



Ore bin at Ura Mine. ID 89, Bull Canyon Field Operations Plant

DEFENSE-RELATED URANIUM MINES ANNUAL REPORT

January 1–December 31

2021

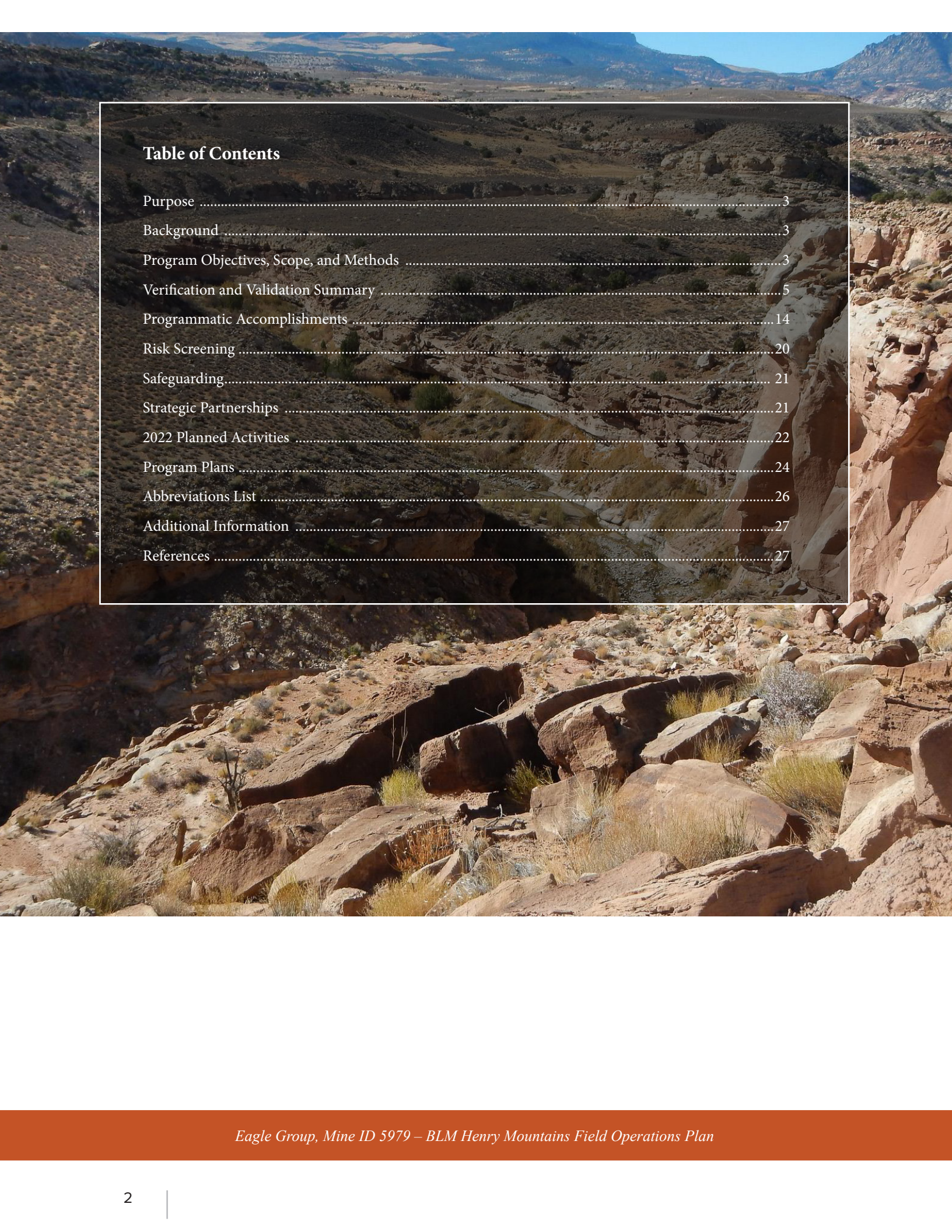


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Purpose

The purpose of this document is to present the 2021 annual report for the U.S. Department of Energy (DOE) Office of Legacy Management (LM) Defense-Related Uranium Mines (DRUM) Program. It provides details on 2021 program activities and accomplishments and project plans for 2022. Additional information on the program is presented in other documents available through the contact information provided at the end of this report.

I Background

The 2014 *Defense-Related Uranium Mines Report to Congress* (DOE 2014) (Report to Congress) identified 4,225 purchase records in 19 states, revealing an unknown degree of liability from a unique set of abandoned uranium mines in the United States. These mines provided uranium ore to the U.S. Atomic Energy Commission (AEC) for defense-related activities between the years 1947 and 1970. In response to this Report to Congress, LM recognized this legacy as falling within their primary strategic goal and initiated DRUM Campaign 1 in 2017 to conduct verification and validation (V&V) activities of existing mine information and collect screening level site-specific data at approximately 2,500 legacy mines on public land administered by federal and state agencies. Campaign 2 is scheduled to commence field V&V work in fiscal year (FY) 2022 and will assess DRUM sites on tribal land. Campaign 3, which will address DRUM sites on private property, is scheduled to begin field V&V work in FY 2024.

II Program Mission, Objectives, Scope, and Methods

The overall DRUM Program mission is to identify DRUM sites that pose potentially unacceptable risks to human health and the environment and improve strategies for allocation of government resources to address these risks. More specifically, the DRUM Program mission is to: (1) correlate individual mines with ore production and location information, (2) inventory mine features and complete screening-level sampling of mine sites, (3) provide risk screening information to help prioritize any potential future actions, and (4) identify potential environmental concerns.

The DRUM Program supports LM's strategic goal of "protecting 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).

In support of its mission and goals, the objectives of the DRUM Program are to:

1. Share existing information and collect site-specific data at each mine to identify physical safety hazards or human health and environmental risks.
2. Perform program-specific risk scoring and ranking of these mine hazards.
3. Improve the data quality and content of the DRUM Program database and partner agency databases.
4. Exchange program results and information with federal, tribal, and state governments.

5. Quantify the resources necessary to mitigate physical hazards posed by these sites and work with partner agencies to leverage resources to address mines with priority physical safety hazards.

The V&V process has three sequential steps: (1) reconciliation, (2) field inventory and environmental sampling, and (3) technical report preparation. These comprise the scope and methods utilized for the V&V process to achieve program objectives.

In the reconciliation step, available data are reviewed to assess the location, ownership, and land management status of the mine. This includes reviewing AEC ore purchase records, company records, available mine maps, and federal and private libraries and collections. Typical challenges encountered during reconciliation include inaccurate location information, duplicate records, multiple mines listed under one record, and missing records. In some cases, mine locations remain in an unknown status until additional data are found. The reconciliation process ensures the most accurate location data are available to field teams before they conduct field validation activities. As mines in designated geographic areas are reconciled, they are compiled into project areas used by land management agencies and field teams to coordinate field activities.

In the field inventory and environmental sampling step, field teams are deployed to locate the mine site and map the existing features (e.g., adits, shafts, structures, waste rock piles). These activities include describing physical mine conditions, identifying mining-related features, assessing the physical hazards posed by each feature, evaluating ecological and environmental hazards, and assessing the ease of public access to the mine and signs of recent recreational use. Environmental samples are collected to determine the presence of selected radionuclides and chemicals in waste rock, soil, sediment shed areas, and surface water (when present). In addition, environmental sampling includes performing a gamma radiation survey of the mechanically disturbed area of the mine. Field data and observations are used to perform risk rankings for each mine. Data are electronically collected and recorded and undergo a rigorous quality assurance/quality control process before being uploaded into the DRUM Program database.

In the report preparation step, V&V reports are developed for each mine. Each report summarizes the V&V efforts that: (1) confirmed the current conditions and location of the mine; (2) recorded information associated with mine features, such as adits, shafts, and waste rock piles; and (3) provided the primary hazard rankings for physical hazards and potential risks to human health and the environment. Additional factors that influence risk rankings, such as current ecology and ease of public access, are also included in each V&V report. Risk screening is a systematic approach to evaluating risks associated with the mines. Risk screening information is conveyed to partner agencies via risk roll-up reports. An outgrowth of these activities is safeguarding physical mine hazards identified during V&V operations and subsequently evaluated and documented during risk roll-up reporting.

Subsequent to completing the V&V steps, LM and its partner agencies collaborate as a cohesive team to safeguard physical hazards posed by remnant mining-related features at DRUM sites. Safeguarding involves construction of barricades designed

to prohibit public access to hazardous adits, shafts, subsidences, hazardous highwalls, and other excavated mine features. It may also remove or secure dilapidated structures. The scope and relative degree of hazard presented by each feature are documented in risk roll-up reports prepared by the DRUM Program for use by land management agencies.

III Verification and Validation Summary

This section presents a summary of 2021 program V&V activities and accomplishments. DRUM teams completed field visits at 507 mine locations in 2021. In addition, 143 records were removed from the DRUM Program database during the reconciliation process since they were redundant records of the same mine (i.e., duplicate records). A summary of mine reconciliation and field V&V activities is presented in Table 1.

Table 1. Summary of Verification and Validation Activities

State	Duplicates Removed ^a		Field V&V Complete ^b		Total V&V Complete ^c	
	2021	Project to Date	2021	Project to Date	2021	Project to Date
Colorado	22	434	377	870	399	1,304
Utah	99	448	123	791	222	1,239
Arizona	15	83	-	-	15	83
Wyoming	1	78	-	38	1	116
New Mexico	4	47	-	59	4	106
South Dakota	-	26	-	26	-	52
Texas	-	7	-	-	-	7
California	1	5	-	-	1	5
Nevada	-	2	-	-	-	2
Montana	-	4	7	7	7	11
Other States ^d	1	8	-	-	1	8
Total	143	1,142	507	1,791	650	2,933

Notes:

^a Duplicates Removed is the process of eliminating redundant (duplicate) records from the DRUM database, when more than one record references the same mine. In addition, non-DRUM sites, when removed from the database, are included in the count of duplicate records. In 2021, 456 mine records were reviewed; 143 of these (31%) were duplicate records. Since program inception, 4,615 mine records have been reviewed; 1,142 of these (25%) were duplicate records.

^b Field V&V Complete is the number of mine site visits accomplished.

^c Total V&V Complete is the number of field V&V visits completed added to the number of duplicate mines eliminated from the database.

^d Other states include North Dakota, Idaho, Oregon, Oklahoma, Alaska, Florida, New Jersey, and Pennsylvania.

Lessons learned from the 2020 field season led to improvements in 2021 field inventory methodology and refinements to mine V&V protocols to ensure consistency in application of program data collection standards. The *Defense-Related Uranium Mines Verification and Validation Work Plan* (April 2021) (V&V Work Plan) was updated to incorporate these changes. As described above, all this information is captured in individual mine reports. In 2021, 535 V&V reports were completed, and 1,669 V&V reports have been completed since the program's inception. Please note that additional analysis on the project status and progress was presented in the *DRUM Program Midyear Progress Report (DOE2021e)*.

Field V&V operations are organized into logical project areas. The project areas are termed Field Operations Plans (FOPs) for ease of reference. The following is a summary of the field activities within each FOP conducted in 2021, organized by state.

Colorado

Bull Canyon – Tres Rios FOP: This project area covers Montrose and San Miguel Counties in southwestern Colorado. The 124 mines in this FOP are on U.S. Bureau of Land Management (BLM)-administered land and mixed-ownership (private and BLM-administered) land. V&V activities were conducted at 123 mines in 2021.

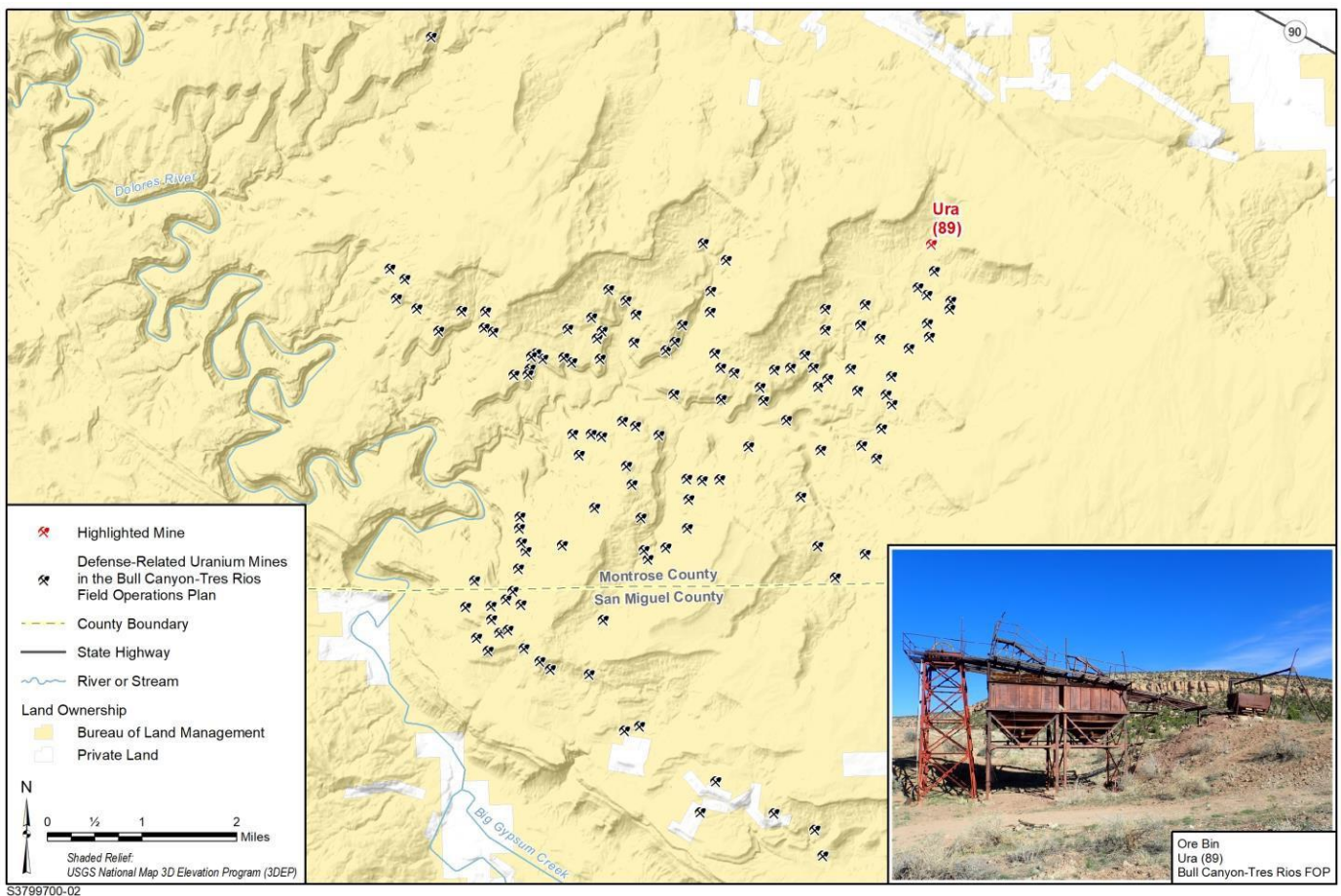
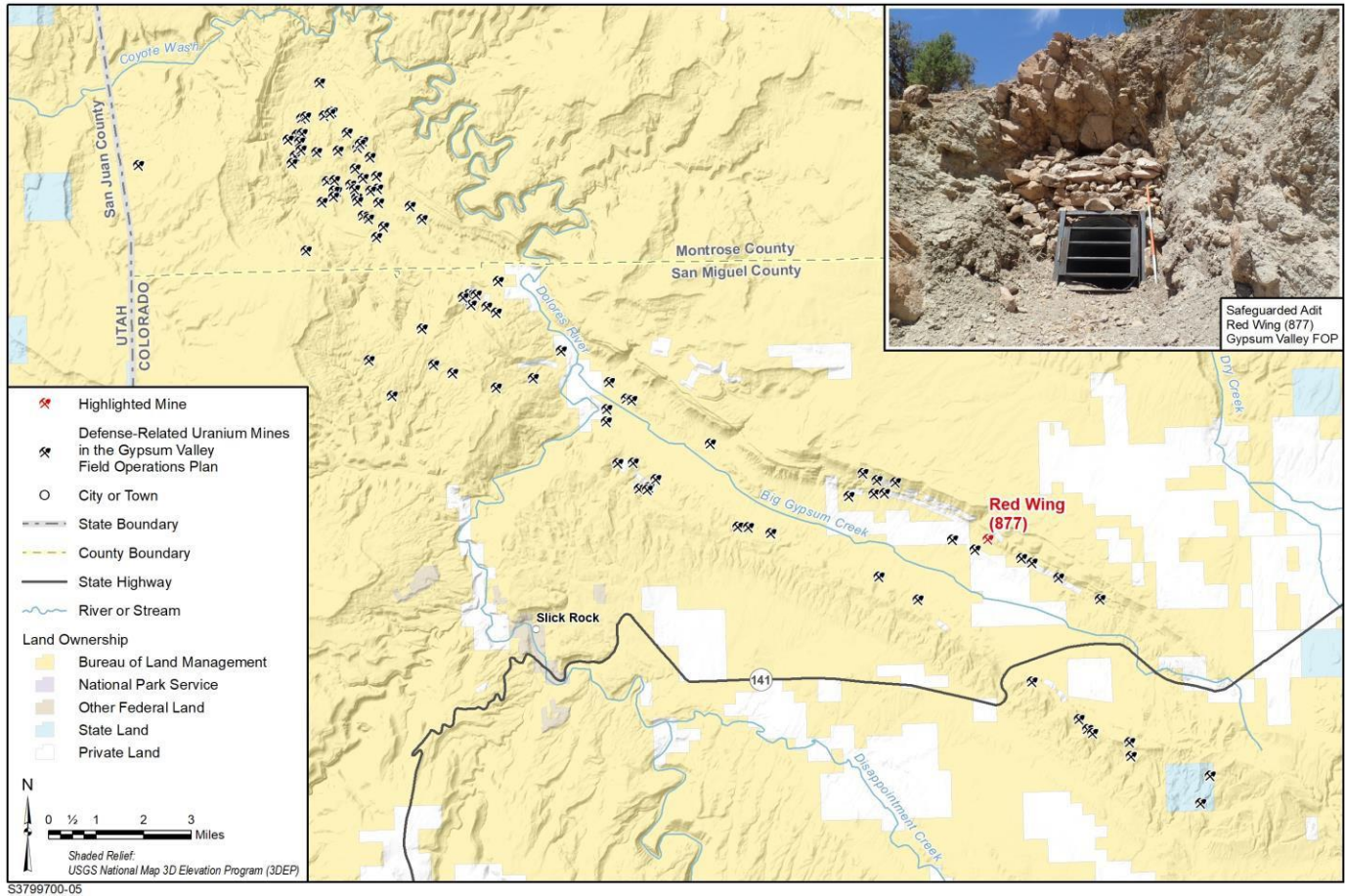


Figure 1. Map and Photo, Ura Mine, Mine ID 89, Bull Canyon – Tres Rios FOP

Bull Canyon – Uncompahgre Field Office (UFO) FOP: This project area is primarily in Montrose County in southwestern Colorado. It includes mines on BLM-administered land and on mixed-ownership (private and BLM-administered) land, some of which are partially on the LM Uranium Leasing Program (ULP) lease tracts. V&V activities were conducted at one mine in 2021 on public land in this FOP. The remaining eight mines on public land will be visited in the future, which will complete work in this FOP.

Gypsum Valley FOP: This project area covers San Miguel and Montrose Counties in southwestern Colorado. The 97 mines in this FOP are mostly on BLM- administered land, with a couple on public lands managed by the State of Colorado and nine on mixed-ownership land. V&V activities were conducted at 88 mines in 2021, and the remaining nine mines will be visited in 2022.

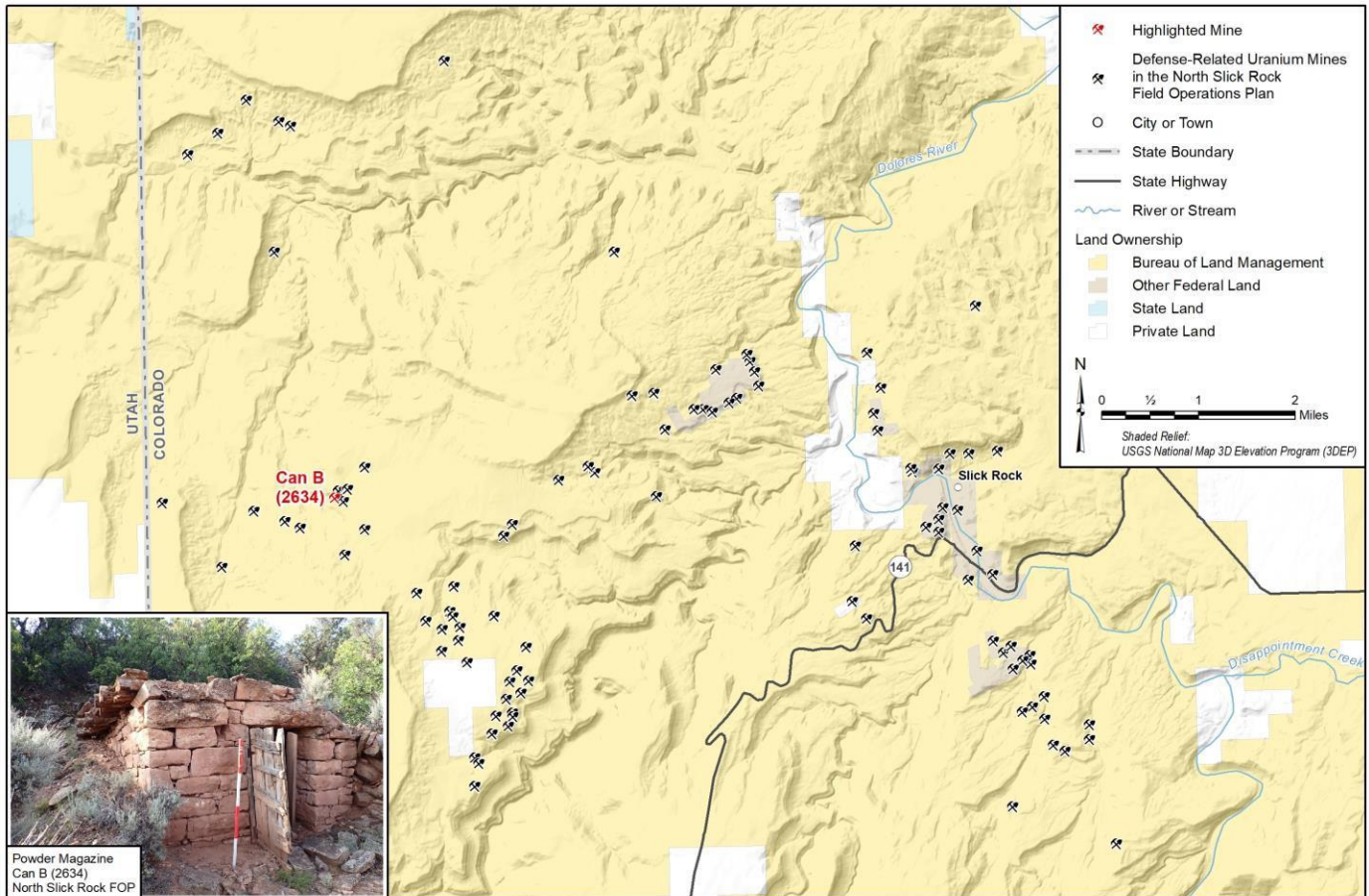


Note: Land ownership boundaries are provided by BLM National Surface Management Agency Area Polygons – National Geospatial Data Asset (2021) without guarantee of accuracy. There are potential inaccuracies in the representation of National Park Service, BLM, Other Federal Land, and private property boundaries.

Figure 2. Map and Photo, Red Wing Mine, Mine ID 877, Gypsum Valley FOP

Northern Montrose County FOP: This project area is in Montrose County in southwestern Colorado. A total of 92 mines on BLM-administered and mixed-ownership land. Some of these mines are located on land administered by the LM ULP. V&V activities were conducted at two mines in 2021. The remaining two mines on public land and will be visited in the future.

North Slick Rock FOP: This project area covers Montrose and San Miguel Counties in southwestern Colorado. A total of 103 mines on BLM-administered and mixed- ownership land. Some of these mines are located on land administered by the LM ULP. V&V activities were conducted at 94 mines in 2021. The remaining nine mines will be visited in 2022.



Note: Land Ownership boundaries are provided by BLM National Surface Management Agency Area Polygons – National Geospatial Data Asset (2021) without guarantee of accuracy. There are potential inaccuracies in the representation of BLM, Other Federal Land, and private property boundaries.

Figure 3. Map and Photo, Can B Mine, Mine ID 2634, North Slick Rock FOP

South Slick Rock FOP: This project area is in San Miguel County in southwestern Colorado. The FOP comprises 133 mines on BLM-administered and mixed ownership (lands administered by BLM and ULP lease tracts, and private and BLM-administered) land. V&V activities were conducted at 69 mines in 2021. The remaining 64 mines will be visited in 2022.

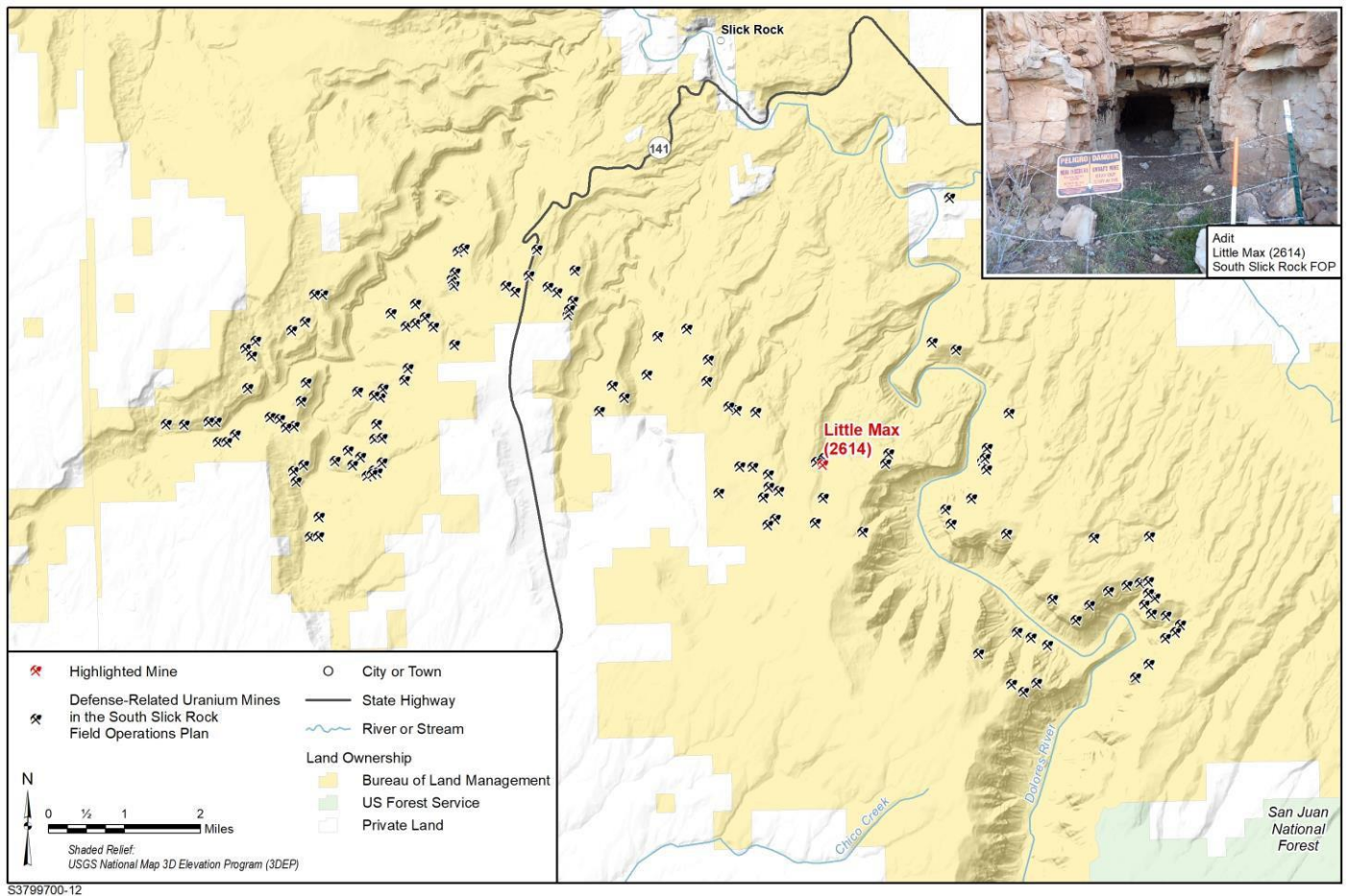


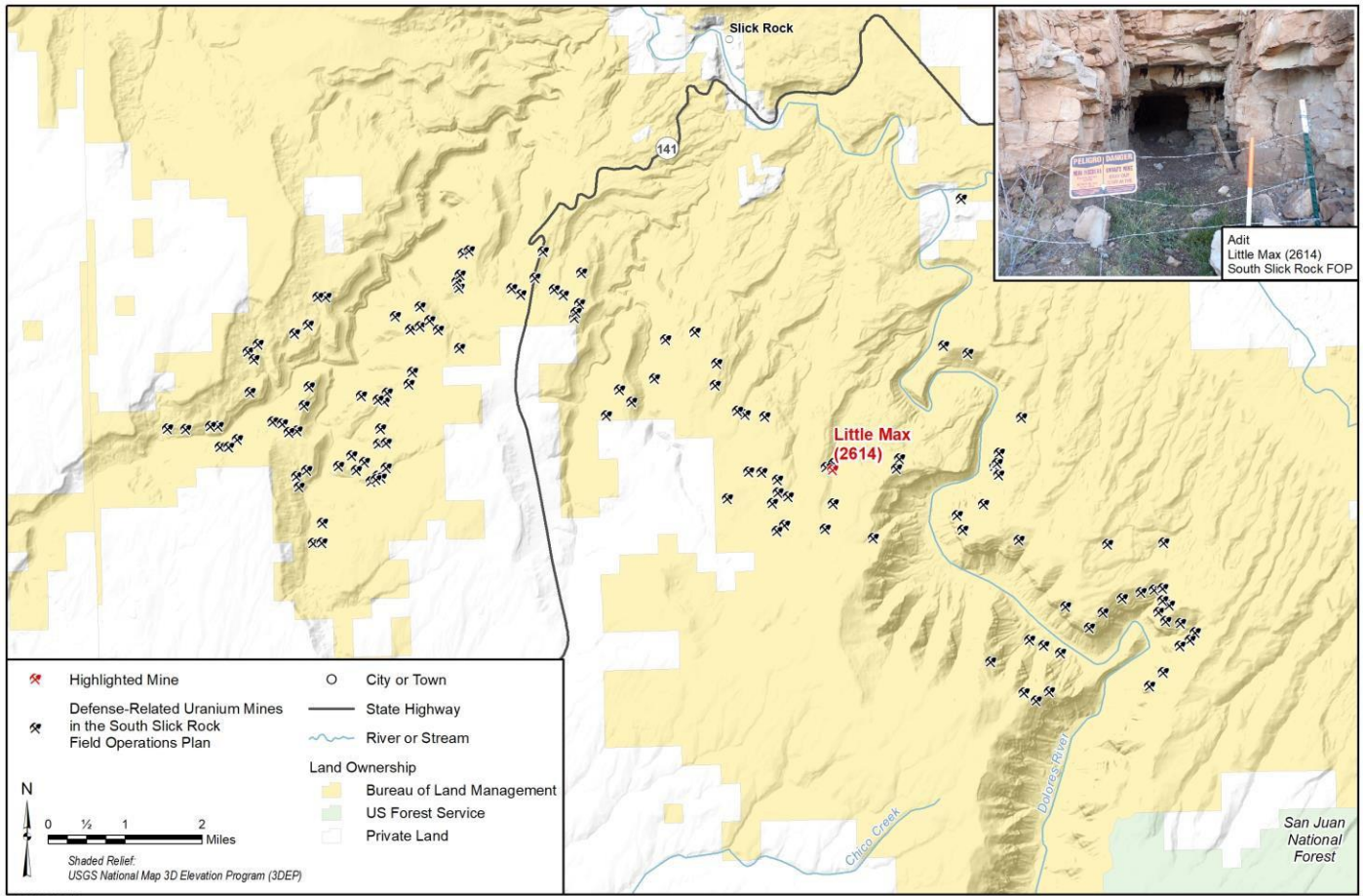
Figure 4. Map and Photo, Little Max Mine, ID 2614, South Slick Rock FOP

Montana

Black Hills and Northern Rockies FOP: This project area covers portions of Montana, Wyoming, South Dakota, and North Dakota. It includes mines on U.S. Forest Service (USFS)- administered land, BLM-administered land, public land managed by the state of North Dakota, and on mixed-ownership (private and USFS-administered and private and BLM-administered). V&V activities were conducted at seven mines in 2021, in the Butte Mining District in Montana. The remaining 92 mines will be visited in 2022.

Utah

Green River FOP: This project area is primarily in Grand County in west-central Utah. It includes mines located on public land managed by BLM and Utah School and Institutional Trust Lands Administration (SITLA), as well as mines on mixed-ownership land. V&V activities were conducted at 11 mines in 2021. The remaining 15 mines will be visited in 2022.



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Figure 5. Map and Photo, Danice Mine, ID 781, Green River FOP

Henry Mountains FOP: This project area is in Garfield and Wayne Counties in south-central Utah. V&V work is focused on 125 mines on public land managed by BLM, the USFS Dixie National Forest, and the SITLA. Field activities have the potential to affect several federally listed plant species at certain times of the year. Therefore V&V operations are timed so that no adverse impacts on these species occur. V&V activities were conducted at 33 mines in 2021. Of the remaining three mines, two have active mine permits and will not be visited. The final mine will be visited in 2022.

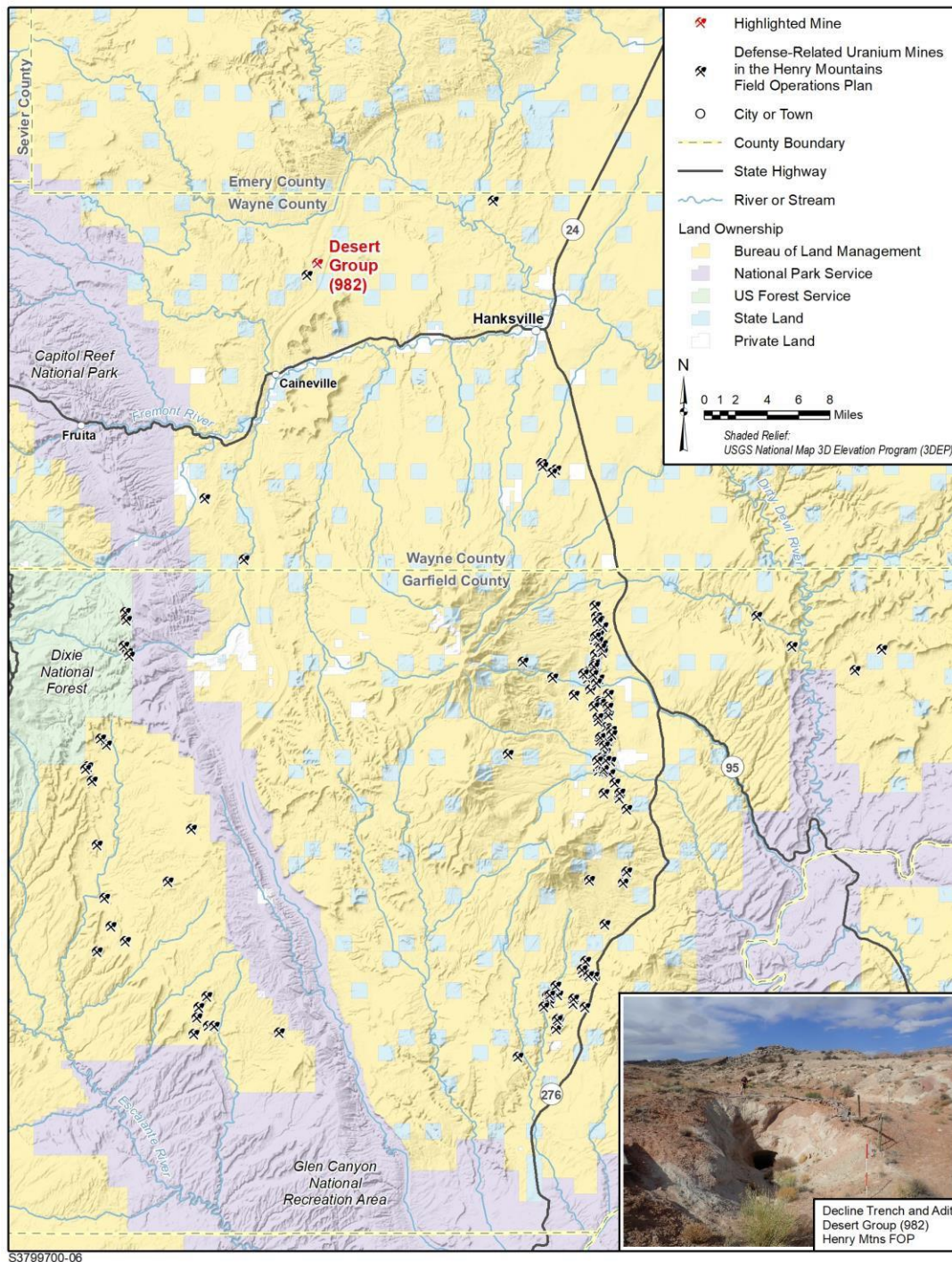


Figure 6. Map and Photo, Desert Group Mine, ID 982, Henry Mountains FOP

Manti-La Sal National Forest FOP: This project area is in southeastern Utah and southwestern Colorado. It includes mines on USFS-administered land, BLM-administered land, SITLA public land administered by the state of Utah, and mixed-ownership (USFS-administered and BLM-administered, and private and USFS-administered) land. V&V site visits have been conducted at all 88 mines, of which four were completed in 2021.

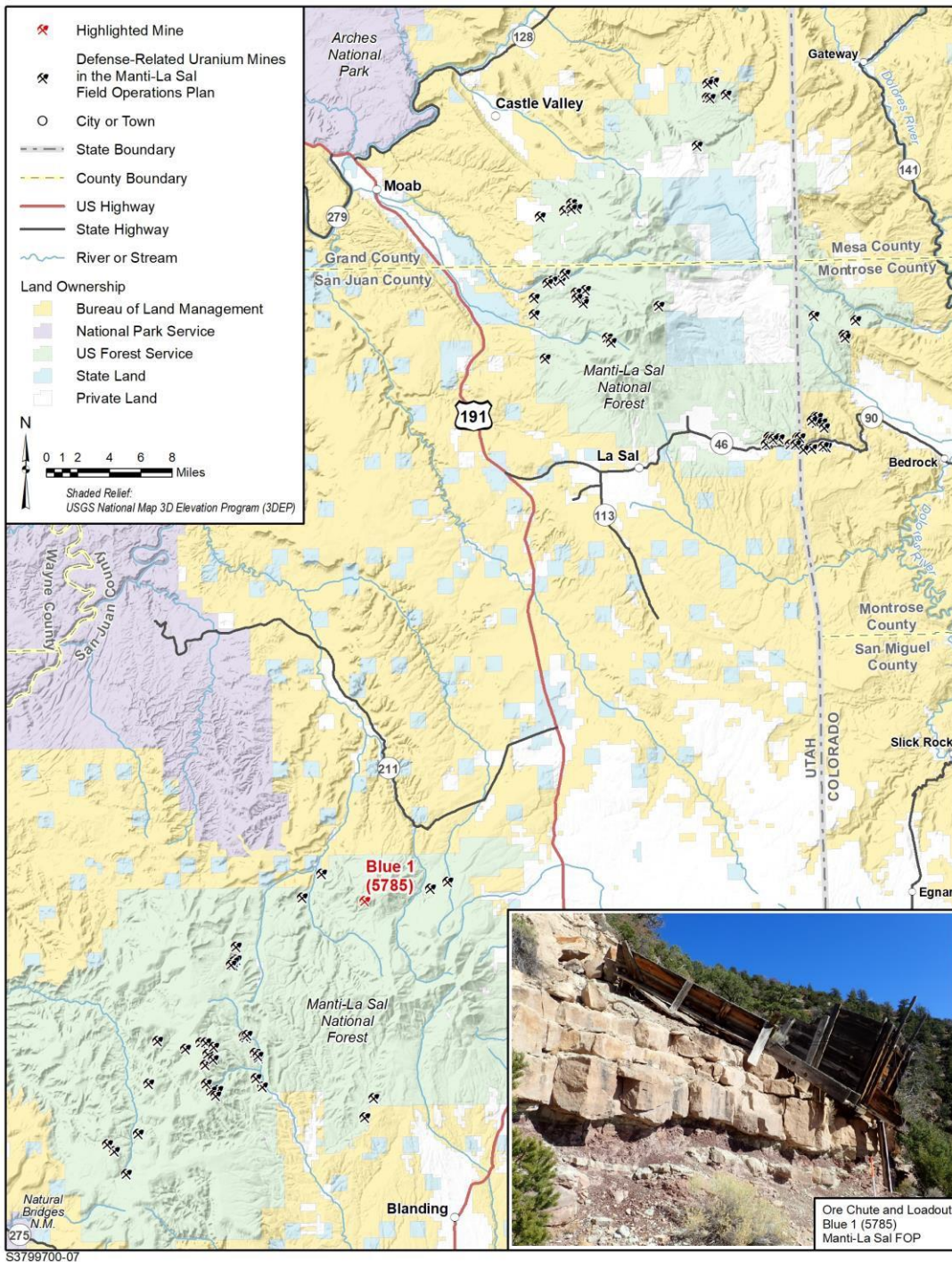


Figure 7. Map and Photo, Blue 1 Mine, ID 5785, Manti-La Sal National Forest FOP

Moab Mining District FOP: This project area is primarily located in Grand County generally near Moab in southeastern Utah. There are 42 mines located on public land — BLM-administered land, SITLA public land, and mixed-ownership land. V&V site visits have been conducted at 39 mines, of which one was completed in 2021. The three remaining mines will be visited in 2022.

Monticello FOP: This project area is primarily located in San Juan County in southeastern Utah. The 208 mines in this FOP area are mostly on BLM-administered land with some on SITLA public land, USFS-administered land, mixed-ownership land, and private property. V&V activities were conducted at 74 mines in 2021. Field work will be completed at the remaining 39 mines on public land in 2022.

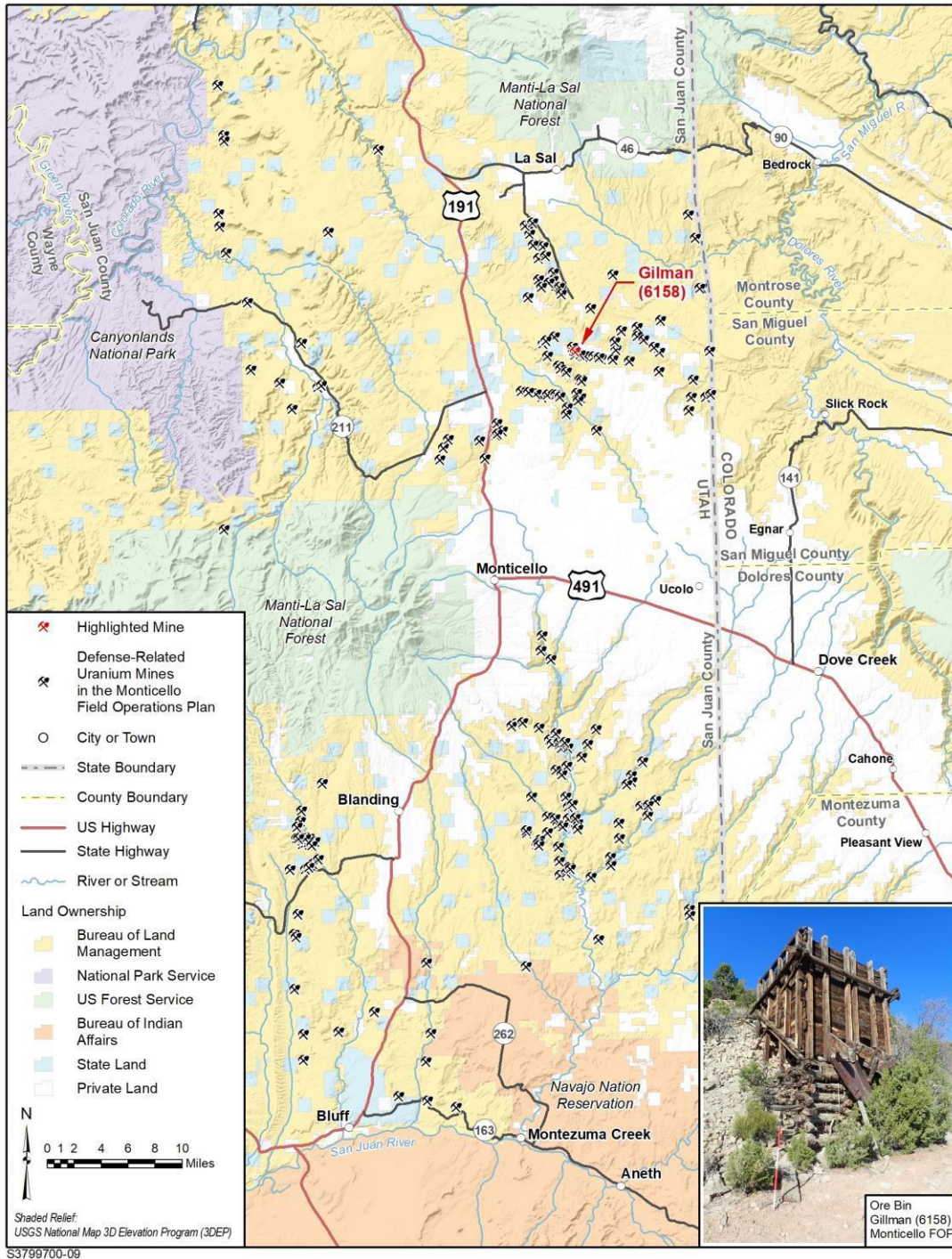


Figure 8. Map and Photos, Gilman Mine, ID 6158, Monticello FOP

IV Programmatic Accomplishments

The DRUM Program had a very successful year while still following DOE and other federal workplace protocols to protect our staff from the coronavirus disease of 2019 (COVID-19). Every facet of the program, including management, reconciliation, field and report staff, data and records management, environmental compliance, safety and health, quality assurance, stakeholder engagement, business services (e.g., technical editing), and project services (e.g., analytical laboratory), contributed to its success. The DRUM team has built a “center of excellence” providing thoughtful leadership; best practices and expertise; strategic partnerships; and meaningful engagement, research, support, and training for the inventory, assessment, and safeguarding of abandoned defense-related uranium mines.

The following programmatic activities were accomplished in calendar year 2021:

- **January 2021**
 - Met with Western Colorado University to discuss opportunities to expand their environmental curriculum and possible industry projects for their graduate students. This university is also looking for DRUM internship possibilities and field trips to DRUM sites for their students.
 - Successfully deployed the DRUM III database upgrade. Added a new “Safeguarding Information” tab to capture that work and a hazardous features table to the “Risk Evaluation” tab to facilitate the DRUM risk screening process, among other necessary updates.
 - Met with BLM Utah to begin planning for safeguarding projects in Mineral Canyon, Buckmaster Draw, and another possible project to capture state-wide notifiable features.
 - Met with the BLM Uncompahgre Field Office to begin project planning for safeguarding projects in 2022.
 - Received a General Notice Letter addressed to DOE and the U.S. Department of the Interior (DOI) from U.S. Environmental Protection Agency (EPA) Region 6, which indicates DOE may be partially responsible under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for cleanup associated with the San Mateo Creek Basin legacy uranium mines superfund site in Cibola and McKinley Counties, New Mexico.
 - Provided EPA Region 6 the number of tons of ore production in New Mexico upon request. Through reconciliation of mine records, ore production estimates increased from 35 million, as indicated in the Report to Congress, to 41 million tons.
- **February 2021**
 - Conducted “spring training” in preparation for the upcoming field season. Training topics included field hazards, changes to the DRUM V&V Work Plan, vehicle maintenance, sampling, risk screening evaluations, risk roll-up reports, equipment use and calibration, and safety data sheets.

- Published the DRUM Program’s annual report for calendar year 2020 providing details on 2020 program activities and accomplishments, project planning for 2021, and an updated program timeline.
 - Updated the DRUM V&V Work Plan to incorporate operational experiences and common deviation requests from the 2020 field season and streamline field processes for the 2021 field season.
 - Completed the FOP for the Green River Mining District in Utah. The plan covers 26 mines in the Inter-River Locality on land managed by BLM, SITLA, and mixed ownership.
 - Began planning proposed access considerations for DRUM located in U.S. National Parks in coordination with the agency’s regional AML program manager.
 - Worked with Navajo AML, Navajo EPA, and EPA Region 9 to provide a chapter on the DRUM Program in EPA’s Ten-Year Plan, identifying the next steps in addressing the human health and environmental risks associated with the legacy of uranium mining and milling on the Navajo Nation.
 - Published the 2020 Annual Stakeholder Report for the Abandoned Uranium Mines Working Group (AUMWG), which is a consortium of federal agencies working together to address the human health, safety, and environmental challenges posed by the nation’s abandoned uranium mines. This report communicates the AUMWG’s collaborative efforts and accomplishments during 2020.
 - Completed environment review (including National Environmental Policy Act [NEPA]) for aerial survey of large mines in Wyoming. Amended existing categorical exclusion to include manned aerial survey (in addition to unmanned) of the mine sites.
 - Worked with USFS to terminate regional agreements and establish a new Washington Office-level interagency agreement for inventorying and safeguarding mines on National Forest System lands.
- **March 2021:**
 - Started the fifth year of conducting V&V field visits of mines on public land on March 8 in the Monticello and Henry Mountains Mining Districts in Utah.
 - Published the DRUM Safeguarding Program Management Plan providing the structure and basis for the management of safeguarding, monitoring, and maintenance of hazardous mining related features at DRUM sites.
 - Completed the FOP for the Gypsum Valley Mining District of Colorado to BLM’s Tres Rios Field Office. This FOP covers 97 mines in the Gypsum Valley Mining District in the Gypsum Gap, Long Ridge, Big Gyp, and Little Gyp Mining Localities.
 - Developed the FOP for the Northern Region of the Slick Rock Mining District of Colorado to BLM’s Tres Rios Field Office. This FOP covers 103 mines in the northern region of the Slick Rock Mining District in the Empire Group, Lower Group, Middle Group, Radium Group, and Upper Group Localities.

- Prepared a rollup document of risk rankings for the mines located in:
 - 1) Northern Trachyte and Orange Cliffs Localities (24 mines) in central Utah on BLM-administered land.
 - 2) Seven Mile Canyon, Klondike Ridge-Courthouse Wash, and Richardson Localities (17 mines) in eastern Utah on BLM-administered land.
 - 3) Upper Kane Creek, Lower Kane Creek, Cane Canyon, and Brumley Ridge Localities (18 mines) in eastern Utah on BLM-administered land.
 - Began teaming with the National Nuclear Security Administration's (NNSA) Aerial Measuring System (AMS) program to conduct an aerial gamma radiation survey of large mines in Wyoming. The survey will cover more than 17,000 acres and screen for anomalies or spatial trends to help optimize ground-based sampling procedures.
 - Chaired the quarterly AUMWG meeting discussing the following topics with federal agencies: 1) aerial survey of the Wyoming mine sites, and 2) an update of DRUM's safeguarding program.
- **April 2021:**
 - Developed the FOP for the Southern Region of the Slick Rock Mining District of Colorado to BLM's Tres Rios Field Office. This FOP covers 130 mines in the southern region of the Slick Rock Mining District in the Golden Rod Group, Horseshoe Group, Legin Group, Mercantile Group, and Spud Patch Group Localities.
 - Prepared a rollup document of risk rankings for the mines located in:
 - 1) East Calamity Mesa Locality (32 mines) in western Colorado on BLM-administered land and Uranium Leasing Program land.
 - 2) Southern Trachyte Locality (33 mines) in central Utah on BLM-administered land.
 - 3) Northeastern South San Rafael Locality (32 mines) in eastern Utah on BLM-administered land.
- **May 2021:**
 - Completed construction of the Mineral Canyon project safeguarding 29 hazardous mine features in the Green River Mining District of Utah, north of Canyonlands National Park. The DRUM Program teamed with the state of Utah's Abandoned Mine Reclamation Program, BLM's Moab Field Office, and Bat Conservation International (BCI) to complete the project. Safeguarding included construction of barricades to prohibit public access to hazardous adits, shafts, subsidence areas, and other mine features.
 - Virtually presented aerial gamma radiation survey plans of large mines in Wyoming at the International Atomic Energy Agency's (IAEA) Annual Meeting of the Coordination Group of Uranium Legacy Sites (CGULS). The current focus of CGULS is on uranium legacy sites in the former Soviet Central Asian Republics

of Tajikistan, Kyrgyzstan, and Uzbekistan to help them better understand what activities may be necessary at abandoned mine sites.

- Initiated discussions with several EPA regional offices regarding the next campaign to verify and validate abandoned uranium mines on tribal lands. The specific methodologies of the campaign will be developed in consultation with tribal governments particularly AML programs. The DRUM sites are primarily on Navajo Nation land (96%) and are unique when compared to mines situated on public land since tribal members may live on or near DRUM sites.
- Prepared a roll-up document of risk rankings for the mines located in:
 - 1) Atkinson Mesa and Mesa Creek Localities (15 mines) in western Colorado on BLM-administered land.
 - 2) Big Pinto-Blue Chief, Buckhorn Mesa-Scharf Mesa, and Dewey Bridge-Squaw Park Localities (12 mines) in eastern Utah on BLM- administered land.
 - 3) East Yellow Cat Locality (32 mines) in eastern Utah on BLM- administered land.
 - 4) West Yellow Cat Locality (27 mines) in eastern Utah on BLM- administered land.
 - 5) Fry Canyon Locality (eight mines) in southeastern Utah on BLM- administered land.
 - 6) Long Park and adjacent Localities (22 mines) in western Colorado on BLM-administered land.
 - 7) Outlaw Mesa Locality (34 mines) in western Colorado on BLM- administered land and Uranium Leasing Program land.
 - 8) West Calamity Mesa Locality (22 mines) in western Colorado on BLM-administered land and Uranium Leasing Program land.
- **June 2021:**
 - Established an interagency agreement with the USFS Washington Office for support of the DRUM program. An estimated 370 abandoned uranium mines are located on National Forest System lands in numerous USFS regions throughout the United States.
 - Chaired the AUMWG quarterly meeting with over 50 participants from across the federal government. Topics included industry's use of airborne geophysics to develop hydrogeologic frameworks and identify groundwater contamination, an EPA paper on evaporative transfer covers, and an update on DRUM's safeguarding program.
 - Met with AML program counterparts at the USFS in the state of Wyoming and Montana to set the stage for completing an abandoned uranium mine inventory and conducting safeguarding during FY 2022.

- Prepared a roll-up document of risk rankings for the mines located in:
 - 1) Beaver Mesa Locality (26 mines) in western Colorado on BLM-administered land.
 - 2) Southwestern South San Rafael (27 mines) in southeastern Utah on BLM-administered land.
 - 3) Swazys Flat and Temple Mountains Localities (38 mines) in eastern Utah on BLM-administered land.

- **July 2021:**
 - Met with EPA Region 6 to discuss the Grants (New Mexico) Mining District Five-Year Plan. Federal, state, and tribal agencies are partners to the plan, which addresses contamination caused by legacy uranium mining and milling operations in the mining district. The State of New Mexico has identified nearly 100 uranium mines that require assessment and possible cleanup. The DRUM Program will contribute the resources to inventory and safeguard DRUM sites in that mining district. These sites had reportable ore production and legacy surface features (i.e., waste rock piles, vents/shafts, and other physical remnants).
 - BLM Montana requested LM expedite the DRUM's V&V schedule for an area within their field office known to contain several DRUM sites. The area in the Pryor Mountains is located directly south of Billings, Montana, and is approximately 4 square miles. For many years, a system of trails for hiking and non-motorized bicycles has been proposed to be built for public use but was never completed because of concerns of possible radiation in this area due to legacy mining.
 - Provided an overview, update, and way forward presentation of the DRUM Program and the next campaign on tribal land at the quarterly Navajo, Hopi, DOE meeting in Farmington, New Mexico.
 - Assisted the Ute Mountain Ute Tribe to assess the Cottonwood Wash watershed in Utah. This project is being funded by EPA's water program under the Water Infrastructure Improvements for the Nation (WINN) Act. Funding allocated to this project will include resources for mine restoration work in addition to this assessment.
 - Conducted NEPA Categorical Exclusion Evaluation to conduct safeguarding, monitoring, and maintenance activities on DRUM sites on federal, state, and tribal abandoned mine lands in accordance with the DRUM Safeguarding Program Management Plan.

- **August 2021:**
 - A DRUM field team located and communicated to BLM a mining-related physical hazard at the Blue Ribbon 1 & 2 Mine. The subsidence feature was along a well-traveled four-wheel-drive road and was partially fenced. Notification allowed the BLM Colorado State Office to contract for its safeguarding.

- Held virtual meeting with EPA Region 6 to discuss an overview of DRUM’s Campaign 2 with particular emphasis on integrating DRUM activities with EPA’s on-going CERCLA activities on the Pueblo of Laguna in New Mexico. The group discussed the technical methods used by the DRUM Program. The Pueblo of Laguna has six DRUM sites; however, the DRUM Program will only address the three mines not being addressed under CERCLA.
 - Completed V&V of the mines in the Pryor Mountains in Montana to accommodate a request made by the BLM to expedite the V&V schedule.
 - Published and posted the *DRUM Program Midyear Progress Report, January 1- June 30, 2021* (DOE 2021e) on the public-facing website.
 - The NNSA AMS program completed the aerial survey of three large DRUM sites in Wyoming — Crooks Gap, Gas Hills, and Shirley Basin.
 - Attended the Federal Mining Dialogue (FMD) meeting hosted by EPA. The discussion focused on environmental justice and climate change activities within member agencies. The FMD comprises U.S. federal environment and land management agencies. The FMD oversees the environmental, health, and safety impacts of abandoned mine lands across the country.

- **September 2021:**
 - Achieved a major milestone by reconciling all the U.S. Atomic Energy Commission (AEC) ore production records to identify and confirm the location of all the legacy mines across the U.S. that were used for defense purposes between the years 1947 and 1970. The DRUM Reconciliation Team completed an exhaustive review of over 15,000 records and their detailed research reduced the government’s perceived environmental liability by over \$300 million.
 - Held a pre-planning kick-off meeting with Pueblo of Laguna and EPA Region 6 to discuss upcoming V&V activities on tribal lands.
 - Attended the National Association of Abandoned Mine Lands Program virtual conference. Gave a technical presentation on DRUM Program updates featuring accomplishments to date and upcoming plans for Campaigns 2 and 3.
 - Prepared a roll-up document of risk rankings for the mines located in:
 - 1) Rimrock Blues Locality (17 mines) in western Colorado on BLM-administered land.
 - 2) Bucks Flats- Dry Valley Locality (10 mines) in eastern Utah on BLM-administered land.
 - Chaired the quarterly AUMWG meeting discussing the following topics with federal agencies:
 - 1) an update of the aerial survey of large mines in Wyoming,
 - 2) status of expedited request to survey mines in Montana, and
 - 3) safeguarding program update.

- **October 2021:**
 - Performed Long Park 2, Martin Mesa, Prayer 9, and Mixed-Private Colorado BLM projects, which safeguarded 62 hazardous mine features. These projects were a collaboration between federal and Colorado state agencies, nonprofit organization, and industry.
 - Completed Buckmaster II project safeguarding nearly 50 hazardous mine features. The project was managed by Utah AMRP and includes mines on lands managed by BLM and SITLA.
 - Attended the multi-day Colorado Advisory Council Meeting hosted by the Colorado Division of Reclamation, Mining, and Safety (CO-DRMS). The advisory council comprises representatives from Colorado local governments and industry, CO-DRMS, and Colorado offices of BLM, USFS, and LM. LM provided a brief, highlighting accomplishments in 2021 and future project planning for 2022.
 - Prepared a roll-up document of risk rankings for the mines located in North Deerneck Mesa Locality (eight mines) in eastern Utah on BLM-administered land.

- **November 2021:**
 - LM participated in IAEA Regulatory Supervision of Legacy Sites (RSLS) technical meeting and gave a presentation focused on the approach DRUM uses to gather and evaluate risk on abandoned uranium mines.
 - Prepared the following two roll-up documents of risk rankings: 1) mines located in Starlight Group Locality (29 mines), and 2) Bachelor Draw (20 mines); both are in western Colorado on BLM-administered land.

- **December 2021:**
 - The first monthly coordination meeting was held with representatives from the Navajo Nation and EPA Region 9. The topics discussed included the proposed scope for DRUM on the Navajo Nation and an update on the cooperative agreement between LM and the Navajo Nation. In addition to the monthly meeting, a reoccurring bi-weekly meeting schedule was established to collaboratively resolve various technical and logistical components prior to initiating V&V field efforts.
 - Chaired the quarterly AUMWG meeting discussing the following topics with federal agencies: 1) the initial report on the Wyoming aerial survey, 2) the DRUM mid-year Progress Report, and 3) an inventorying and safeguarding program update.

V Risk Screening

To date, program results indicate that physical hazards (e.g., open shafts and adits) at the mines pose the greatest risk to the public, with roughly 28% of the mines ranked “high” for physical hazards. This suggests the need for a future safeguarding action to mitigate the risk presented by these features. Over 50% of the mines ranked “low” or “none” for physical

risk. These estimates represent mining-related physical hazards associated with uranium ore extraction operations. Other hazardous features, such as structures, which have previously been included in evaluations of physical risks, were not considered. However, LM will address the handling of structures individually with each land management agency, since each agency tends to address these differently, if at all.

V&V reports are prepared for each mine, and risk roll-up reports are prepared for a group of mines in the same area (e.g., mining district, national forest) so land management agencies can set priorities for that region and develop potential physical hazard safeguarding projects.

VI Safeguarding

The DRUM Program assisted land management agencies in safeguarding physical hazards posed by some mine features at seven different project areas in western Colorado and eastern Utah. These hazards were primarily open adits, shafts, and subsidence features. Table 2 summarizes the 2021 safeguarding projects and lists the cooperating land management agencies and state AML offices. These safeguarding projects demonstrate the collaborative relationships between the DRUM Program and cooperating state AML offices and land management agencies.

Table 2. 2021 Safeguarding Projects

State	Project Area	Features Safeguarded	Cooperating AML Office	Cooperating Land Management Agency
Colorado	Long Park 2	20	Colorado DRMS	BLM-Uncompahgre Field Office
Colorado	Martin Mesa	20	Colorado DRMS	BLM-Uncompahgre Field Office
Colorado	Prayer 9	1	Colorado DRMS	BLM-Uncompahgre Field Office
Colorado	Long Park Mixed	21	Colorado DRMS	BLM-Uncompahgre Field Office
New Mexico	Grants	17	New Mexico BLM	BLM-New Mexico State Office
Utah	Buckmaster Draw 2	51	Utah AMRP	BLM-Price Field Office
Utah	Mineral Canyon	29	Utah AMRP	BLM-Moab Field Office
Total Safeguards Installed		159		

AMRP – Abandoned Mine Reclamation Program
 DRMS – Division of Reclamation, Mining and Safety

VII Strategic Partnerships

LM strives to maintain and encourage collaborative partnerships with the U.S. Bureau of Land Management, U.S. Forest Service, National Park Service, and the states of Colorado, Montana, New Mexico, South Dakota, Utah, and Wyoming. LM also collaborates with EPA Regions 6 and 9 on program V&V assessment and risk screening

methods on tribal lands. LM continues to revise partnership agreements among various federal, state, and nonprofit entities to not only accomplish the V&V work, but also safeguard physical safety hazards at these abandoned uranium mines. Most notably, DOE has a cooperative agreement with BCI that provides long-term access to the spectrum of project development, environmental review (including NEPA documentation), and design and construction services needed to safeguard mines on public land.

Collaboration with a multitude of federal and state entities on the DRUM Program supports a one-government approach with financial agreements. This provides access to agency expertise involving managing abandoned mines on public land and critical input into work plans, schedules, data reviews, conclusions, and safeguarding projects. State AML programs in Colorado and Utah have been used to inventory private property intermixed with public land, providing valuable planning information needed to support the DRUM Program.

In 2021, the DRUM Program began its tribal land campaign. Formal and informal communication occurred with the Pueblo of Laguna in New Mexico and the Navajo Nation in New Mexico and Arizona. Ongoing communication will occur to plan for V&V work scheduled for 2022. A cooperative agreement is being developed with the Navajo Nation for their assistance with public outreach, operational planning, V&V assistance, and future safeguarding tasks.

VIII 2022 Planned Activities

LM completed V&V work at 74% of the mines in Campaign 1 by the end of 2021, and this effort will continue in 2022. Reconciliation of all DRUM locations was completed by the end of 2021 and will continue into 2022 as we crosswalk mine lists with EPA and tribal nations. LM will pursue expanding its partnerships with states and agencies for field activities scheduled through 2022. Included in the implementation of Campaign 1 is LM's plan to leverage resources to assist partner agencies in addressing priority physical hazards identified by the program. Through a process of collaboration and concurrence with hazards defined during V&V activities, LM and partner agencies determine the priority and optimize available resources for safeguarding physical hazards. This process, which was initiated in 2020, will continue at an accelerated pace in 2022.

V&V Field Operations

The field teams will be deployed to several locations during the 2022 field season, which lasts from March through December. The teams are scheduled to conduct inventory and environmental sampling at DRUM sites in:

- Black Hills Mining District, South Dakota.
- Butte Mining District, Montana.
- Cochetopa, Cortez, Marshall Pass, Maybell, San Juan, Tallahassee Creek, and Wet Mountain Mining Districts, Colorado.
- Cuchara, Grand Mesa, North Sangre de Cristo, Placerville, and Uravan Mining Districts, Colorado.
- Dakota Plains Mining District, North Dakota.
- Green River Mining District, Utah.

- Grants Mining District (Laguna Pueblo Reservation), New Mexico.
- Gypsum Valley Mining District, Colorado.
- Henry Mountains Mining District, Utah.
- Moab Mining District, Utah.
- Monticello Mining District, Utah.
- Canyonlands National Park, Glen Canyon National Park, and Capitol Reef National Park, Utah.
- Navajo Nation Trust, Arizona.
- Powder River Basin Mining District, Wyoming.
- Slick Rock Mining District, Colorado.
- Southern Arizona Mining District (Tohono O'odham Nation), Arizona.
- Williston Basin Mining District, South Dakota.
- Wind River Basin Mining District, Wyoming.

The field teams are poised to complete V&V activities on approximately 350 mines in calendar year 2022. For each project, a FOP will provide coordination instructions to the teams for the inventory and environmental sampling activities so that field work is conducted efficiently. The FOP conveys to LM and partner agencies information pertinent to the V&V activities at the specific project area. Also, contingencies are in place to ensure that field teams always have a DRUM site to inventory and assess. Although a field team may be impacted by weather (e.g., late seasonal snow) or a natural disaster (e.g., smoke from a wildland fire), they will have other options allowing them to safely continue field work.

Campaign 2

Tribal outreach for Campaign 2, which will address DRUM sites on tribal land, was initiated in 2021. This will continue in 2022, and V&V activities on tribal land will begin in 2022. The current plan is to start V&V activities on tribal land with a small number of mines in the first half of the year and expand this to the Navajo Nation in the fall of 2022. Although V&V work on tribal lands will begin in 2022, the more significant effort will not begin until 2023.

Safeguarding Program

In 2022, the DRUM Program will increase the number of safeguarded features with additional projects in Colorado and Utah. In Colorado, the DRUM Program will safeguard more than 60 hazardous mine features at BLM's Uncompahgre Field Office. The DRUM Program plans to expand safeguard work to both BLM's Grand Junction and Tres Rios Field Offices and closing 83 and 40 hazardous mine features, respectively. In Utah, two safeguarding projects are planned at Manti La Sal National Forest, which will safeguard 81 hazardous features. In total, the DRUM Program is planning to safeguard 265 hazardous mine features in 2022.

Safeguarding projects are initiated as a follow-up to DRUM Program's risk roll-up reports, which document physical hazards presented by individual features at mines. LM works with affected land management agencies as they concur with the need to safeguard specific mine features in specific geographic areas. Land management agencies, state AML offices, and LM or BCI will collaborate to complete environmental reviews, develop designs and construction specifications, and contract and manage safeguard construction.



Figure 10. Adit safeguarded with bat-accessible grate (Marie Incline, Mine ID 6021 – Black Hills & Northern Rockies Field Operations Plan).

IX Program Plans

The activities performed by the DRUM Program are represented in multiple documents that provide specific guidance and direction in the performance of tasks or project activities. These documents are the DRUM Program Management Plan, the V&V Work Plan, the *Defense-Related Uranium Mines Quality Assurance Program Plan* (LMS/ DRM/ S15867) (QAPP), the DRUM Safety Plan, the FOPs, the *Defense-Related Uranium Mines Data Management Plan* (LMS/DRM/S19467) (Data Management Plan), and the DRUM *Safeguarding Program Management Plan* (LMS/DRM/S33217).

A summary of each plan is provided below:

Program Management Plan

The Program Management Plan defines how LM will execute the DRUM Program, set goals, and effectively communicate program strategies and objectives to the partner agencies. It is the primary guiding document of the program. A revised Program Management Plan was issued in March 2020. The revised plan addressed V&V activities for the three DRUM campaigns, including safeguarding of physical safety hazards. It describes how LM, the LMS contractor, and partner agencies will work as a cohesive team to execute the DRUM Program.

Verification and Validation Work Plan

The V&V Work Plan provides data objectives, direction, and methodologies regarding how LM and partner agencies will collect, store, and report information gathered during V&V activities at mines on public land. This includes inventorying mine-related features using digital technology, radiological data collection, soil, and water sampling (if required), photo documentation of mine-related features, in-field and office-based data quality assurance procedures, and reporting. A separate V&V Work Plan will be developed for Campaigns 2 and 3.

Quality Assurance Program Plan

The QAPP describes the procedure for ensuring that environmental data collected during V&V activities at a mine will be of sufficient quantitative and qualitative value for use in determining whether data-quality objectives are being met. The data provided to partner agencies will be used to supplement existing documentation of mine conditions.

Safety Plan

The Safety Plan defines the requirements of the LMS Worker Safety and Health Program and the Integrated Safety Management System. These are high-level programs that set forth the parameters for how the LMS contractor integrates safety into program activities. The DRUM Safety Plan replaced the previous DRUM Health and Safety Plan in spring 2020.

Field Operations Plans

The FOPs provide the details of activities to be performed on lands administered by partner agencies within discreet operational areas. Each FOP provides contact information for the relevant personnel from LM, the LMS contractor, and partner agencies; identifies the mines where V&V activities will be performed; provides information pertinent to mine access; describes special circumstances and restrictions that need to be addressed before, during, or after V&V activities; and includes emergency contacts and locations of medical facilities nearby where V&V activities are being performed.

Data Management Plan

The Data Management Plan describes the tasks, processes, and procedures for managing DRUM Program data. This plan identifies responsibilities, outlines data sources and locations, and provides insight on the quality control checks, capabilities, and queries that can be done related to the DRUM Program database.

Safeguarding Program Management Plan

The Safeguarding Program Management Plan was issued in 2021. This plan addresses how LM, in collaboration with land management agencies, state and tribal AML offices, the LMS contractor, and BCI implements safeguarding and follow-up monitoring and maintenance activities.

X Abbreviations List

AEC	U.S. Atomic Energy Commission
AML	Abandoned Mine Lands
AMRP	Abandoned Mine Reclamation Program
AUMWG	Abandoned Uranium Mines Working Group
BCI	Bat Conservation International
BLM	U.S. Bureau of Land Management
DOI	Department of Interior
DRMS	Division of Reclamation, Mining and Safety
CGULS	Coordination Group of Uranium Legacy Sites
COVID-19	Coronavirus disease of 2019
DOE	U.S. Department of Energy
DRUM	Defense-Related Uranium Mines
EPA	U.S. Environmental Protection Agency
EPNG	El Paso Natural Gas
FOP	Field Operations Plan
FY	Fiscal year
IAEA	International Atomic Energy Agency
LM	Office of Legacy Management
LMS	Legacy Management Support
LTD-OPS	Limited Operations
mrem/yr	Millirem per year
NEPA	National Environmental Policy Act
QAPP	Quality Assurance Program Plan
RSLs	Regulatory Supervision of Legacy Sites
SITLA	School and Institutional Trust Lands Administration
UFO	Uncompahgre Field Office
ULP	Uranium Leasing Program
UMREG	Uranium Mining Remediation Exchange Group Utah
OGM	Utah Division of Oil, Gas, and Mining
USFS	U.S. Forest Service
USGS	U.S. Geologic Survey
V&V	Verification and Validation

XI Additional Information

Additional information about the DRUM Program, including the 2014 Report to Congress, other program documents, ongoing projects, and updates, is available at the following DOE website: <https://www.energy.gov/lm/defense-related-uranium-mines-program>.

For more information about the DRUM Program, please contact:

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Defense-Related Uranium Mines Safeguarding Program Management Plan, LMS/DRM/S33217.