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Legacy
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Standing Up the U.S. Department of Energy's Defense-Related Uranium Mines Program

Deborah Steckley, PMP
U.S. Department of Energy (DOE)
Office of Legacy Management (LM)

John Elmer, P.E.
Navarro Research and Engineering, Inc.
(Contractor to DOE-LM)

8.1 LM Uranium Mine Programs

Presentation Overview

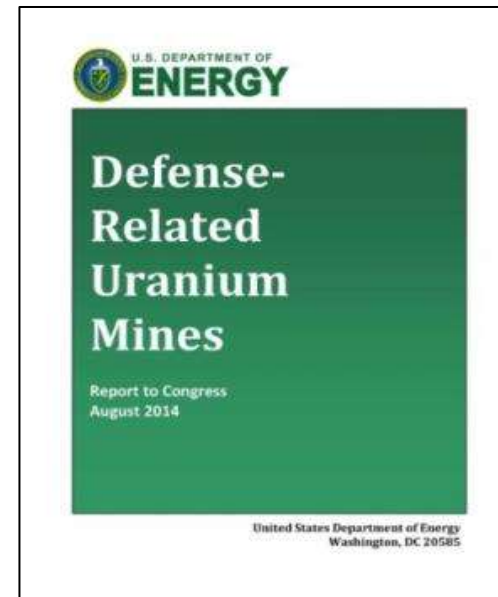
- History of the U.S. Department of Energy's (DOE's) Defense-Related Uranium Mines (DRUM) Program: Report to Congress
- Establishment of the DRUM Program
- Program Accomplishments-to-Date
- Standing up the DRUM Program
 - Collection of Historical Data
 - DRUM Program Documents
 - Establishing Risk Standards
 - Developing the DRUM Database
 - Challenges of Ramping Up
- Lessons Learned



Geologist locating an adit at a small mine on federal public land in the Yellow Cat District, Utah

History of the DOE DRUM Program: Report to Congress

- DOE prepared an August 2014 Report for Congress on 4,225 DRUM (mines) that produced uranium ore for defense-related purposes of the United States
 - Most of the mines are abandoned.
- The Report is based on U.S. Atomic Energy Commission (AEC) records, and required consultation with other federal agencies, affected states and tribes, and the interested public.
- Numerous data gaps were identified regarding the condition of the mines.
- The majority of mines were found to be on U.S. Bureau of Land Management (BLM) and U.S.D.A. Forest Service administered land.
- Mines present physical hazards that are the greatest, most immediate dangers.
 - Chronic exposure to radiological and chemical constituents from legacy mine waste is also of concern.



Establishment of the DRUM Program

- DOE's Office of Legacy Management (LM) initiated the DRUM Program in fall 2016, building on Report to Congress findings.
- The Program's goal is to verify and validate (V&V) the condition of 2,500 mines on federal public land by 2022.
- V&V will result in identifying whether the mines pose physical hazards as well as potential radiological and chemical risks, and to what extent.
- LM will also assess:
 - the federal government's potential environmental liability;
 - costs to address high-risk physical hazards; and
 - the Program's return on investment to the American taxpayer.



Merry Widow Mine, Eagle Basin, Colorado

Establishment of the DRUM Program: State and Federal Partnerships

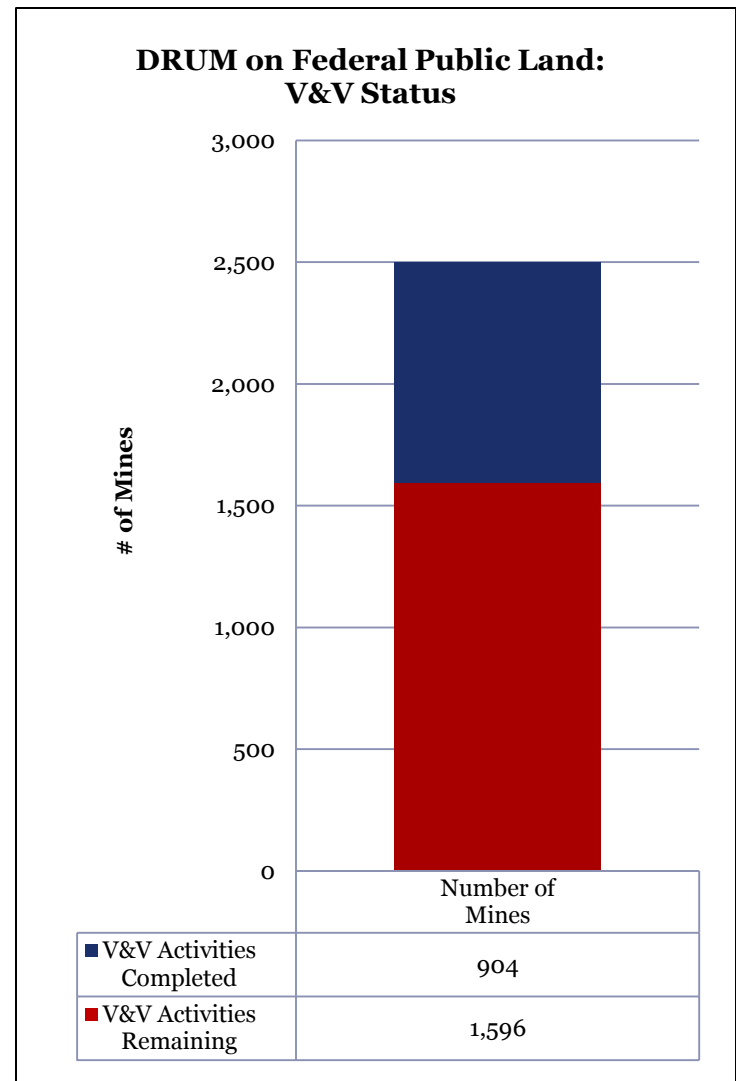


- LM formed partnerships and executed agreements with BLM and Forest Service to inventory and sample mines.
 - Approximately 2500 mines are on federal public land and pose risks to recreationalists.
- LM also formed partnerships and executed agreements with state abandoned mine land programs.
- Partnerships are advantageous because they leverage resources and expertise.
 - BLM and Forest Service facilitate site access and advise on land issues.
 - States have years of mine inventory expertise to contribute; some states also have authority to access state and private land for inventory activities.
 - LM contributes its radiological expertise.

Program Accomplishments To Date

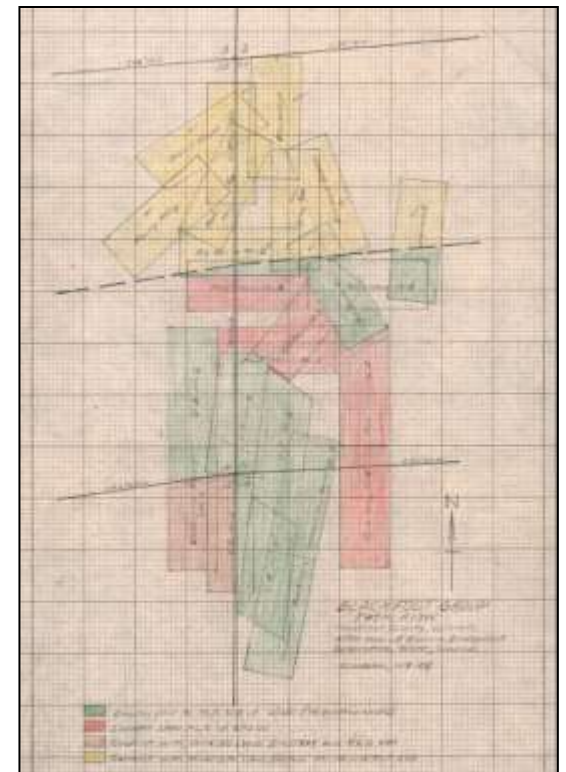
As of July 22, 2018:

- V&V activities for 904 mines in Colorado, New Mexico, and Utah are complete.
- Risk scoring assessments are complete for 113 mines and provide rankings of physical hazards, and potential chemical and radiological risks.
 - The majority of mines present physical hazards (e.g., open adits).
 - Few mines rank medium or high for chemical and radiological risks.
- The federal government has reduced its potential environmental liability by approximately \$150 million through preliminary risk screening efforts.
 - Screening results generally don't exceed established chemical and radiological risk screening levels.



Standing Up the DRUM Program: Collection of Historical Data

- AEC sources include allocation and certification bonus case maps and files from the National Archives and Records Administration.
 - Over 3,700 maps were scanned for the DRUM Program.
- Other historical data sources
 - W. Chenoweth
 - Well-known uranium geologist whose collection includes reports and first-hand knowledge of mines in Arizona and New Mexico
 - S. Hollingsworth
 - Former lead geologist for Umetco; numerous maps of claims
 - Museums of Western Colorado (AEC data)
 - National Uranium Resource Evaluation
 - Defense Minerals Exploration Administration
 - USGS Bulletins, geologic maps, and professional papers



AEC Map

Standing up the DRUM Program: DRUM Program Documents

DOE developed five Program Documents to guide V&V efforts.

- The **Program Management Plan** describes how DOE LM and its contractor will execute the program.

The image shows a screenshot of a web-based checklist titled "DRUM Verification and Validation Work Plan Process". At the top, it features the HAVARRO logo and the text "Requirements for the development of the DRUM program". Below the title, there is a paragraph explaining the purpose of the checklist. The form is divided into several sections with checkboxes and input fields:

- Review the following:**
 - Reconciliation process completed (including OIG)?
 - Location information is correct and listed in the DRUM database, including context?
 - DRUM database location and name are correct (including system ID)?
 - Location is known to project and is a reasonable location (including system ID)?
- Field Operations Plan:**
 - Under project area, expectations are identified and documented?
 - Field site data collection activities are defined, as appropriate?
 - Location information is correct and listed in the DRUM database, including context?
 - Location is known to project and is a reasonable location (including system ID)?
- Field Operations Plan:**
 - Field site data collection activities are defined, as appropriate?
 - Location information is correct and listed in the DRUM database, including context?
 - Location is known to project and is a reasonable location (including system ID)?

At the bottom, there are fields for "Field site location", "Field site date", and "Field site personnel", each with a "Save" button. The footer includes "DOE is the lead and HAVARRO is the contractor" and "Page 1 of 1".

V&V Work Plan Checklist

- The **V&V Work Plan** provides structure and procedures for V&V activities reconciliation efforts that include:
 - reconciliation to determine mine location;
 - field inventory of mine features;
 - gamma surveys;
 - environmental sampling; and
 - risk scoring assessments to determine physical hazards, and potential chemical and radiological risks posed by a mine.

Standing up the DRUM Program:

DRUM Program Documents (continued)

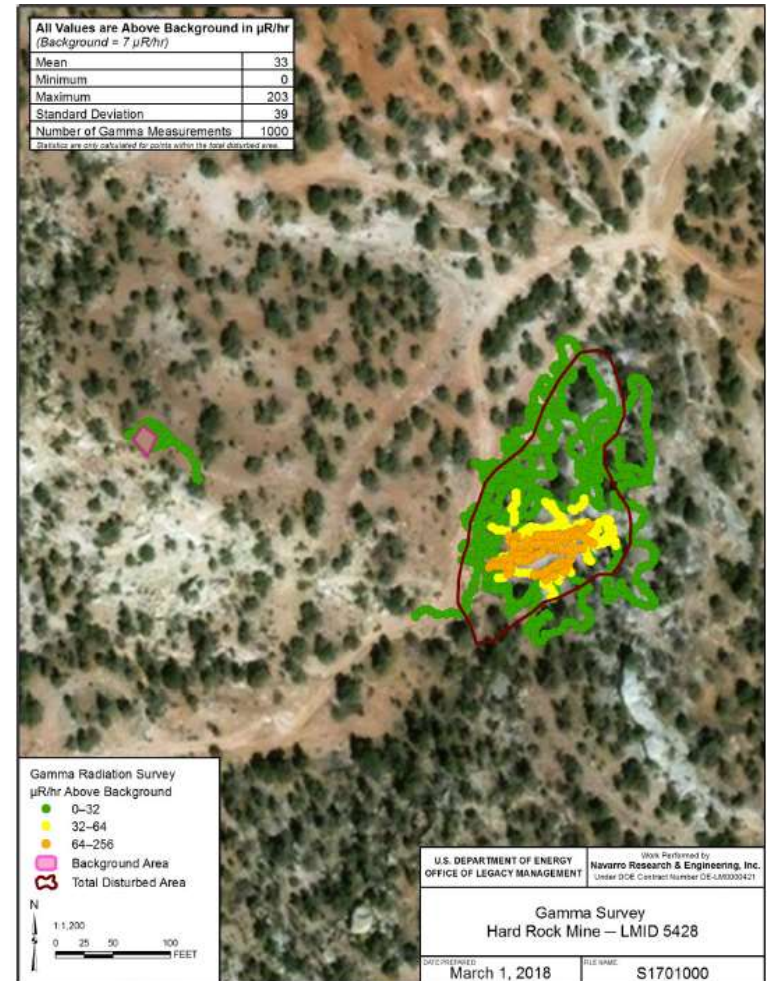
- The **Health and Safety Plan Analysis** identifies hazards and procedures for site workers performing field activities.
- The **Quality Assurance Program Plan** presents steps to ensure that data collected are of correct type and quality.
 - Reinforces management's commitment to perform and deliver high quality services.
- The **Data Management Plan** describes data generation and use, management of the DRUM Database.
 - Data generated from field activities; quality assurance involved at each step.



Mine waste pile at Markey Mine, Red Canyon, Utah

Standing up the DRUM Program: Establishing Risk Standards

- DOE and BLM agreed to a two-week exposure over a 26-year timeframe risk scenario for radiological and chemical screening levels.
 - Screening levels only apply to mines on federal public land.
- Gamma radiation screening levels were developed by DOE and are set for screening based on different exposure standards (none, low, medium, high); chemical screening levels developed by BLM.



Hard Rock Mine: Gamma Survey

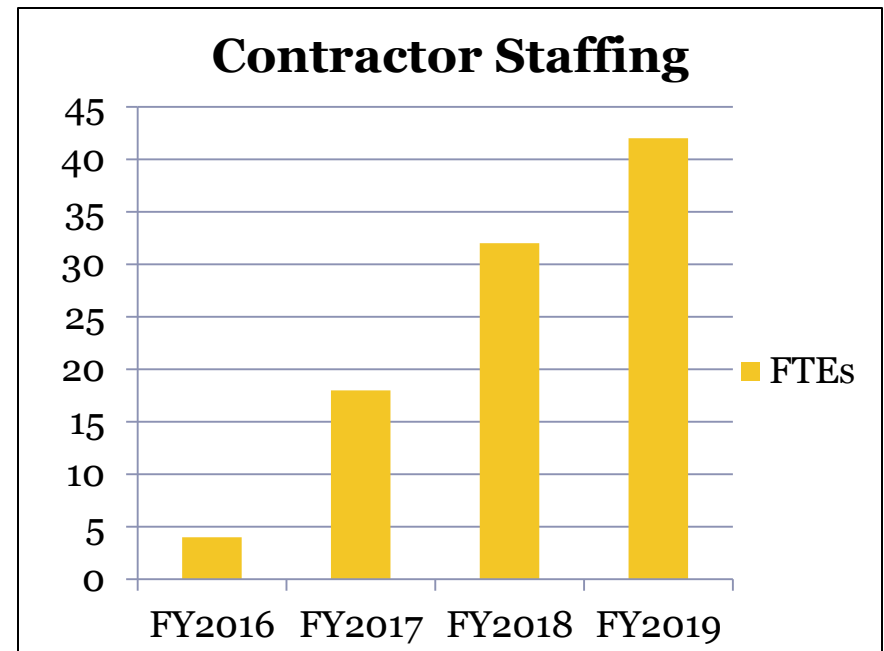
Standing up the DRUM Program:

Developing the DRUM Database

- Report to Congress database was developed from an Microsoft Excel spreadsheet; included fields such as ownership, production level, and status.
- DOE determined an upgraded database for the Program was needed to document V&V results.
- Requirements included:
 - a “permanent” IT platform so data can be archived after the Program concludes;
 - canned and ad-hoc data query and reporting capabilities;
 - the ability to eliminate multiple spreadsheets used for storing data; and
 - an ArcGIS platform for storing data collected by GPS-enabled devices.
- First database upgrade included improvements to the existing interface, database, and reporting functionality.
- Second database upgrade will add additional data fields and reporting, making it a useful tool for all project personnel.

Standing up the DRUM Program: Challenges of Ramping Up

- DOE staff grew from 1 to 4 FTE in 1 year.
- Contractor staff grew from 4 to 42 FTEs in 3 years.
- Contractor was required to hire 32 new contractor positions to accommodate work load. Personnel included:
 - radiological control technicians;
 - ecologists;
 - geologists;
 - technical report writers;
 - document management;
 - abandoned mine experts; and
 - other support staff.



Lessons Learned:

General

- Reporting without upgraded DRUM Database
 - Tracking data by spreadsheet led to errors
- Quality versus production
 - Program rolled out rapidly; three field crews hired in one year
 - Primary attention placed on production and safety
 - Less focus on training and quality assurance led to nonconformity with some work plan requirements
- Corrective Actions
 - Collected additional information at select sites that were sampled during the 2017 field season
 - Conducted extensive training on field techniques during the beginning of the 2018 field season
 - Increased management and quality assurance assessments to ensure quality and consistency will be achieved moving forward

Lessons Learned:

General (continued)

- Constantly monitor lessons learned from other sites and programs
 - Bulletin made LM sites aware of suspect counterfeit bolts
 - Safety inspection of trailers and tie-downs used to hold all-terrain vehicles discovered eight suspect bolts holding tie-downs
 - Information was disseminated regarding a recall on lithium batteries used in tough pads
 - Pulled four tough pads out of service and replaced batteries
- Conducted additional training of field personnel
 - Provided advanced wilderness first aid training
 - Provided mine safety training along with tour of underground mine teaching facility (Edgar Mine operated by Colorado School of Mines)

Lessons Learned:

Instrumentation

- First gamma unit did not have ability to observe data at the mine
 - New units purchased, allowing transects to be observed in the field
 - Units also allow for download of data onto an aerial image to ensure coverage was achieved
- Initially utilized X-ray fluorescence meter to measure waste rock samples, with goal of reducing number of analytical samples
 - Too difficult to set up a correlation for wide range of metals
 - Useful as a screening tool or to target one or two metals



XRF testing a piece of ore

Lessons Learned:

Instrumentation (continued)

- Radon daughter measurements
 - Measured radon levels at site and near mine openings
 - Many factors influenced readings
 - Opening venting in or out
 - “Fresh radon” doesn’t result in exposure levels reported
 - Generally field teams don’t work near openings where highest levels occur; additionally, field teams don’t enter mines
- Hazardous gas measurements
 - Four-gas meter used to look for low levels of oxygen, carbon monoxide, and hydrogen sulfide
 - Don’t go underground or into confined spaces; no need for monitoring
- High-volume air sampler (required portable generator) measurements for long-lived radionuclides
 - Collected enough data early on and determined not needed

Questions?



DRUM Site Tour, DOE, Navarro, and DRUM Program Partners
Southwest Colorado