# Overview of BLM Abandoned Mine Lands Program

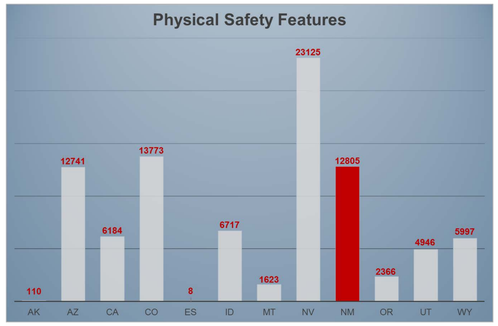
## Restoring Watersheds Impacted by Abandoned Mines, Protecting Public Safety and Liability, and Using Risk-Based Decision Making

William Auby, Abandoned Mine Lands Program Lead, BLM New Mexico

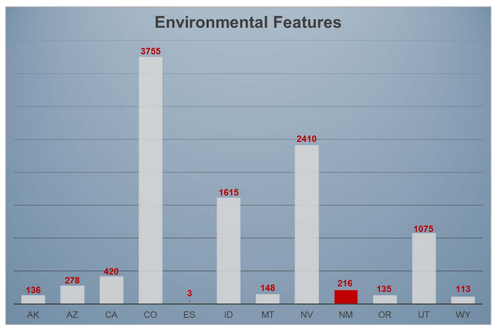
## Inventory

Inventory crews walk the area around Mining Districts collecting field data with GPS-equipped dataloggers.

Abandoned mine features and sites are recorded into the Abandoned Mine and Site Cleanup Module database. Sites are tracked from discovery to remediation and monitoring/maintenance.




Total number of abandoned mine features that pose a physical safety risk inventoried by BLM and distributed by state. 90,395 as of April 2017.




Total number of abandoned mine features that pose a potential environmental threat distributed by state. 10,183 as of April 2017.

## Risk Analysis

BLM analyzes each mine in terms of risk to human health and environment to determine if an action is needed and to rank sites. BLM evaluates each site using the recreational visitor screening assessment.

| Analyte | Background[a] | Recreational Screening Level [b] | Waste Rock Pile [c, d] | Risk Ratios Sample 1 |
|---|---|---|---|---|
| Metals (mg/kg) | | | | |
| Aluminum | 4,320 | 1,000,000 | 4,510 | 0.005 |
| Antimony (J) | 0.34 | 782 | 1.66 | 0.002 |
| Arsenic | 0.961 | 30.6 | 88.7 | 2.899 |
| Barium (J) | 167 | 390,000 | 278 | 0.001 |
| Beryllium | 0.266 | 3,910 | 0.353 | 0.000 |
| Cadmium | 0.0834 | 1,780 | 2.1 | 0.001 |
| Chromium | 4.93 | 1,000,000 | 27.5 | 0.000 |
| Cobalt (J) | 2.42 | 586 | 38.4 | 0.066 |
| Copper | 5.5 | 78,200 | 16.7 | 0.000 |
| Iron | 4,980 | 1,000,000 | 5,510 | 0.006 |
| Lead | 5.03 | 800 | 83.8 | 0.105 |
| Manganese | 255 | 46,700 | 214 | 0.005 |
| Mercury (J) | 0.00586 | 271 | 0.294 | 0.001 |
| Molybdenum | 0.0834 | 9,780 | 34.1 | 0.003 |
| Nickel | 4.72 | 39,000 | 13.1 | 0.000 |
| Selenium (J) | 0.701 | 9,780 | 34.2 | 0.003 |
| Silver (U) | 0.103 | 9,780 | 0.502 | 0.000 |
| Thallium | 0.146 | 19.6 | 2.03 | 0.104 |
| Uranium | 0.884 | 391 | 318 | 0.813 |
| Vanadium | 12.1 | 9,850 | 1,940 | 0.197 |
| Zinc | 11.6 | 587,000 | 105 | 0.000 |
| Cumulative Risk Ratio | | | | 4.210 |
| Radionuclide (pCi/g) | | | | |
| Radium-226 | 0.886 | 37-147 | 144 | |
| Soil pH | | | | |
| pH | 8.66 | none | 8.2 J | |

BLM developed screening level metal concentrations for the recreational visitor. In this example from a legacy uranium mine in Utah, the site has an exceedance of arsenic.

| Primary Hazards | | Risk Ranking | Comments |
|---|---|---|---|
| Physical Safety Hazard Evaluation | | High | Large unstable ore bin and two ore chutes |
| Human Health Risk Evaluation | Radiological | None | Mean gamma radiation is 31 µR/hr above background |
| | Chemical | Medium | Waste Rock Pile 4 has a cumulative risk ratio of 3.29 and two individual COIs with risk ratios greater than 1 |
| **Modifying Factors** | | **Risk Ranking** | **Comments** |
| Ecological and Environmental Risk Evaluation | Physical Hazards | None | No physical hazards to birds or other animals. However, the Juniper titmouse and pinyon jay were observed; potentially sensitive bat species may be present in adits with bat gates. |
| | Pathway Hazards | Medium | Migration potential of waste material was observed in the drainage. |
| Access and Suitability Evaluation | Access | High | Accessible with standard two-wheel drive vehicle and visible from a maintained road. |
| | Suitability | High | There is evidence of visitation such as footprints, the total disturbed area is 9.3 acres, and has areas suitable for camping. |
| Complexity and Magnitude Evaluation | Complexity | High | The mine has 3 open adits and 3 large unstable structures |
| | Magnitude | Not Applicable | The highest cumulative risk ratio is 3.29 for Waste Rock Pile 4. |

Additional risk factors analyzed include safety hazards, evidence of visitation and accessibility. The risk factors are then ranked qualitatively (high, medium, low, none).

## Response Actions — Physical Safety Hazards

The BLM AML program mitigates risk to humans while protecting wildlife habitat and preserving historical integrity.

**Installation of a bat cupola** – La Florida Mountains, New Mexico.

Constructing support for the riser.

Applying polyurethane foam.

Backfilling the mine shaft.

Finished bat gate.

**Other examples of closures.**

Bat gate in adit.

Wildlife-friendly mesh.

Cupola installation that preserves historical integrity.

## Response Actions — Environmental Mitigation

Abandoned mine sites are assessed for contaminants and contaminant pathways and are remediated to reduce exposure to visitors and impacts to the environment.

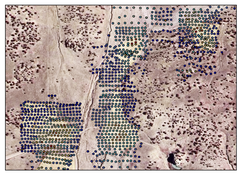
**Mine Effluent** – Example from Champagne Creek, Idaho.

Mine Effluent.

Passive water treatment using cells filled with organic debris to raise pH of water and precipitate metals.

**Contaminated Soil** – Example from Grants Uranium Belt, New Mexico.

Radiation Survey being conducted at the T-20 Mine.



Radiation Survey of the Barbara J mines.

Waste Rock Repository for the Barbara J mines.