemented, the appropriate land management agencies will handle the CERCLA process. This is a smaller population of mines than the 20% estimated in the Report to Congress. This trend, if it continues, will reduce the resulting

potential remediation scope from about 500 mines (the Report to Congress estimate) to about 198 mines, representing a reduction in potential cost of approximately \$392,600,000 (Table 1). The total projected program expenditure of \$29,000,000 (an average of \$5,800,000 per year for 5 years) has the potential to reduce cost projections by an estimated \$319,500,000, a return on investment of roughly 11:1.

Table 1. Estimated Versus Projected DRUM Actions and Expenditures at Mines on Public Land

| | Report to Congress Estimates | Program Estimates as of June 30, 2021 | Difference |
|--|------------------------------|---------------------------------------|---------------|
| Number of mines | 2,500 | 1,980 | 520 |
| Estimated number of mines to safeguard | 2,000 ^a | 1,267 ^b | 733 |
| Estimated cost to complete safeguards ^c | \$108,000,000 ^a | \$68,418,000 ^b | \$39,582,000 |
| Estimated number CERCLA-eligible mines | 500 ^a | 198 ^b | 302 |
| Estimated cost to complete CERCLA remediation ^d | \$650,000,000 ^a | \$257,400,000 ^b | \$392,600,000 |

Notes:

^a Estimates based on Report to Congress population of 2,500 mines.

^b Estimates based on population of 1,980 mines.

^c Safeguard construction estimated at \$54,000 per mine.

^d CERCLA remediation costs estimated at \$1,300,000 per mine.

V&V Progress

The DRUM program will complete most V&V fieldwork at mines on public land by the close of FY 2022 (September 30, 2022). V&V activities consist of: (1) a reconciliation step completed in the office to confirm land status, location, and ore-purchase data for each mine and to remove duplicate purchase records from the DRUM program database; (2) an inventory step to confirm the mine location in the field and to gather information regarding mine features and their potential hazards; (3) an environmental sampling step to collect chemical, radiological, and ecological data; and (4) a report-preparation step. Field V&V work is completed after inventory and environmental sampling are complete or after inventory is complete for mines that do not require sampling. The DRUM team prepares draft and final reports for each mine following completion of V&V activities. The DRUM team generally submits draft reports 120 days after V&V work is completed with final reports being prepared once LM reviews and accepts the draft reports. The DRUM team documents merged duplicates on a certificate, and V&V activity is considered completed for duplicate mines once the merge certificate is produced.

During this reporting period, the DRUM team completed 116 V&V field visits on public land and prepared 108 final reports (Table 2). Cumulatively, the DRUM team completed V&V work at 1,613 mines on public land and removed 1,140 duplicate records. Cumulatively, the DRUM team completed 1,533 final reports for mines on public land (Table 3). The DRUM team completed final reports for the mines at which V&V work was completed last field season; draft reports representing 2022 field visits are currently in production.

Table 2. V&V Progress on Public Land for the Period Jan. 1-June 30, 2022^a

| Land Management Agency | Reconciliation Completed | Inventory Completed | Environmental Sampling Completed | Total V&V Complete | Number Final Reports |
|--------------------------------|--------------------------|---------------------|----------------------------------|--------------------|----------------------|
| BLM | 0 | 99 | 99 | 99 | 108 |
| USFS | 0 | 10 | 10 | 10 | 0 |
| NPS | 0 | 7 | 7 | 7 | 0 |
| U.S. Bureau of Reclamation | 0 | 0 | 0 | 0 | 0 |
| U.S. Fish and Wildlife Service | 0 | 0 | 0 | 0 | 0 |
| U.S. Department of Defense | 0 | 0 | 0 | 0 | 0 |
| Duplicates | 0 | | | | |
| | 0 | 116 | 116 | 116 | 108 |

^a The data presented in this table are for mines managed by only one federal agency. There are also mixed-ownership mines that are managed or owned by more than one organization or individual (private property). For this reporting period, the DRUM team completed V&V work on the public land portions of 32 mixed-ownership mines and completed 44 final reports on the public land portions of mixed-ownership mines.

Table 3. Cumulative V&V Progress on Public Land Through June 30, 2022^a

| Land Management Agency | Reconciliation Completed | Inventory Completed | Environmental Sampling Completed | Total V&V Visits Completed ^b | % V&V Visits Completed ^c | Mines Remaining for V&V Work ^d | Final Reports Completed | % Final Reports Completed ^e |
|--------------------------------|--------------------------|---------------------|----------------------------------|---|-------------------------------------|---|-------------------------|--|
| BLM | 1,602 | 1,424 | 1,420 | 1,423 | 89% | 180 | 1,359 | 96% |
| USFS | 327 | 184 | 173 | 180 | 55% | 147 | 171 | 95% |
| NPS | 44 | 7 | 7 | 7 | 16% | 37 | 0 | NA |
| U.S. Bureau of Reclamation | 3 | 0 | 0 | 0 | 0% | 3 | 0 | NA |
| U.S. Fish and Wildlife Service | 2 | 2 | 2 | 2 | 100% | 0 | 2 | 100% |
| U.S. Department of Defense | 1 | 1 | 1 | 1 | 100% | 0 | 1 | 100% |
| Duplicates | 1,140 | | | | | | | |
| | 3,119 | 1,618 | 1,603 | 1,613 | | 367 | 1,533 | |

Notes:

^a The data presented in this table are for mines managed by only one federal agency. There are also mixed-ownership mines that are managed or owned by more than one organization or individual (private property). To date, the DRUM team performed V&V work on the public land portions of 275 mixed-ownership mines and completed 243 final reports on the public land portions of mixed-ownership mines.

^b The total number of mines at which V&V work has been completed includes both the mines visited where environmental sampling was completed and mines field visited where no environmental sampling was required (e.g., previously remediated mines or mines with accessibility issues).

^c The percentage of mines where V&V work has been completed is based on number of mines out of those that have been reconciled where all V&V work is complete.

^d The number of mines remaining for V&V work is the total number of reconciled and unreconciled mines that have not been field verified or removed as duplicates from the DRUM program database.

^e The percentage of final reports completed is based on the number of mines out of those where all V&V work is complete for which final V&V reports have been produced.

Abbreviation:

NA = not applicable

Accounting for the Total Number of DRUM Program Mines

The primary sources for estimating the potential number of mines in the DRUM program are U.S. Atomic Energy Commission ore-purchase records. The Report to Congress identified 4,225 mines from these records, counting each purchase record as an individual mine. The estimated total number of mines changes as more information is obtained. The DRUM program confirmed that duplicate (two or more) purchase records exist for many mines, resulting in an overestimation of the total number of mines. Aside from merging duplicate records, the DRUM team occasionally discovers additional previously unreported purchase records that are added to the total number of mines.

The current accounting of mines in the DRUM program database for all types of land ownership is:

$$\begin{aligned} &4,225 \text{ (Report to Congress)} - 1,140 \text{ (duplicates)} - 7 \text{ (deleted records)} + 380 \text{ (added records)} \\ &= 3,458 \text{ mines currently in the database} \end{aligned}$$

Additional V&V Progress – The Bigger Picture

The DRUM team conducted the reconciliation process geographically, based on mining district or land management agency boundaries, and reconciled all mines in a geographic area regardless of land ownership, leading to overall program efficiency as Campaign 2 (DRUM mines on tribal land) and Campaign 3 (DRUM mines on private property) are initiated. Table 4 and Table 5 present the V&V progress made so far for mines in each land ownership category. Including all mines regardless of ownership not only improves the efficiency of the reconciliation effort but also ensures that all the mines are properly identified and that land ownership is confirmed.

As part of the public land campaign, LM developed relationships and cooperative agreements with state AML programs in Colorado and Utah and with BLM in New Mexico to assist in performing the inventory task of V&V work. LM leveraged the state agencies' authority to inventory mines on state and private property because some mixed-ownership mines are on both federal land and private property or state land.

By using this cooperative approach to gain additional inventory information during the public land campaign, LM efficiently improves the completeness of the DRUM location data and is better positioned to develop and implement work at mixed-ownership mines in Campaigns 2 and 3.

Table 4. Bigger Picture V&V Progress for the Period Jan. 1-June 30, 2022

| Land Management Agency | Reconciliation Completed | Inventory Completed | Environmental Sampling Completed | Total V&V ^a Completed |
|----------------------------------|--------------------------|---------------------|----------------------------------|----------------------------------|
| Federal land management agencies | 0 | 116 | 116 | 116 |
| Private | 0 | 0 | 0 | 0 |
| Mixed | 0 | 32 | 32 | 32 |
| State | 0 | 3 | 3 | 3 |
| U.S. Bureau of Indian Affairs | 2 | 0 | 0 | 0 |
| Unknown | 0 | 0 | 0 | 0 |
| Merged duplicates | 0 | | | |
| Total | 2 | 151 | 151 | 151 |

Notes:

^a The total number of mines at which V&V work has been completed includes both mines visited where environmental sampling was completed and mines field visited where no environmental sampling was required (e.g., previously remediated mines or mines with accessibility issues).

Table 5. Bigger Picture Cumulative V&V Progress Through June 30, 2022

| Land Management Agency | Reconciliation Completed | Inventory Completed | Environmental Sampling Completed | Total V&V Completed ^a | Mines Remaining to V&V ^b | Mines with Completed V&V Work ^c |
|----------------------------------|--------------------------|---------------------|----------------------------------|----------------------------------|-------------------------------------|--|
| Federal land management agencies | 1,979 | 1,618 | 1,603 | 1,613 | 367 | 81% |
| Private | 550 | 175 | 3 | 4 | 546 | 1% |
| Mixed | 333 | 278 | 273 | 275 | 58 | 83% |
| State | 93 | 55 | 50 | 50 | 43 | 54% |
| U.S. Bureau of Indian Affairs | 394 | 0 | 0 | 0 | 395 | 0% |
| Unknown | 1 | 0 | 0 | 0 | 105 | 0% |
| Merged duplicates | 1,140 | | | | | |
| Total | 4,490 | 2,126 | 1,929 | 1942 ^d | 1,514 | 56% |

Notes:

^a The total number of mines at which V&V work has been completed includes both mines visited where environmental sampling was completed and mines field visited where no environmental sampling was required (e.g., previously remediated mines or mines with accessibility issues).

^b The number of mines remaining for V&V work is the total number of reconciled and unreconciled mines that have not been field verified or removed as duplicates from the DRUM program database.

^c The percentage was calculated by comparing the number of mines where V&V work is completed to the total estimated number of mines (those where V&V work has been completed plus those remaining for V&V work).

^d The total number of mines where V&V work has been completed includes four Campaign 3 mines. The land where these mines are was slated to be donated to USFS; however, the land transaction was canceled, and these mines remain on private property.

Physical Hazard

Physical hazards are mining-related features that pose potential harm to human health or safety and are recognized as the primary risk at DRUM mines. Physical mining-related features that pose threats to human safety include open vertical mine entries (shafts, some vents, and subsidence features) as well as horizontal mine entries (adits and declines). In some instances, a remnant topographic surface feature, such as a hazardous highwall, may pose a threat to human health. To protect the well-being of members of the public who visit DRUM mines, LM partners with land management and state AML agencies to construct safeguards at hazardous mine features. These safeguards will prevent human ingress to abandoned mines, while honoring the cultural and ecological value of the mines and their environments.

As the DRUM program evolves, it has become apparent that partner land management agencies prefer to safeguard most open mine entries rather than only high-hazard mine entries. Safeguarding most open mine entries in a specific area during a single mobilization is the most cost-effective and time-efficient means of completing this work.

Cumulatively, the DRUM program has identified approximately 4,530 hazardous mine features at 1,184 mines that may require safeguarding. Table 6 shows the number of mines with physical hazards by state and the estimated total cost of safeguarding. The estimated cost of constructing mine safeguards may be reevaluated following completion of additional mine safeguard projects.

Table 6. Mines with Potential for Safeguarding, Cumulative Through June 30, 2022^a

| State | Mines Risk Screened ^a | Mines with Physical Hazards | Potential Features for Safeguarding | Total Costs for Safeguarding (\$ millions) ^b |
|--------------|----------------------------------|-----------------------------|-------------------------------------|---|
| Colorado | 876 | 542 | 1,777 | \$31.99 |
| Montana | 7 | 6 | 45 | \$0.81 |
| New Mexico | 60 | 29 | 49 | \$0.88 |
| South Dakota | 26 | 17 | 87 | \$1.57 |
| Utah | 835 | 574 | 2,548 | \$45.86 |
| Wyoming | 38 | 16 | 24 | \$0.43 |
| Total | 1,842 | 1,184 | 4,530 | \$81.54 |

Notes:

^a This includes all mines at which V&V work has been completed, regardless of land management or ownership status.

^b Total costs were calculated using the figure of \$18,000 multiplied by the number of potential features to be safeguarded.

LM expanded its safeguarding assistance of partner agencies through existing agreements to promote collaboration on the safeguarding of physical hazards identified by the DRUM program. In addition to using the agreements with land management agencies and state AML programs, LM is using a financial agreement with BCI to bolster the program's overall safeguarding capacity. In 2021, LM completed seven safeguarding projects on BLM-managed land in Utah, Colorado, and New Mexico. In addition, LM anticipates that it will increase the number of safeguarding projects

with partner agencies in future years. LM anticipates that the funding and scope of existing cooperative agreements will be maintained to provide for future safeguarding work. Lessons learned from these experiences helped formulate the *Defense-Related Uranium Mines (DRUM) Safeguarding Program Management Plan* (LMS/DRM/S33217), which was completed in March 2021. Most importantly, there are six more safeguarding projects planned for 2022 in Colorado and Utah. These projects will safeguard over 200 hazardous mining-related features at DRUM mines on BLM- and USFS-managed land.

Human Health Risk and CERCLA Potential

The number of mines that could potentially move from the DRUM program screening process to a CERCLA process is much lower than the number of mines that will require safeguarding of physical hazards. Land management agencies utilize their authority under CERCLA to address releases, or potential releases, of hazardous substances. Mines with a “high” or “medium” score for chemical or radiological risks could be further investigated by the land management agencies, potentially leading to CERCLA response actions. Of the 1,842 mines that have been risk screened to date, approximately 190 mines (10%) could require further analysis via the CERCLA process.

However, the DRUM program can further refine this assessment with the application of modifying factors. Incorporating the risk-modifying factors into the screening process — so only mines that rank “high” for suitability for camping and “high” or “medium” for ease of access are considered for CERCLA response actions — would potentially enhance the CERCLA evaluation and reduce the population of mines requiring future remediation; if the suitability- and access-modifying factors are applied, it reduces the number of mines that could require further analysis via the CERCLA process to 2%. LM will collaborate with the land management agencies for concurrence on safeguarding priorities and planning, but CERCLA determinations are completely at the discretion of the land management agencies. Table 7 shows the mines with “high” or “medium” risk rankings for chemical or radiological hazards (without applying the above-mentioned modifying factors) and the potential costs.

*Table 7. Mines That Are Potential Candidates for Remediation (CERCLA)
Actions Cumulative, Through June 30, 2022*

| State | Mines Risk Screened | “High” Chemical Risk Rank | “Medium” Chemical Risk Rank | “High” Radiological Risk Rank | “Medium” Radiological Risk Rank | Potential CERCLA Mines (Remediation Process) ^a | Potential CERCLA (Remediation) Costs (\$ million) ^{b, c} |
|--------------|---------------------|---------------------------|-----------------------------|-------------------------------|---------------------------------|---|---|
| Colorado | 876 | 18 | 29 | 0 | 12 | 56 | \$73 |
| Montana | 7 | 2 | 1 | 0 | 0 | 3 | \$4 |
| New Mexico | 60 | 0 | 3 | 0 | 0 | 3 | \$4 |
| South Dakota | 26 | 0 | 0 | 0 | 0 | 0 | \$0 |
| Utah | 835 | 10 | 98 | 0 | 21 | 124 | \$161 |
| Wyoming | 38 | 0 | 3 | 0 | 1 | 4 | \$5 |
| Total | 1,842 | 30 | 134 | 0 | 34 | 190 | \$247 |

Notes:

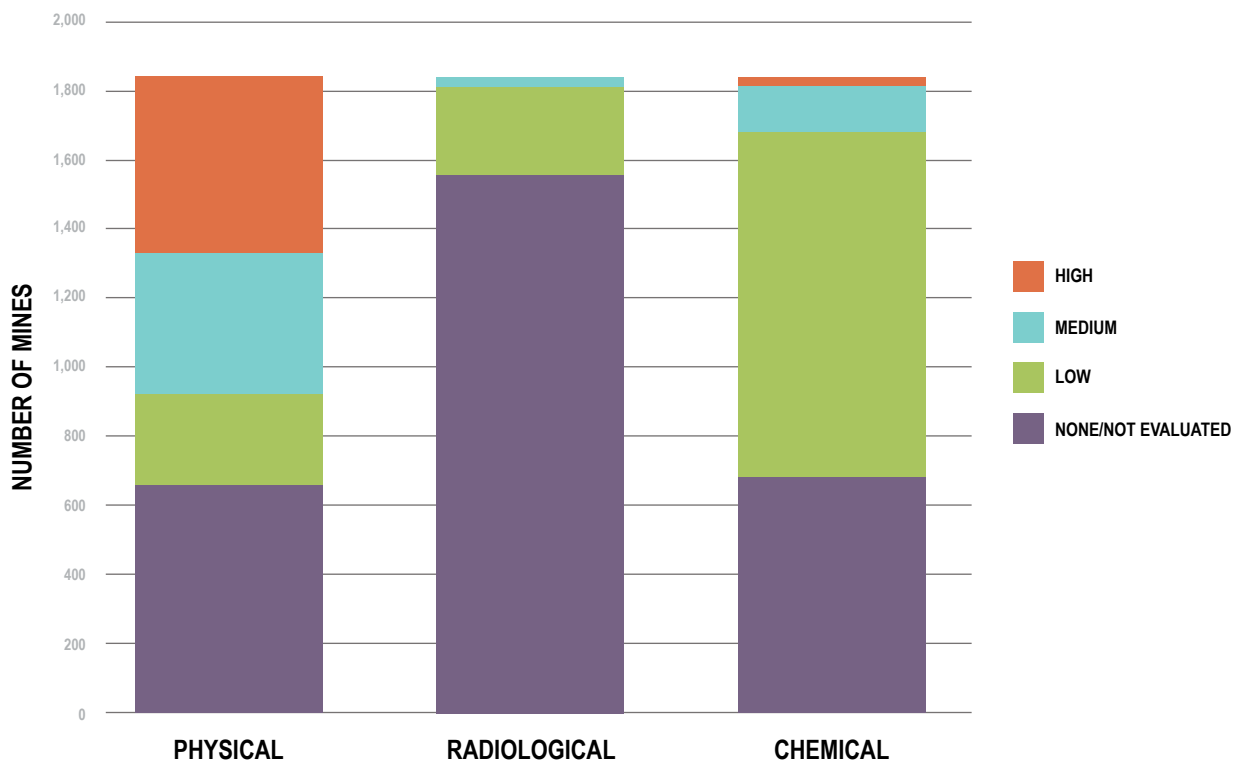
^a Seven mines had more than one elevated risk ranking (e.g., both a “medium” chemical risk ranking and a “medium” radiological risk ranking). Since one CERCLA action would address any elevated risk rankings at the same mine, these were subtracted from this column to avoid double counting.

^b The potential CERCLA cost of \$1.3 million per remediated mine was calculated using data from Table 4 in the Defense-Related Uranium Mines Cost and Feasibility Topic Report.

^c Starting in March 2020, LM began evaluating radium-226 concentration on a separate risk track. As of June 30, 2021, LM completed this evaluation for 203 mines in Colorado and 280 mines in Utah; LM has not performed this evaluation for mines in any other state. If the elevated risk rankings for radium-226 could result in a potential CERCLA action, this could result in the addition of 22 mines in Colorado and 12 mines in Utah to the list of potential candidates for CERCLA actions (mines that already had elevated rankings for chemical or radiological risks were not included in these estimates). If these were to be added, the potential number of CERCLA mines would be 204 (15%), with a potential cost of approximately \$265 million.

Figure 1 below shows the rankings of mines for physical, radiological, and chemical risks. While “high,” “medium,” and “low” physical hazards could be considered for safeguarding activities (“low” hazards [e.g., prospects] are not always addressed, but they are often safeguarded when equipment is on-site for other high-priority mine features), only mines with “high” or “medium” radiological and chemical risks may be considered for estimating the costs of future remedial (CERCLA) work. LM observed that seven mines exhibited a “high” or “medium” chemical risk and a “medium” radiological risk. For mines that exhibit both elevated chemical and radiological risks, LM would concurrently address both risks during a single remediation construction event. To avoid overestimating the potential number remediations that may be considered, LM considered potential CERCLA actions at the seven mines exhibiting dual risk factors as single remediation events. As a result, LM may consider 190 mines for future remedial (CERCLA) work.

Figure 1. Mine Physical, Radiological, and Chemical Risk Rankings



Agency Concurrence

The DRUM program continues to work collaboratively with partner agencies for the successful implementation of the program and the identification of physical hazards. Concurrence on those features that need to be safeguarded allows LM and partner agencies to initiate hazardous mine-feature-safeguarding projects. Therefore, concurrence is an important tool in safeguarding the public and wildlife from the inherent physical hazards posed by open mine features.

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