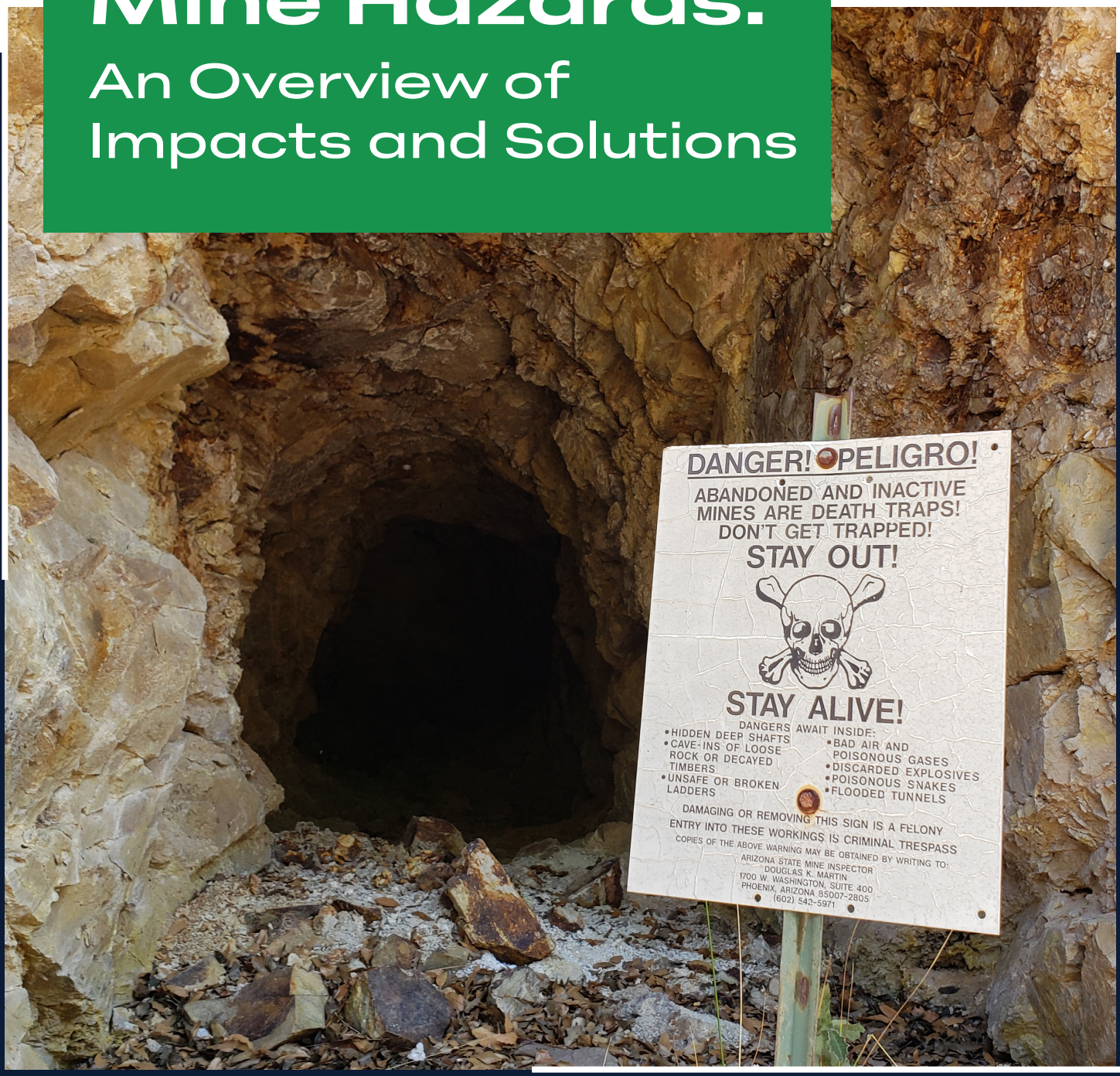
IMCC-NAAMLP

Hardrock Abandoned Mine Hazards:

An Overview of Impacts and Solutions



2025

EXECUTIVE SUMMARY

This report provides a comprehensive overview of issues related to hardrock abandoned mine lands (AML) across the United States. It outlines the diverse impacts stemming from hardrock AML sites, reviews ongoing reclamation efforts of state, tribal, and federal agencies, and identifies policy solutions to accelerate progress with reclamation.

Key Findings

- Hardrock AML Programs have demonstrated they are effective in protecting public health, restoring ecological integrity, and stimulating economic development, but efforts are constrained by insufficient funding.
- Hardrock AML programs can bolster domestic supplies of critical minerals by helping to identify and facilitate recovery of resources in mine waste at AML sites.
- There are an estimated 1.8 million hardrock AML features nationwide. Of these, it is estimated, at least 750,000 pose immediate safety hazards and tens of thousands degrade the environment.
- IMCC and NAAMLP estimate the minimum cost to mitigate all physically dangerous hazards is estimated at $11 billion, and to remediate all environmentally damaging hazards, an estimated $50 billion or more.
- The Abandoned Hardrock Reclamation (AHMR) grants program has made good progress developing a framework for a national strategy for hardrock AML reclamation. The program is now ready to be fully funded.

Key Recommendations

- Develop a comprehensive national strategy to accelerate hardrock AML reclamation.
- Secure appropriate funding for hardrock AML work e.g., through the allocation of excess claims maintenance fees to the AHMR program.
- Empower state and tribal hardrock AML programs to assume primary responsibility for reclamation activities, leveraging their localized expertise and understanding.
- Set the AHMR program up for long-term success through strong collaboration with states and tribes, a broad and inclusive scope, streamlined administrative processes, and continued effective federal management by the Office of Environmental Policy and Compliance (OEPC).
- Continue support for the development of a comprehensive national inventory of hardrock AML sites by the United States Geological Survey (USGS).
- Establish a permanent "Good Samaritan" program to facilitate water pollution remediation at hardrock AML sites by states, tribes, and qualified third-parties like conservation groups and the mining industry.
- Facilitate the recovery of critical minerals from AML mine waste, contributing to domestic supply chain resilience.

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Abandoned building at Silver King Mine, Park City, Utah

GLOSSARY OF TERMS & ACRONYMS

Please note: there are many terms used in AML work that refer to the same or similar things. For this report, we have attempted to use the most self-explanatory, common terms.

Acronyms Used In The Report:

AHMR - Abandoned Hardrock Mine Reclamation Program

AML - Abandoned Mine Lands

BLM - Bureau of Land Management

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

DRUM - Defense Related Uranium Mines Program

EPA - Environmental Protection Agency

GAO - Government Accountability Office

IIJA - Infrastructure Investment and Jobs Act

IMCC - Interstate Mining Compact Commission

MRDS - Mineral Resource Data Systems

NAAMLP - National Association of Abandoned Mine Land Programs

NPS - National Park Service

OEPC - Office of Environmental Policy and Compliance

SMCRA - Surface Mining Control and Reclamation Act

USFS - United States Forest Service

USGS - United States Geological Survey

USMIN - USGS mineral deposit database project

Terms Used In The Report:

Abandoned Mine Lands (AML) - Former mining or quarrying operation that is no longer in use and that predates modern regulations with no responsible entity to finance the cost of reclamation.

AML Feature - Individual remnant of a site, such as a highwall cliff, mine portal, or mine drainage; one AML site will typically include multiple features.

AML Hazard - Feature that is impacting or poses a threat to public safety, public health, and/or the environment.

AML Inventory - Database containing information on the locations and characteristics of known AML sites, features, and hazards.

Critical Minerals - Minerals deemed to be especially vital to the economy, national security, and/or important technologies and which may be subject to supply chain vulnerabilities.

Good Samaritan - Person or group, such as a conservation NGO or mining company, with no connection to an AML site that engages in efforts to reclaim the site.

Hardrock Minerals - Solid minerals extracted from “hard rocks”, such as precious metals; for the purpose of this report, hardrock minerals include all minerals other than coal, as is the case for the federal AHMR program.

Reclamation/Remediation - Returning an AML site to as safe, stable, and natural a condition as possible including addressing any physical safety, public health, and/or environmental hazards. The term "remediation" is often used to refer specifically to eliminating or reducing hazards to public health and the environment, but in this document, the term "reclamation" is typically used to refer to both physical safety and public health and environmental hazard reclamation/remediation.

ABOUT NAAMLP AND IMCC

More information can be found at: www.naamlp.com and IMCC.isa.us

The National Association of Abandoned Mine Land Programs (NAAMLP) fosters cooperation and communication among state and tribal AML programs to support the reclamation of lands impacted by abandoned mines. NAAMLP currently includes 30 states and 3 tribes, with membership open to any state or tribe engaged in AML reclamation efforts. By promoting collaboration and sharing resources, NAAMLP helps address public health, public safety, and environmental concerns, such as polluted water and unstable ground, while encouraging the practical reuse of these areas to the benefit of local economies. The organization is focused on improving both the environment and the communities affected through efficient, effective reclamation practices.

The Interstate Mining Compact Commission (IMCC) is a multi-state governmental organization that supports the natural resources, related environmental protection, and mine safety and health interests of its member states. IMCC offers a strong, united voice for its member states with Congress and the federal agencies. Currently, there are 27 member states and membership is open to any state interested in joining the IMCC. Semi-annual commission meetings and state workgroups provide regular opportunities for IMCC’s member states to learn from one another, discuss challenges, and collaboratively develop solutions. IMCC is contracted by NAAMLP to provide legislative and regulatory affairs support.

INTRODUCTION

Abandoned mill site in Lousia County, VA

Abandoned mine lands (AML) are the legacy of mining operations conducted before modern environmental regulations. They are present in every region of the country and impact surrounding communities and ecosystems in numerous, significant ways:

- **Public Safety Risks** – Unsecured AML sites present physical dangers, including unstable highwall cliffs, open mine shafts, and collapsing ground (called subsidence).
- **Environmental Damage** – Contaminated runoff from AML sites pollutes drinking water supplies and leaves affected lands and waters unable to support life.
- **Economic Challenges** – AML sites damage homes and businesses, lower property values, deter investment and tourism, and hinder job creation and agriculture.

This report provides a comprehensive overview of the United States' hardrock AML problem. It draws on the long-standing experience and expertise of state and tribal AML programs to examine the types and distribution of AML impacts and the funding and policies needed to eliminate the problem. Its findings are informed by data collected through IMCC surveys of states and tribes.

Open mine shaft at Exposed Reef Mine in Santa Cruz County, Arizona

Though definitive information on the full scope and cost of hardrock AML remediation remains limited, the available data clearly demonstrates the severe and widespread nature of this public safety, public health, and environmental concern. NAAMLP and IMCC estimate there are 750,000 physical safety hazards and 100,000 or more public health and environmental hazards across the country. Reclaiming all physical safety hazards will cost an estimated $11 billion, and to reclaim all public health and environmental hazards, as much as $50 billion.

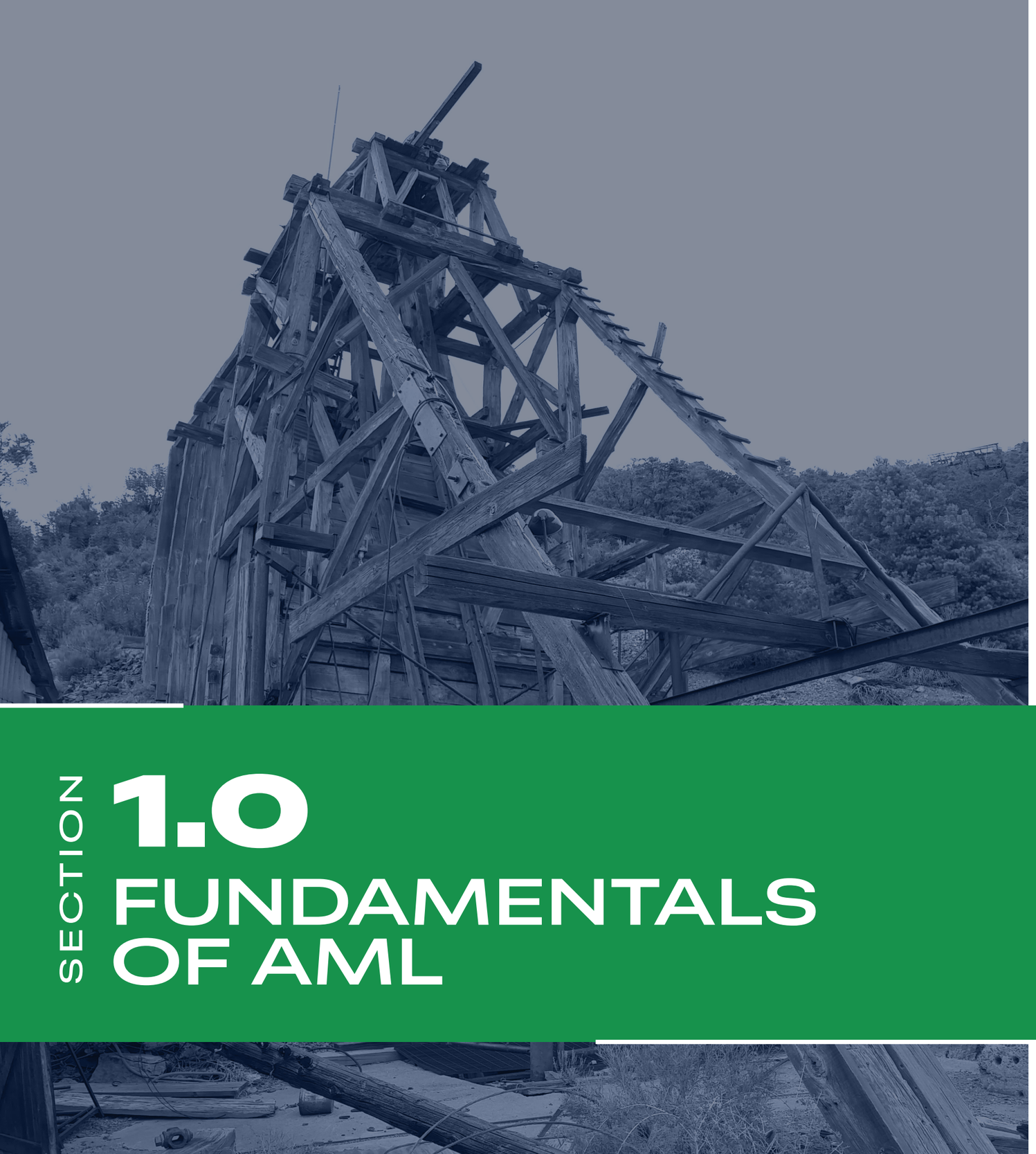
A commitment to AML reclamation efforts reflects our Country's shared goal of ensuring our natural resources support future generations. Reclaiming AML hazards ensures that the communities living near them - who have for decades, in some cases centuries, supported the Country's need for minerals - can move forward with the safe landscapes, clean water, and vigorous economic growth they deserve.

Note: this report concentrates on state hardrock AML programs because states constitute the majority of the membership of IMCC and NAAMLP and, consequently, the authors of this report possess the most direct expertise and insight into the circumstances of state hardrock AML programs.

Acid mine drainage at Pennsylvania Mine in Summit County, Colorado

This Report should make clear that:

1. Support for hardrock AML reclamation efforts should be a national priority.
2. State and tribal AML programs are in place and ready to accomplish great things once appropriate funding and policy support is provided.



SECTION

1.0 FUNDAMENTALS OF AML

1.1 Defining Hardrock AML

Abandoned mine lands (AML) are generally defined as unreclaimed mine sites that predate modern environmental regulations. Most of these sites date back to the 1800s or early 1900s. However, the exact definition of an AML can vary based on when environmental regulation was implemented. The term "hardrock" refers to certain types of minerals. In this report, "hardrock" includes all noncoal minerals.

DID YOU KNOW?

Modern mining is subject to strict regulation, with requirements varying based on the mineral, location, and regulatory framework. In the latter half of the 20th century, significant federal laws shaped mining regulations, including:

- **Clean Air Act (1963)**
- **National Historic Preservation Act (1966)**
- **National Environmental Policy Act (NEPA) (1969)**
- **Clean Water Act (1972)**
- **Endangered Species Act (1973)**
- **Safe Drinking Water Act (1974)**
- **Federal Land Management Policy Act (FLPMA) (1976)**
- **Resource Conservation and Recovery Act (RCRA) (1976)**
- **National Forest Management Act (1976)**
- **Surface Mining Control and Reclamation Act (SMCRA) (1977)**
- **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (1980)**

Ore Loadout, Lincoln County Nevada

The implementation of FLPMA required mine operators to reclaim federal lands post-mining, supported by financial bonding to ensure reclamation even in cases of bankruptcy. These federal regulations, along with state-level counterparts, have made modern mines largely self-reliant for reclamation, minimizing the need for government intervention. By the 1990s, most states had adopted robust regulatory and bonding systems. For example, Nevada holds roughly $4.2 billion in reclamation bonding for active operations.

Hardrock AML Definition

The U.S. Department of Interior's (DOI) Office of Environmental Policy & Compliance (OEPC) provides the following more in-depth definition of hardrock AML as part of its recently established Abandoned Hardrock Mine Reclamation (AHMR) program.

Land or water resources that were (A) used for, or affected by, hardrock mining activities; and (B) abandoned or left in inadequate reclamation status prior to the enactment of [the Infrastructure Investment and Jobs Act (IIJA)], or land for which the Secretary makes a determination that there is no continuing reclamation responsibility of a claim holder, liable party, operator, or other person that abandoned the site prior to completion of required reclamation under Federal or State law. [IIJA Section 40704(a) and (c)].

For the purposes of IIJA Section 40704, "hardrock Abandoned Mine Lands (AMLs)" are defined as: Federal, State, Tribal, local, and private lands and water resources that contain one or more sites or features resulting from the past exploration, development, mining, or processing of any solid minerals, excluding coal, and associated facilities. Such sites or features may include, but are not limited to, disturbances resulting from prospecting for or extraction of minerals; stockpiles, processing locations, shafts, adits, open pits or prospect pits/trenches, waste rock piles, and tailings piles; roads and other areas of disturbance such as highwalls; and associated structures and equipment, such as buildings, headframes, and tools that are incident to mining, mineral extraction, or mineral exploration activities.

A hardrock mine site or feature is determined to be "abandoned" when exploration, development, mining, reclamation, maintenance of facilities and equipment, and other operations have ceased with no evidence demonstrating that the owner, operator, or other party intends to resume mining or any other activities. Similarly, a hardrock AML is determined to be "left in inadequate reclamation status" when the previously conducted reclamation is no longer adequate and there is no other statutory or regulatory requirement for the mining claimant, operator, or other entity to conduct any additional reclamation activities.[1]

1 Office of Environmental Policy and Compliance. (2024). Abandoned Hardrock Mine Remediation: Annual Report. Pg. 6.

Abandoned mine site with associated buildings, Lincoln County, Nevada

1.2 Most Common Types of Hardrock AML

The types of minerals associated with hardrock AML hazards vary significantly by region, each presenting unique environmental and public safety challenges. In Western states, hardrock AML hazards are commonly linked to precious metals, zinc, lead, and, in some cases, uranium—many of which pose serious risks of heavy metal contamination in soil and water. East of the Rocky Mountains, Hardrock AML hazards are frequently associated with limestone, sand, gravel, and other industrial minerals. These sites present risks including land subsidence, unstable mine openings, and degraded ecosystems.

Table 1 outlines the most common minerals found at hardrock AML sites in states that responded to IMCC surveys.

** Includes Sand, Gravel, and other Industrial Minerals*

1.3 Types of Hardrock AML Features & Hazards

A single AML site may include one or more AML features that are considered physical or environmental hazards. Physical hazards are a risk to public safety, while environmental hazards are a risk to public health and the environment. For example, a site may contain an open mine shaft (physical hazard) in addition to a mine waste pile (environmental hazard) spilling downhill below the shaft, which would be counted as two separate features. The number and type of AML features present at AML sites differs widely due to factors including mineral type, local conditions, and the size of the mine. For instance, a copper mine in Arizona may have vastly different water chemistry impacts than a stone quarry in New York.

> *The number and type of AML features present at AML sites differs widely due to factors including **mineral type**, **local conditions**, and the **size of the mine**.*

PHYSICAL HAZARDS VERSUS PUBLIC HEALTH AND ENVIRONMENTAL HAZARDS

Physical Hazards include:

- Openings in the ground that people and animals can fall into
- Falling rock inside old underground mine workings
- Collapse of old underground mine workings or unmaintained structures
- “Bad air” made up of toxic gases and lacking oxygen
- Old and unstable explosives
- Unmaintained surface waters (i.e. ponds or pits) or flooded mine workings that are a drowning hazard

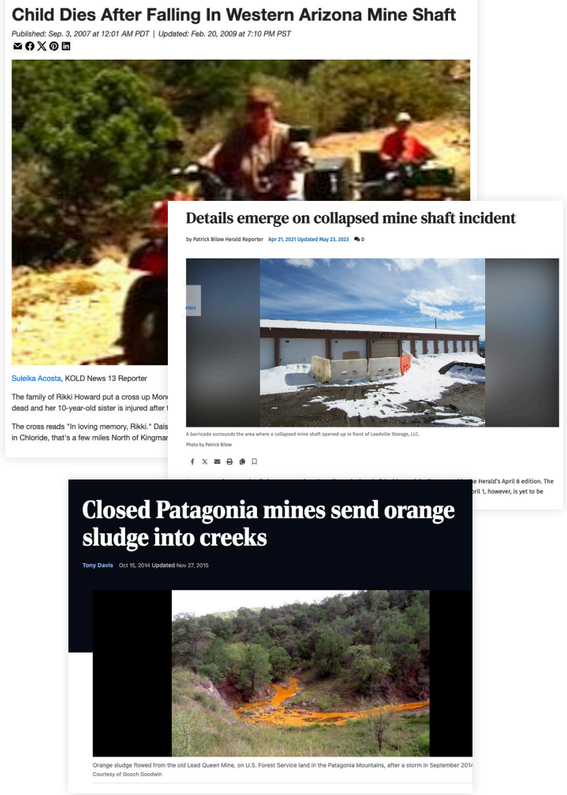
Public Health and Environmental Hazards include:

- Drainage of water through mines and tailings elevating heavy metals content in surface water and groundwater to the point they are unable to support life (known as "Acid mine drainage" (AMD))
- Releases of hazardous chemicals from ore processing and mineral extraction equipment and tailings impoundments
- Transport of contaminants during rain or snow melt
- Ingestion or inhalation of airblown radioactive materials that emit alpha, beta and gamma radiation
- Uptake of radioactive materials in wildlife that impacts the food chain or water supply

The most common types of AML features are listed and described in the following pages, including the types of hazards they pose to people and the environment. Table 2 outlines the most common AML hazards reported by states that responded to IMCC surveys, and Table 3 shows the estimated percentage of AML sites posing physical hazards and/or environmental hazards, as reported by states in IMCC surveys.

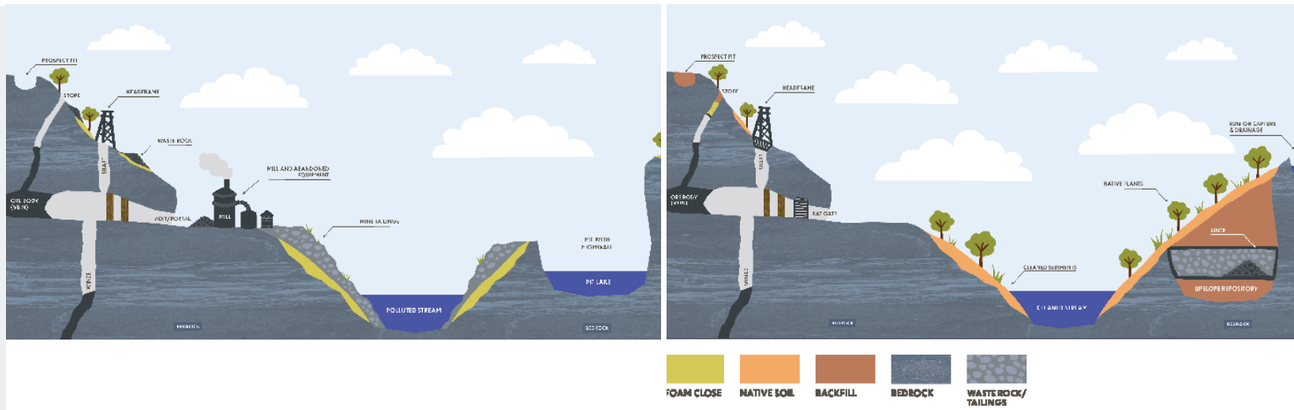
Mine Openings and Underground Workings

- Adits/Portals – horizontal entries into mine workings
- Tunnels – horizontal workings with at least two openings
- Inclines and Declines – angled entrances and trenches into mine workings
- Stopes – an underground, upward cut into ore or rock, typically utilizing gravity to move material down to a haulage area



Left: Before reclamation at an abandoned mine site.

Right: After reclamation at an abandoned mine site.



Highwall

- Vertical to near vertical surface feature cut into rock or earth, typically by blasting

Waste Rock and Tailings

- Waste Rock - rock removed from the mine but not processed through a mill that is generally low in ore content
- Tailings - left-over materials from processing mined ore

Open Pits

- Large surface excavations that may include multiple highwalls or former quarries

Abandoned Equipment

- Mining equipment or former processing facilities, an infinitely variable category of structures and industrial equipment
- Decomposing explosives that become more unstable and hazardous over time and are absorbed into surrounding materials resulting in highly hazardous storage situations; arid environments can lead to higher risk of static discharge creating sparks with improper grounding of storage

Subsidence

- Settling of earth into void space left by mine workings, creating sinkholes

Water Pollution/Acid Mine Drainage

- Heavy metal contamination of water moving through the AML site from processing facilities, tailings ponds, and/or waste rock piles
- Water draining from mine workings that have low pH or contain a variety of contaminants

Chemical Contamination

- Radiation from uranium, vanadium, radium, and other radioactive materials
- Hazardous chemicals left on site after processing such as cyanide, arsenic, mercury, and acids

Dangerous Waterbodies/Impoundments

- Water-filled pits, tailings ponds, or other mine-related reservoirs

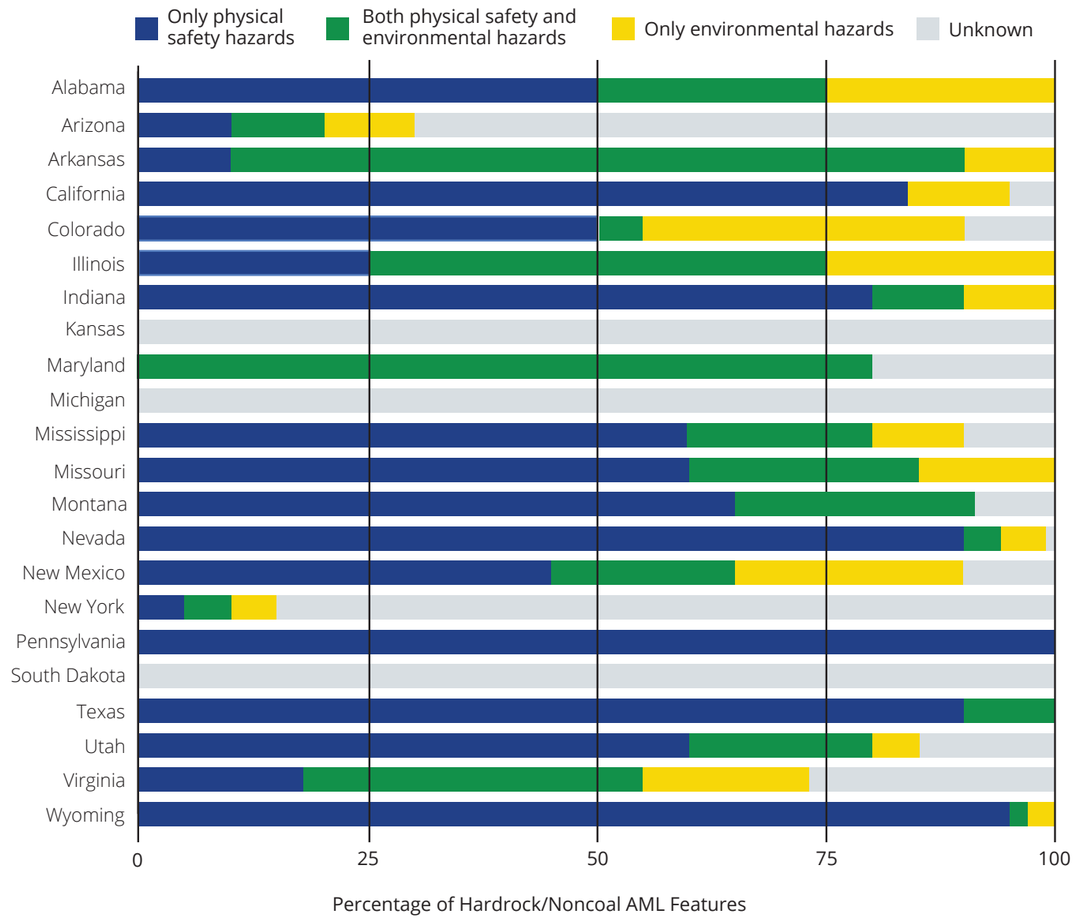
Sedimentation/Erosion

- Movement of contaminated sediment at the AML site due to run-off from rain or snowmelt

TABLE 2: COMMON TYPES OF HARDROCK AML HAZARDS, BY STATE

State	Mine Openings/ Underground Mine Workings	Highwalls	Waste Rock / Tailings	Open Pits	Abandoned Equipment	Subsidence	Water Pollution / Acid Mine Drainage	Chemical Contamination	Dangerous Water Bodies / Impoundments	Sedimentation & Erosion
AL		•		•	•					
AZ	•		•		•	•	•		•	•
AR		•	•				•		•	
CA	•	•	•				•	•		•
CO	•		•				•			
ID	•		•		•		•			•
IL		•	•				•			
IN		•	•		•					
IA						•				
KS		•				•				
ME	•	•								
MD		•							•	•
MI	•		•	•		•				
MS		•								•
MO	•	•	•	•		•				
MT	•				•	•	•			
NV	•	•	•	•	•		•	•		
NJ	•	•								
NM	•	•	•	•		•				
NY	•	•	•	•			•		•	•
NC						•				
OH		•				•				
OK	•	•	•						•	
OR			•				•			
PA		•	•			•			•	
SD	•	•	•			•	•			
TN				•						
TX	•									
UT	•		•	•		•		•		•
VA	•	•	•	•	•	•	•	•	•	•
WV				•						
WY	•	•	•	•		•			•	•

TABLE 3: PERCENTAGE OF HARDROCK/NONCOAL AML FEATURES POSING PHYSICAL HAZARDS AND/OR ENVIRONMENTAL HAZARDS



SECTION

2.0 BENEFITS OF RECLAIMING AML SITES

2.0 Benefits of Reclaiming AML Sites

Reclaiming hardrock AML hazards delivers significant public safety and health, environmental, and economic benefits. Safe, clean, productive land and water resources are at the core of what any community needs to thrive. Reclaiming AML sites also serves broader national interests such as access to domestic supply of critical minerals.

2.1 Public Safety Benefits

Abandoned hardrock mines pose serious public safety and health risks. These dangers are often hard to avoid. They may be hidden by vegetation or sediment, can collapse suddenly, or the danger may be invisible, as with toxic air inside a mine. The primary goal for an AML program is typically eliminating these kinds of public hazards, e.g. by sealing and stabilizing mine openings.

Above: Rescue operation at open mine shaft in Boulder County, CO.
Below: Sealed mine shaft in Boulder County, CO.

DID YOU KNOW?

In September 2021, the Boulder County, Colorado Sheriff's Office was called to the scene of an abandoned mine along the popular Switzerland Trail to conduct a rescue operation for a 19-year-old that had fallen into a mine shaft. Upon arrival, rescuers found the individual trapped nearly 45 feet below the surface. The individual was successfully rescued from the mine shaft following a more than 3 hour ordeal.

The Colorado Division of Reclamation, Mining and Safety (CDRMS) was contacted by Boulder County following the rescue to provide assistance in addressing this and other potential abandoned mine hazards in the area located on both private and federal lands, highlighting the complexity of land ownership in areas impacted by historic hardrock mining.

That same year, CDRMS secured funding and landowner consent to move forward with a project to safeguard 24 hazardous mine features in what would become the Bald Mountain Project. The Bald Mountain Project was completed in 2022, resulting in 24 physical safety closures around the popular Switzerland Trail, significantly reducing risk to public safety and generating increased community awareness of the hazards associated with abandoned hardrock mines.

2.2 Public Health & Environment Benefits

AML sites can leave behind barren landscapes and toxic waterways, where water draining through mine workings and mine waste becomes laden with harmful chemicals and other pollutants. Without intervention, these sites will continue to degrade the local environment indefinitely. AML programs redirect or treat water affected by AML sites to restore water quality and revitalize habitats, bringing once-lifeless areas back to productive use. AML programs take care to reclaim AML sites in a way that preserves their benefits to wildlife, e.g., where they serve as shelter for bats or desert tortoises.

Efforts to restore AML polluted water are constrained both by limited funding and by the lack of a Good Samaritan program. More information can be found in *Section 8.5, Establish Protections for Good Samaritan AML Cleanups*.

Acid Mine drainage in Louisa County, VA

Tailings and acid mine drainage at New Idria Mercury Mine, Superfund site in San Benito County, California

DID YOU KNOW?

Pinto Creek in Arizona is a 33-mile intermittent stream that flows into Roosevelt Lake, which is highly recreated and provides drinking water to the Phoenix Metropolitan Area. The upper half of the creek is located on the Tonto National Forest. The watershed is home to ranchers, animals, and plants, including threatened and endangered species like the Mexican spotted owl and yellow-billed cuckoo.

Beginning in 2001, Arizona Department of Environmental Quality (ADEQ) identified six hardrock AML sites contributing to heavy metals in Pinto Creek, which negatively impacts drinking water for both people and animals. Between 2006 and 2023, ADEQ, the U.S. Forest Service (USFS), contractors, and private landowners forged relationships to catalyze clean-ups at these sites.

Project highlights include:

- Removing 100,000 tons of mine-impacted soils
- Aggregating 8,340 cubic yards of waste rock in 5 onsite consolidation cells
- Closure of 10 adits and 5 shafts with waste rock, polyurethane foam, bat-friendly grates, and/or wire-mesh grids
- Revegetation of 6.5 acres of disturbed areas using USFS-approved native seed mix

With the reclamation of these six AML sites complete, the upper segments of Pinto Creek are now meeting protective water quality standards. Reclamation was successful in restoring the health of this important Arizona water.

2.3 Economic Benefits

Hardrock AML hazards hinder economic development and activity, depress property values, and strain public resources. For example, mine drainage contaminates water supplies—especially precious in the arid Western U.S.—and underground mine workings cave-in and collapse homes, businesses, and roads. AML programs transform these liabilities into assets, revitalizing AML-impacted land and water while preserving mining heritage, fosters economic growth, creates jobs and new business opportunities, and makes historic mining communities better places to visit and to live.

Street-view of reclaimed AML site in San Jose, CA, from Google Earth 2025

DID YOU KNOW?

In 2022, the City of San Jose, California, successfully remediated the historic Hillsdale Mine, which was inactive for nearly 150 years. Located in a densely populated urban area with a pressing need for affordable housing, the site posed significant environmental and public safety challenges.

To effectively mitigate environmental hazards, mine-impacted soils were strategically buried 10 to 60 feet below the surface of a city road, ensuring long-term containment of contaminants. This thorough reclamation effort paved the way for the development of a vibrant, transit-oriented urban village featuring 1,000 affordable housing units—directly advancing the city's Housing Crisis Workplan.

By transforming a once hazardous, underutilized site into a thriving community, this project not only safeguarded public health and the environment but also contributed to sustainable urban growth and expanded housing opportunities for residents.

2.4 Recovering Critical Minerals

Critical minerals present in mine waste at AML sites present a valuable opportunity to bolster domestic supply of resources vital to modern technology and national security. Congress has in various ways acknowledged the need to take advantage of this opportunity. For example, in the Energy Act of 2020, Congress authorized the United States Geological Survey (USGS) to assess potential sources of critical mineral resources, including those at AML sites.[2] Additionally, the Good Samaritan Remediation of Abandoned Hardrock Mines Act of 2024 will help to make critical mineral recovery from AML sites (under certain allowable conditions) more financially viable, which will help fund current and future cleanup efforts.[2]

State AML programs will be essential as efforts to recover critical minerals from AML mine waste continue to develop. They possess the most detailed knowledge of the locations, characteristics, and historical records of abandoned mine sites within their jurisdictions. They often manage or have access to these sites and can help to facilitate research, sampling, and technology testing. They have the experience in water treatment, waste management, and land reclamation at AML sites that is needed to address environmental concerns while accomplishing critical minerals recovery. They can also partner with the many universities working to develop recovery and reprocessing technology, for example, The University of Arizona, Colorado School of Mines, Penn State University, and West Virginia University.

2 https://www.congress.gov/crs-product/R48005
Abandoned Hardrock Mine Remediation: Annual Report. Pg. 6.

Mine tailings at Caselton mine and mill site in Lincoln County, Nevada

DID YOU KNOW?

Re-mining" is another potential opportunity for reclamation of AML sites and access to critical minerals. AML sites sometimes contain critical minerals resources that were left behind during historic mining but could now be recovered due to advances in mining and processing technologies. (For example, Perpetua Resources Stibnite Gold project[hyperlink:https://acrobat.adobe.
idurn:aaid:sc:va6c2:85bb3432-
456e-bbb1-1b32c291d7ef]).
n a company re-mines such a site,
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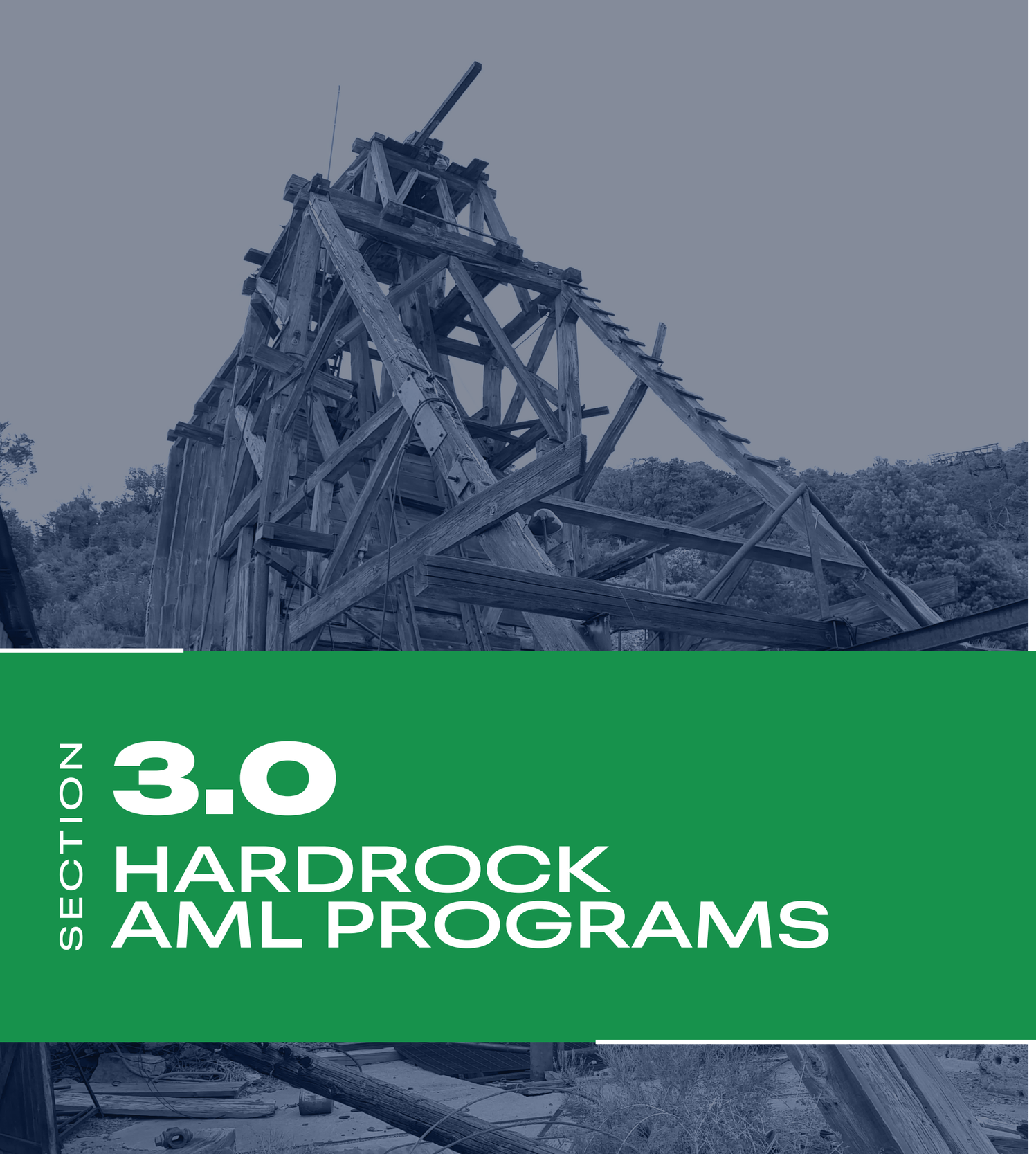


SECTION 3.0 HARDROCK AML PROGRAMS

3.0 Hardrock AML Programs

Hardrock AML hazards are reclaimed primarily through a network of state, federal, and tribal agencies. These agencies generally have their own distinct goals and funding sources, though there is often cooperation between them. Federal agencies often enlist state AML programs to conduct AML projects on federal lands located within their state.

Hardrock AML programs serve a crucial role. They regularly respond to calls from the public reporting AML emergencies or inquiring about how to address an AML problem on their land or in their community. They are often the only source of relief available for AML-related problems, which can be truly devastating, such as when a home or highway collapses due to subsidence of a mine void underneath.

> ***Hardrock AML programs are often the only source of relief available for AML-related problems.***

AML programs do all the things necessary to address the many types of problems caused by hardrock AML hazards. They identify and investigate AML sites, work directly with citizens, communities, and other stakeholders to understand and prioritize AML problems, design and permit projects to fix the problems, manage the construction of those projects, and then when the project is finished and the problem is resolved, monitor and maintain sites in the long term.

Hardrock AML programs do all of this without a national source of funding, forced to rely instead on a patchwork of discrete, often uncertain sources of federal and state funding. There has recently been promising progress toward the kind of national hardrock AML grant funding framework that is needed to fulfill the tremendous need that exists for hardrock AML work throughout the United States. The following sections will discuss the state, federal, and tribal hardrock AML programs that currently exist and the outlook for a national hardrock AML strategy through OEPC's promising new Abandoned Hardrock Mine Remediation (AHMR) grants program.

3.1 State Hardrock AML Programs

State AML programs are the primary agencies for reclaiming abandoned hardrock mines on private and state lands and often work cooperatively with federal agencies on federal lands. Many states have a single agency that deals with all types of hardrock AML hazards within their jurisdiction, from addressing public safety risks like open adits and shafts to mitigating environmental concerns such as acid mine drainage. In some instances, states have multiple agencies dedicated to specific types of AML impacts. The states' on-the-ground experience with the AML problems within their borders makes them the ideal candidates to lead reclamation efforts using federal funds. A state-led approach for a national hardrock AML strategy would mirror the very successful structure of the coal AML program under Title IV of the Surface Mining Control and Reclamation Act (SMCRA).

Funding for state hardrock AML programs is limited and often inconsistent, typically patched together from a variety of sources. There are a few states, like California, Nevada, and Virginia, with longstanding programs dedicated wholly to addressing hardrock AML and which are funded by state appropriations and/or specific taxes and fees. There are also a number of states, like Colorado, Montana, New Mexico, and Wyoming, with 40+ year old AML programs that are able to utilize a small portion of their SMCRA TItle IV funding on hardrock AML hazards. There are also a number of states, like Michigan and New York, that have state agencies capable of and motivated to address their significant hardrock AML problems but have no funding currently available for that purpose. According to IMCC surveys, the average five-year budget for state hard rock AML programs is only $1.8 million and one third of these programs have no regular budget for hardrock AML at all. The states are making the most of the funding available to them, but the scope of what they can accomplish is greatly hindered without more funding.. For example, Nevada estimates that it would take nearly 120 years to reclaim its AML safety hazards at current funding rates.

DID YOU KNOW?

The Surface Mining Reclamation and Control Act (SMCRA) of 1977 is the primary federal law in the United States that governs the regulation of coal mining. Title V of SMCRA regulates active coal mines by setting minimum federal performance standards and requiring mining companies to obtain permits and post bonds to ensure that reclamation occurs. Title IV of SMCRA established an AML Fund financed by a per-ton fee on mined coal, the "AML fee", which is distributed to state and tribal programs to reclaim lands and waters damaged by coal mining prior to the law's passage.

SMCRA utilizes a “state primacy” approach, placing state and tribal AML programs in the lead role in addressing AML impacts within their borders. These state and tribal coal AML programs have become an indispensable benefit to historic coal communities throughout the country. They have restored over a million acres of dangerous coal AML sites and restored hundreds of miles of AML polluted streams over their more than 40-year history. Recognizing the critical role played by these programs, in 2021, the Infrastructure Investment and Jobs Act (IIJA) reauthorized the AML fee through 2034 and provided a significant injection of additional coal AML funding to be distributed to states and tribes through 2036.

The vast majority of funding derived from the SMCRA AML fee is devoted to coal AML sites, but, recognizing there is equal danger posed by hardrock AML sites, SMCRA allows for AML fee-sourced funding to be used on reclamation of hardrock AML hazards under certain conditions. (This does not apply to the additional coal AML funding provided by the IIJA). The amount of funding able to be directed to hardrock AML hazards through the AML fee is very limited, but is helpful to states and tribes that are able to make use of it. However, there are many states with major hardrock AML impacts, such as Arizona, California, and Nevada, that do not benefit from this source of hardrock AML funding because they are not eligible to receive AML fee funds.

In the absence of an adequate national source of hardrock AML funding , states have done their best to find other ways to accomplish hardrock AML work, though these opportunities are also limited and only fulfill a fraction of the need. Examples of partners and alternate sources for hardrock AML funding utilized by state hardrock AML programs include:

- Collaboration with federal agencies for hardrock AML hardrock sites on federally owned lands…
  - » *Example: Western states often collaborate with BLM on reclamation of hardrock AML on federal lands, with BLM providing funding and obtaining permits and approvals and the state AML program designing and executing the project.*
  - » *Example: Virgina regularly collaborates with NPS on the reclamation of hardrock AML hazards in federally owned parks, focusing on areas heavily visited by the public.*
- Landowners or land managers meeting local, state, or federal human health protection statutes, regulations, and permit requirements that address water quality, stormwater runoff, soil contamination levels, or blowing dust from the site.
- Federal Brownfields program grants and technical assistance to communities, states, tribes, and others to assess, safely clean up, and sustainably reuse contaminated properties.
  - » *Example: Gambonini Mercury Mine in Marin County, California was reclaimed by the San Francisco Bay Regional Water Quality Control Board and USEPA Region 9 under the Superfund Program.*
- CERCLA-like state programs created to address sites that do not meet the level of Superfund requirements and are funded by the state.
  - » *Example: Tailings and impacted soils were addressed by the state Water Quality Assurance Revolving Fund in Klondyke, Arizona.*
- Voluntary cleanups of communities impacted by historic mining activities funded by industry partners.
  - » *Example: In Arizona, soil impacted from a smelter constructed in 1915 and shut down fully in 1950 was removed from more than 600 properties, including residential.*
- Conservation and Community Groups that identify and cleanup high priority sites utilizing state and federal grants or private funding.
  - » *Example: Since 2006, Trout Unlimited has restored almost 200 miles of stream habitat for trout, salmon, and steelhead that was degraded by abandoned mines in six western states.*
- Fees on modern mining or industrial activities to fund reclamation projects.
  - » *Example: California applies a per ounce fee to gold and silver mined in the state to fund reclamation of mines abandoned prior to modern reclamation and bonding laws.*
  - » *Example: Virginia uses interest earned on the Mineral Reclamation Fund, a self-bonding program for permitted mine sites, for the reclamation of AML Hardrock sites.*

> ***State AML programs are the primary agencies for reclaiming abandoned hardrock mines on private and state lands and often work cooperatively with federal agencies on federal lands.***

3.2 Federal Agencies Addressing Hardrock AML

There are a number of federal agencies that address hardrock AML problems. The federal land management agencies—Bureau of Land Management (BLM), National Park Service (NPS), U.S. Forest Service (USFS)—have programs to address AML problems on the lands they manage. (It is important to emphasize that the federal land management agencies can only address hardrock AML hazards on federal lands; hazards on private and state lands must be addressed by state agencies). The Environmental Protection Agency (EPA), Department of Energy (DOE), and United States Army Corps of Engineers (USACE) each have programs that address certain types of hardrock AML problems. Federal agency hardrock AML work is sometimes funded in their annual budgets and sometimes through special appropriations. This funding is very limited compared to the need.

Bureau of Land Management (BLM)
The BLM AML program addresses physical safety and environmental hazards associated with abandoned hard rock mines on BLM-managed public lands. This includes acid mine drainage, waste rock, mill tailings, retort waste, steep slopes, adits, raises, settling ponds and more[3]. The BLM utilizes appropriated AML funding along with appropriated mining law funds to discover, restore, and sustain AML sites using a risk-based approach to prioritization. BLM's budget from AML work has ranged between $38.5 million and $67.1 million over the last five years. However, this funding is allocated through the Central Hazardous Materials program, which funds remediation of many types of sites, only a portion of which are AML-related.

Environmental Protection Agency (EPA), Superfund Program
Through The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program, also known as Superfund[4], EPA enforces regulations and oversees reclamation of AML sites where hazardous substances have been released. This is an important source of funding and oversight to reclaim AML sites, but the majority of AML sites do not meet the requirements of Superfund, and those that do may have elements this funding is not available to address.

EPA, Office of Mountains Deserts and Plains (OMDP)
OMDP implements the pilot Good Samaritan program established in 2024, which authorized fifteen hardrock AML projects to be conducted by states and charitable third party groups with liability protections needed to achieve remediation of polluted water. More information on this program can be found in *Section 8.5 Establish Protections for Good Samaritan AML Cleanups.*

National Park Service (NPS)
Past mineral development has left thousands of abandoned mine features in national parks and other NPS-managed park units that require mitigation to reduce public safety threats and/or natural resource impacts. An AML fund source established in federal fiscal year 2018 enabled NPS to begin to systematically address this need. AML features within NPS-managed lands include mine shafts, adits, prospects, and historic structures. NPS is careful to preserve the value of these sites where they are remnants of historically important mining and mineral activity, significant cultural or landscape resources, and/or provide critical habitat for wildlife. NPS estimates there are over 39,000 AML features within NPS-managed land and that approximately ten percent of these features pose significant physical safety hazards and/or cause impacts to water quality, hydrology, and vegetation and therefore are in need of mitigation. Funding for NPS AML projects has ranged between no funding and up to $5 million over the last five years.

U.S. Department of Energy, Office of Legacy Management (DOE-LM)

DOE-LM operates the Defense-Related Uranium Mines (DRUM) program with scope limited to abandoned uranium mines (AUM) that sold ore to the Atomic Energy Commission between 1947 and 1970 for defense related activities. Since 2017, the program has identified 3,472 DRUM sites across the nation that range from isolated mine openings to large, complex uranium mine sites. As of July 31st, 2025, the program has inventoried and conducted environmental sampling at 2,663 DRUM sites and prepared risk assessment reports for 2,535 sites. The work has primarily focused on public land, including BLM and USFS-administered land, tribal land, primarily on the Navajo Nation, and some private or mixed ownership land. The completed risk assessment reports identified that physical safety hazards are the leading risks at DRUM sites. The program has so far safeguarded 1,261 of nearly 6,000 inventoried hazardous features at DRUM sites in cooperation with its partner programs. The program is scheduled to sunset in September 2026, leaving the work of safeguarding remaining DRUM related physical hazards to federal land management agencies, state, or tribal AML programs.

U.S. Army Corps of Engineers (USACE) Restoration of Abandoned Mine Sites (RAMS) Program

The RAMS program provides assistance to federal, state, and tribal hardrock AML programs in carrying out projects to address waters impacted by pollution from hardrock AML sites. It is funded by the Water Resources Development Act (WRDA) and requires a 50% non-federal cost share for work on non-federal lands. The RAMS program has partnered with multiple state hardrock AML programs to assist in development of hardrock AML databases. For example, in 2019, RAMS worked with the California Department of Conservation (DOC) to develop a geodatabase for internal agency use. The database has enhanced DOC's field data collection capabilities and provided a single repository for a wide variety of AML data that can be easily accessed from the field or in the DOC office.

U.S. Forest Service (USFS)

The USFS uses its delegated CERCLA authorities to address abandoned hardrock mines in national forests and other USFS-managed lands that are contaminated with hazardous substances. USDA's National Environmental Accomplishment Tracking (NEAT) database is used by USDA agencies to track potentially contaminated sites and report progress towards cleaning up known contaminated sites. There are currently 16,637 contaminated or potentially contaminated hardrock AML sites in NEAT. Based on NEAT data, approximately 32 percent of hardrock AML sites that have been evaluated for hazardous substance releases are found to pose some level of human health or ecological hazard associated with abandoned chemicals or explosives, acid mine drainage, or heavy metal (lead, mercury, etc.) contamination. Based on the current inventory, the estimated number of sites that will require CERCLA cleanup (32%), and typical cleanup costs, the USFS's total estimate of AML CERCLA cleanup costs is over $12 billion. Annual funding for the USFS Environmental Compliance and Protection (ECAP) program, which includes CERCLA activities for both AML and non-AML sites, as well as environmental compliance activities, is approximately $6 million.

The USFS non-CERCLA Abandoned Mines Program (AMP) focuses on completing physical safety projects to reduce injury or severe risk of imminent death and partners with the USFS CERCLA program to reduce the public's risk of exposure to potential environmental hazards. As of April 14, 2025, there are 14,812 verified hazardous mine features on lands administered by USFS, with approximately 103,722 additional mine features to verify and for which to complete full field assessments. The AMP's budget is currently $1.48 million, a significantly reduced amount compared to funding levels 5 years ago.

AMP also receives funding from the OEPC AHMR program, to date, $1.42 million in FY23 and $1.12 million in FY24. At current funding rates, AMP estimates it would cost $60.2 million over 61 years to mitigate all verified physical safety hazards at abandoned mines on USFS-managed lands.

3 https://www.blm.gov/programs/aml-environmental-cleanup/aml

4 More information about EPA's Superfund program can be found here: https://www.epa.gov/superfund

BLM-State partnership closure. Bald Mountain Uranium Shaft Closure. Carbon County, Wyoming

Table 4: Land Ownership Percentage of Hardrock/Noncoal AML Sites, by State

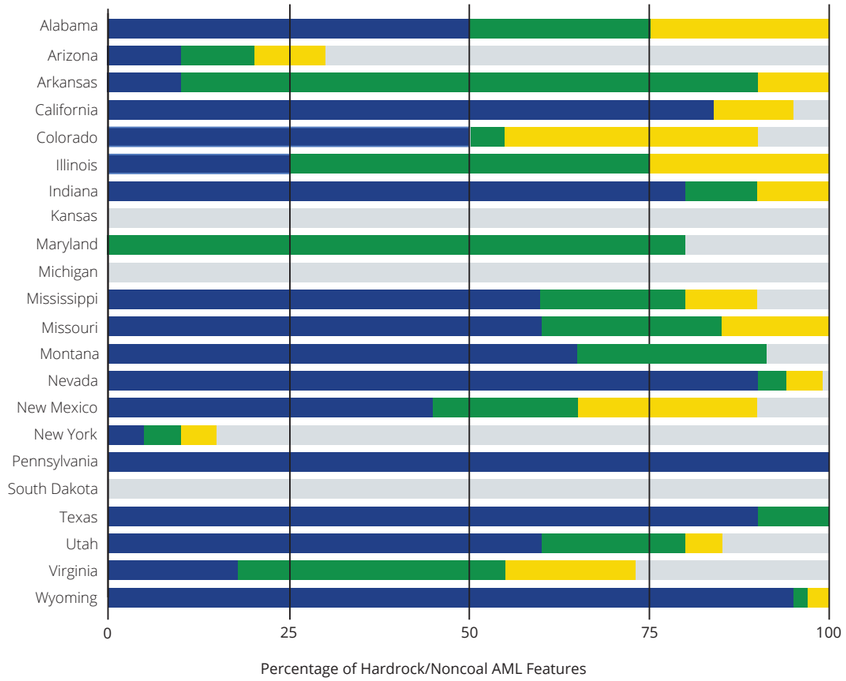


Table 4 displays how many known AML sites occur on federal, state, or private land in each state that responded to IMCC surveys. Funding to reclaim AML sites on federal land, the blue areas, is very limited, and funding to reclaim AML sites on state and private land, the yellow and green areas, is even more limited.

3.3 Tribal Hardrock AML Programs

Across the country, numerous tribes grapple with the complex challenges of hardrock AML hazards. Within the membership of NAAMLP, the Crow Tribe, the Hopi Tribe, and Navajo Nation stand out as tribal members with long-established AML programs and a significant need for dedicated hardrock AML funding. These three tribes have been able to utilize SMCRA funding to inventory and reclaim hardrock AML sites, but funding for this purpose is limited. They have also been able to address uranium sites on tribal lands in cooperation with DOE and EPA, as discussed in the example box below.

The Crow Tribe, Hopi Tribe, and Navajo Nation have all articulated a strong interest in securing funding through the AHMR program to bolster their ongoing efforts to address hardrock AML issues on their respective lands. We understand there are dozens of other tribes that have expressed interest in receiving hardrock AML funding through the AHMR program.

Though this report focuses on state hardrock AML programs, the fundamental principles and considerations it outlines should generally hold relevance for hardrock AML work conducted by tribal agencies. It is, however, important to note that operational differences exist between tribal and state agencies.

EXAMPLE OF TRIBAL HARDROCK AML RECLAMATION WORK

The Navajo and Hopi Nations have developed extensive cooperative relationships with the DOE Uranium Mill Tailings Remedial Action (UMTRA) program. This collaboration necessitates consistent annual monitoring and sampling at four sites to track groundwater contamination from uranium, nitrate, and sulfate as well as ongoing maintenance of disposal cells.

The DOE DRUM Navajo program has focused on cataloging an estimated 344 sites on allotted and Tribal Trust land that provided uranium to the U.S. Atomic Energy Commission for defense-related activities.

This verification and validation effort employs risk screening assessment tools, including data collection and analysis of potential chemical and radioactive contamination at each site. Grant funding for this crucial program is set to conclude in 2026.

Remediation work on abandoned uranium sites within the Navajo Nation's jurisdiction falls under the authority of the U.S. EPA and the Navajo EPA, as mandated by CERCLA. The Navajo AML program has also previously undertaken reclamation efforts at numerous uranium mines on Tribal Trust lands using SMCRA authority.

3.4 Progress Toward a National Hardrock AML Strategy

The Abandoned Hardrock Mine Reclamation (AHMR) program established in 2021 is a first-of-its-kind national hardrock AML grants funding program administered by the Office of Environmental Policy and Compliance (OEPC). The program funds federal, state, and tribal hardrock AML programs to address any kind of impact from an abandoned, inadequately reclaimed non-coal mining operation.

As of the publication of this report in the Fall of 2025, roughly $5m per year has been appropriated by Congress for the AHMR program in each of federal fiscal years (FY) 2022, 2023, 2024, and 2025 for a total of roughly $20m. The funding has been allocated to federal, state, and tribal agencies as directed by Congress.

Federal Agencies: AHMR funding was distributed to BLM, USFS, and NPS for hardrock AML reclamation projects on federal lands in FY22, FY23, and FY24, and additional funding will be made available during FY25.

State Agencies: The first round of AHMR grants to state agencies was awarded during FY25, which will fund hardrock AML reclamation as well as inventorying efforts.

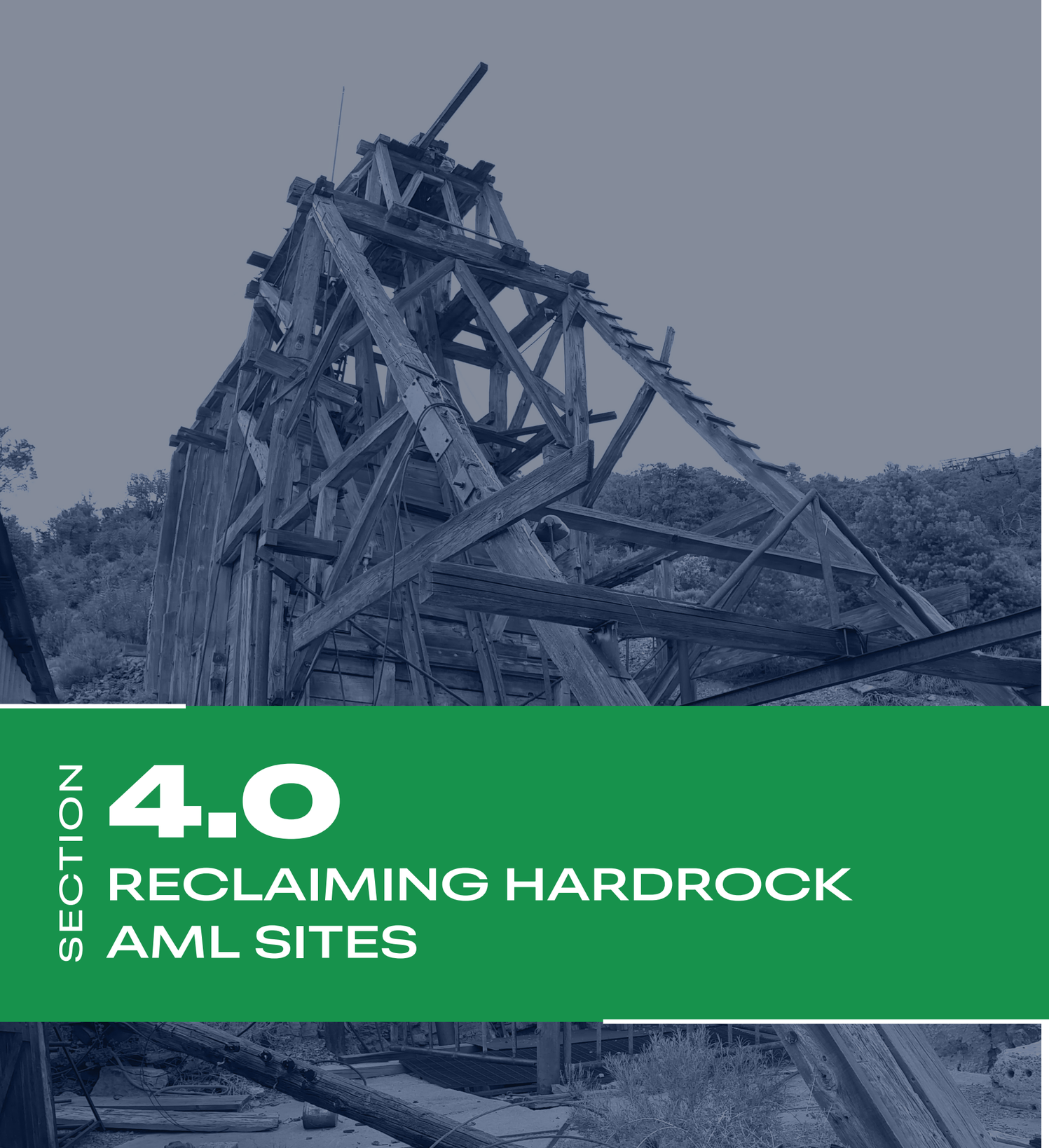
Tribal Agencies: AHMR grants will expectedly be made available to tribal agencies for hardrock AML reclamation and inventorying sometime in FY26.

National Hardrock AML Database: A portion of AHMR funding has also been allocated to USGS for the development of a much-needed national hardrock AML inventory database, gathering information from the various federal, state, and tribal AML databases into one central location. See *Section 5: Hardrock AML Inventorying Challenges and Progress for additional information*.

A solid foundation for the AHMR program has been laid by the initial funding. OEPC worked closely with the federal hardrock AML agencies and with states and tribes through IMCC and NAAMLP to set up the program well for future success. It has been an encouraging start, but additional funding is needed to achieve the full benefits of which this program is capable.

Reclamation at 3R Mine in Santa Cruz County, Arizona

Bat Cupola closure over mine shaft, Carbon County, Wyoming



SECTION

4.0 RECLAIMING HARDROCK AML SITES

4.1 The Reclamation Process

The primary function of an AML project is to restore AML sites to a safe, healthy, and productive state. Each AML project is a multi-step process; there are a number of activities AML programs must undertake to ensure AML projects are successful.

The activities required to conduct AML projects are summarized below. AML programs differ in their processes and priorities, but their goals are fundamentally the same.

Workers constructing a block wall closure at an abandoned uranium mine adit wearing protective clothing and respirators. San Juan County, Utah

AML PROGRAM GOALS

01 Identify and analyze hardrock AML problems

02 Determine the best approach to address them

03 Resolve the problem as effectively as possible

RECLAMATION STEPS

At high-level, AML programs generally follow the same the process for conducting a reclamation project, which is illustrated in the graphic below. However, AML projects often involve unique challenges requiring tailored engineering solutions due to the extremely varied nature of AML sites.

STEP ONE
PRE-PROJECT

- INVENTORYING
- SITE HISTORY
- PRIORITIZATION
- COORDINATION

STEP TWO
PROJECT IMPLEMENTATION

- SITE CHARACTERIZATION
- INTERIM RECLAMATION ACTIONS
- RECLAMATION DESIGN
- RECLAMATION IMPLEMENTATION
- COMPLIANCE

STEP THREE
POST-PROJECT

- MONITORING & EVALUATION
- MAINTENANCE

STEP ONE: Pre-Project

Inventorying - Identify, assess, and catalogue AML sites and features and hazards to determine if further action or investigation is necessary. Inventorying is discussed in more detail in the next section of this report.

Site History - Research potential sources of pollutants (e.g., location of mineral processing equipment and buildings where pollutants may be found). Identify responsible parties (i.e., entities considered financially and legally liable according to local, state, and federal statute or regulation) to determine if the site meets the definition of an abandoned hardrock mine.

Prioritization - Evaluate and rank sites based on federal, stale or local program mission, goals, and priorities such as risk/impacts to public safety, public health, and the environment, stakeholder needs, broader policy goals, and available funding.

Coordination - Collaborate with landowners, communities, land managers, tribal entities, and other relevant stakeholders to understand needs, priorities, and opportunities.

STEP TWO: Project Implementation

Site Characterization - Research and analyze the nature and extent of AML impacts at a site, including health and safety hazards.

- For sites with safety hazards, data is collected to inform design of a safety closure. Using an adit as an example, the dimensions and the stability of the opening in the rock are critical pieces of data. Data must also be collected on cultural resources and wildlife use. An adit may house artifacts of mining history and may be used by wildlife like bats and tortoises.
- For sites with public health and environmental hazards, an investigation is conducted to understand sources and pathways of contamination (i.e. air, water, soil, sediments) and impacts or potential risk (e.g. toxicity of the pollutant, exposure and sensitivity of humans or wildlife). Sources may include drainage from mine openings, piles of mining waste eroding into a nearby stream, or contaminated equipment and structures.

THERE ARE MULTIPLE POSSIBLE APPROACHES TO WATER TREATMENT AT AML SITES

Passive - a water restoration system that does not require continuous chemical and biological processes to treat contaminants. This may take the form of limestone channels or constructed wetlands that interact with natural water flow and do not require significant ongoing maintenance.

Active - refers to remediation technologies that involve the application of physical, chemical, or biological processes that require ongoing maintenance to permanently and significantly reduce the dangers associated with hazardous substance releases such as a constructed filtration, biologic, or chemical treatment system.

Interim Reclamation Actions - When appropriate, immediate actions to address imminent threats or those that can be implemented with limited engineering or design and/or without permits are often implemented at this early stage to reduce impacts quickly. These include halting discharge (via retention ponds), redirecting watercourses around waste, or installing erosion control measures on waste piles.

Reclamation Design - Generate plans for addressing AML problems at the site, which generally involve one or a combination of three approaches:

- Safety closures designed to prevent public access to mine features while also addressing the needs of wildlife and protecting cultural features. Examples include: Gates, cupolas, wire mesh, and fences that allow bat flyways but prevent humans and larger animals from entering the opening.
- Removal, containment, or active or passive treatment of pollutants impacting or threatening to impact people and/or wildlife due to exposure to contaminated water, air, soil, or sediment. Acid mine drainage leaches metals (e.g. lead, zinc, and cadmium) and metalloids (e.g. arsenic and selenium) into streams, rivers, lakes, and groundwater. Mining wastes, like mercury, can be eroded and transported offsite by wind or water and may dissolve in natural waters or attach to sediments. Some wastes can be transported by wind and are hazardous to breathe, like silica.
- Erosion and stormwater controls to reduce or eliminate pollutant transport and interaction with contaminated soils or sediment on site. Examples include: ditches, drains or walls to route stormwater and snowmelt away from sensitive areas; revegetation with native plants to stabilize slopes; and constructed wetlands to slow water flow.

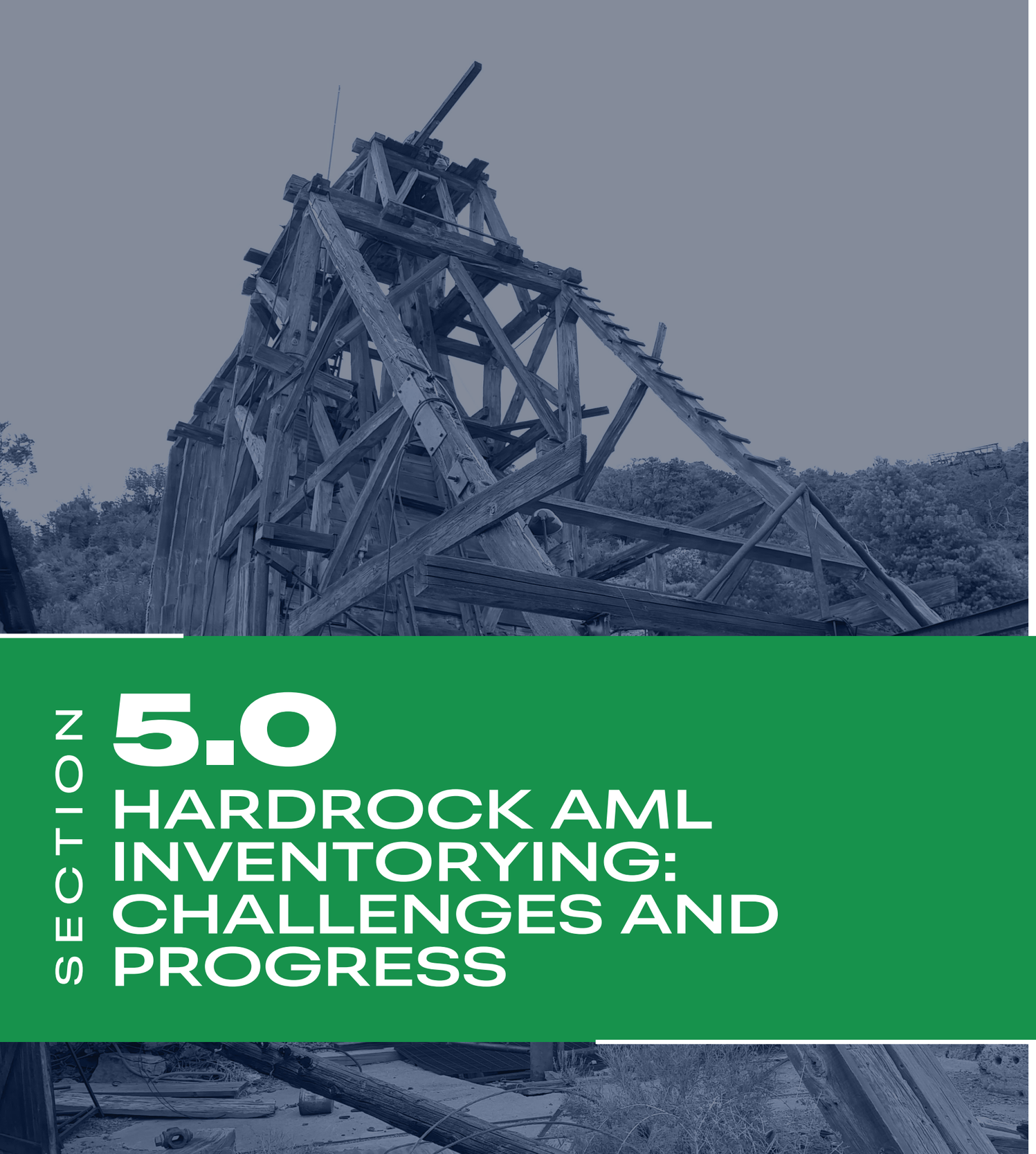
Compliance - Ensure legal requirements are met and obtain approvals under local, state, and federal regulations, such as National Environmental Policy Act (NEPA), Clean Water Act (CWA), and National Historic Preservation Act (NHPA). A variety of regulatory mechanisms are employed, ranging from stormwater and construction permits to cleanup orders that can carry significant administrative liability.

Reclamation Implementation - Manage reclamation construction activities at the AML site. For safety hazards, this is typically conducted by the land owner/manager. For sites with pollutants, this is typically conducted by the responsible party, with oversight by local, state, and federal regulators. If there is no responsible party, local, state or federal agencies may address the hazard. In urban areas, the site may be restored for additional beneficial use, such as creating an industrial, commercial, or residential development or park/open space.

STEP THREE: Post-Project

Monitoring & Evaluation - Conduct monitoring at the site to ensure problems are resolved. The efficacy of the reclamation actions are evaluated in a monitoring program which can range from simple (e.g., visual inspection for evidence of discharge or erosion) to complex (e.g., surface water or groundwater monitoring).

Maintenance - Conduct maintenance as needed to sustain project benefits. Closures must occasionally be repaired and water treatment equipment must be maintained.



SECTION

5.0 HARDROCK AML INVENTORYING: CHALLENGES AND PROGRESS

5.1 The Inventorying Process

AML inventorying involves identifying, assessing, and cataloging AML sites to create a database of features and hazards. AML inventories help agencies and the public understand the location and risks of these sites while providing policymakers with critical data on the scale and distribution of hardrock AML problems.

AML programs identify potential sites primarily through historical records, public input, and remote sensing. Field teams then conduct site visits to document features, assess hazards, and update GIS-based inventories. On-site assessments—known as "ground-truthing" —are essential since many hazards, such as subsidence risks, are not visible through aerial imagery alone.

AML inventorying is an ongoing effort, never entirely complete. New AML sites continue to emerge due to land development, weather events, or mine collapses. Early inventories often require updates using modern technology to improve accuracy. After reclamation projects are completed, inventories are typically updated to reflect mitigated hazards and, in some cases, to record project costs.

California Dept. of Conservation conducting inventorying at Silver Spur Mine, Inyo County, California

5.2 Current Federal and State Hardrock AML Inventories

There is currently no unified national AML inventory.[5] Instead, data is maintained by individual state and federal programs with varying levels of completeness. Federal agencies track sites on the lands they manage, while states tend to compile broader datasets that include federal, state, tribal, and private lands, but only within their state. The variety of methods employed by AML programs for cataloguing this data makes national-level data integration challenging.

Developing an AML inventory is time and resource intensive. According to IMCC surveys, developing a reasonably comprehensive state level AML inventory costs an average of $7 million per state, though cost estimates vary significantly. With limited funding and so many severe hardrock AML problems to address, states are generally not in a position to devote the necessary time and funding to completing a full inventory. Instead, they tend to conduct inventorying in piecemeal fashion as opportunity and funding are available, often while on site reclaiming nearby AML features.

Most hardrock AML inventories lack cost estimates for unaddressed AML sites due to the complexity of accurately predicting project costs. When a reclamation project is completed, agencies will typically record the completed costs in their database, which is helpful in estimating future reclamation costs. (For more on cost estimation challenges, see *Section 6: Method for Projecting Hardrock AML Costs.*)

Table 5 displays the current status of individual state hardrock AML inventories and cost estimates to address known sites. It shows that there are a few states with fairly comprehensive inventories (though no AML inventory can be said to be entirely because of unknown sites and the need for regular updates as conditions change), but most states currently have either a partial inventory or none at all. Note that some states track data on individual AML features while others track the number of sites that host one or more AML hazards.

5 The Government Accountability Office (GAO) attempted to estimate the scope of the national hardrock AML problem using federal agency data in two recent reports, GAO-20-238 in 2020 and GAO-23-105408 in 2023. While these reports provide valuable insights into federal AML tracking, they do not capture the full extent of the known problem due to limited state and tribal data.

Collecting data on mercury tailings near Petaluma, California

TABLE 5: STATE/TRIBE HARDROCK AML INVENTORIES: ESTIMATED SITES/FEATURES AND INVENTORY COMPLETION

State/Tribe	Estimated Sites/Features	No Inventory	Partial Inventory	Fairly Comprehensive Inventory	Cost Estimates Included	Cost Estimates Up-to-Date
AK	Unknown	•				
AL	Unknown	•				
AZ	~200,000 features		•		•	
CA (DOC)[6]	274,000 features; 19,000 sites		•		•	•
CA (SLC)[6]	1,759 features			•	•	•
CA (WB)[6]	~67 features in Central Valley, unknown elsewhere		•			
CO	46,000 features; 40,000+ sites		•		•	
ID	100s to several 1,000s		•			
IL	Unknown		•		•	
IN	Unknown	•				
IA	Unknown		•			
KY	Unknown	•				
ME	~579 features		•			
MD	250 sites		•			
MI	700+ sites			•	•	
MN	Unknown	•				
MS	Unknown		•			
MT	8,524 features ; ~3.200 sites		•			
Navajo	1,300 sites		•			
NV	200-300,000 features; 40,000 sites		•			
NJ	431 sites		•			
NM	~20,069 features		•			
NY	~1,600 sites	•				
NC	At least 130 sites		•			
OH	Unknown	•				
OK	Unknown					
OR	8,000 features		•			
PA	2,800 sites		•			
SD	900 sites		•			
TN	190 sites		•			
TX	12,000+ sites		•			
UT	~17,000 hazardous features		•			
VA	9,900+ features/sites			•	•	•
WY	~3,000-4,000 features; ~1,500 sites			•	•	•

[6] (DOC) Department of Conservation; (SLC) State Land Conservancy; (WB) Water Boards

5.3 Progress Toward a National Hardrock AML Inventory

Fully understanding the scope and scale of the hardrock AML problem across the United States will require comprehensive and accessible data. Over the years, several national initiatives have been undertaken to consolidate available information, each with its own strengths and limitations in capturing the complexity of the issue. Examining these past and present efforts provides helpful context for the continuing need for a unified national hardrock AML database.

Mineral Resource Data System (MRDS)

In the 1960s, the USGS and the U.S. Bureau of Mines developed nationwide mine and mineral deposit databases. After the Bureau of Mines closed in 1996, the USGS took over its datasets, merging them into the Mineral Resource Data System (MRDS) in 2000. However, MRDS suffered from inconsistencies in data entry and outdated information, and the USGS discontinued updates in 2011.

U.S. Mineral Deposit Database (USMIN)

Recognizing the need for a modernized database, the USGS launched the U.S. Mineral Deposit Database (USMIN). A key milestone of this effort was completed in 2023 with the digitization of historic mine symbols from old topographic maps from every state, creating a comprehensive map of mine features. The resulting dataset is displayed on the next page. Known as the "Thousand Points of Light" map, it illustrates the extensive mining history of the U.S.[7] This effort recorded 725,690 mine features from 106,350 maps covering all 50 states, Puerto Rico, and Washington, D.C.. USGS estimates that 633,181 of the mine features in USMIN, 87% of the total, are related to hardrock mining.

7 https://doi.org/10.5066/F78W3CHG

While data from USGS topographic maps provides valuable insight into historical mining activity, it does not assess site conditions or hazards and does not include all known AML sites. Additional research from IMCC and NAAMLP suggests the number of actual AML features is at least three times greater than the number of mine features on USGS topographic maps.. (For more on site estimates, see *Section 6: Method for Projecting Hardrock AML Costs*.)

> ***USGS estimates that 633,181 of the mine features in USMIN, 87% of the total, are related to hardrock mining.***

Developing a National Hardrock AML Database

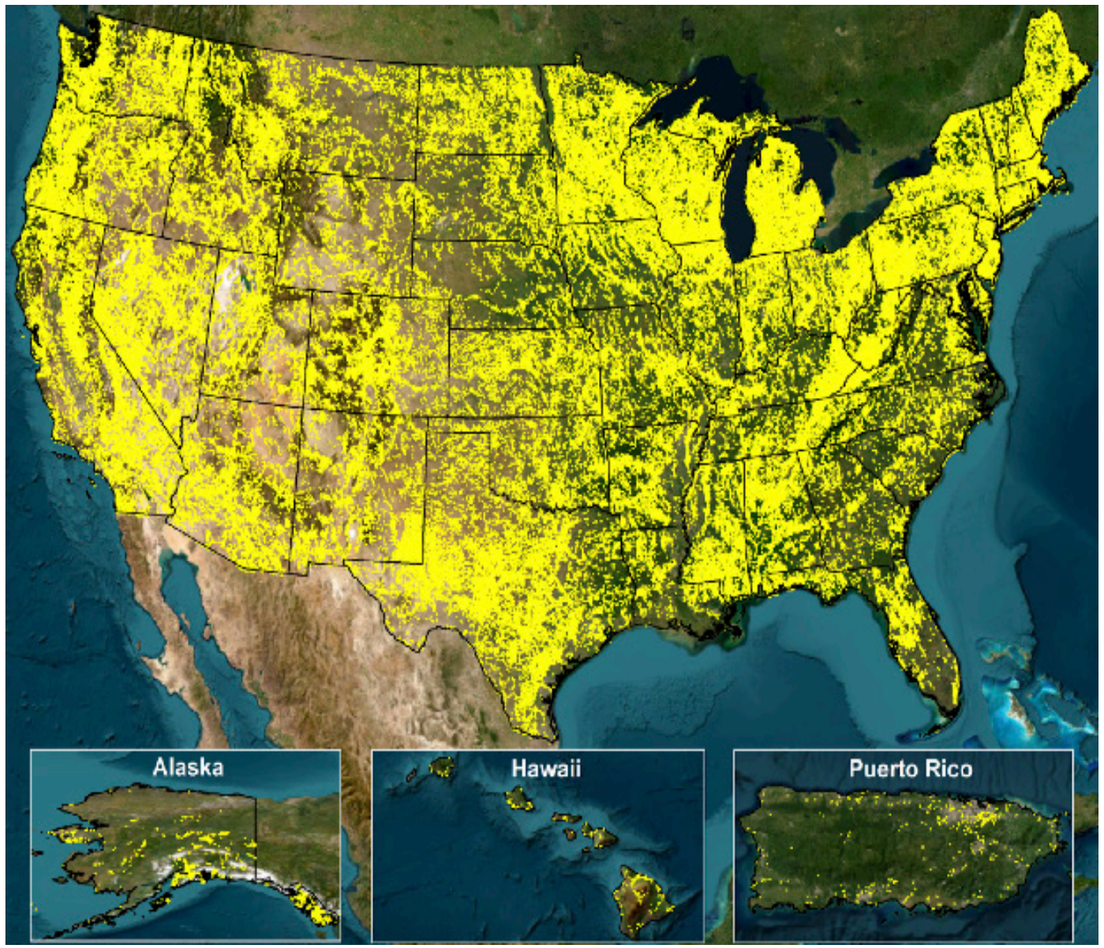
The USGS is now working to create a national AML database integrating federal, state, and tribal inventory data.[8] In 2021, the agency received $1 million to begin this effort as part of the Abandoned Hardrock Mine Reclamation (AHMR) program.

This initiative aims to standardize AML data, improve accuracy, and reduce redundancy. The USGS has consulted closely with federal and state AML programs to design a database capable of accepting diverse datasets. As of this report, state and federal agencies have provided data for more than 724,000 AML features. It is notable that, even at this early stage of data consolidation, the number of AML features entered into this database from state inventories surpasses the number of features found on historic maps digitized in USMIN.

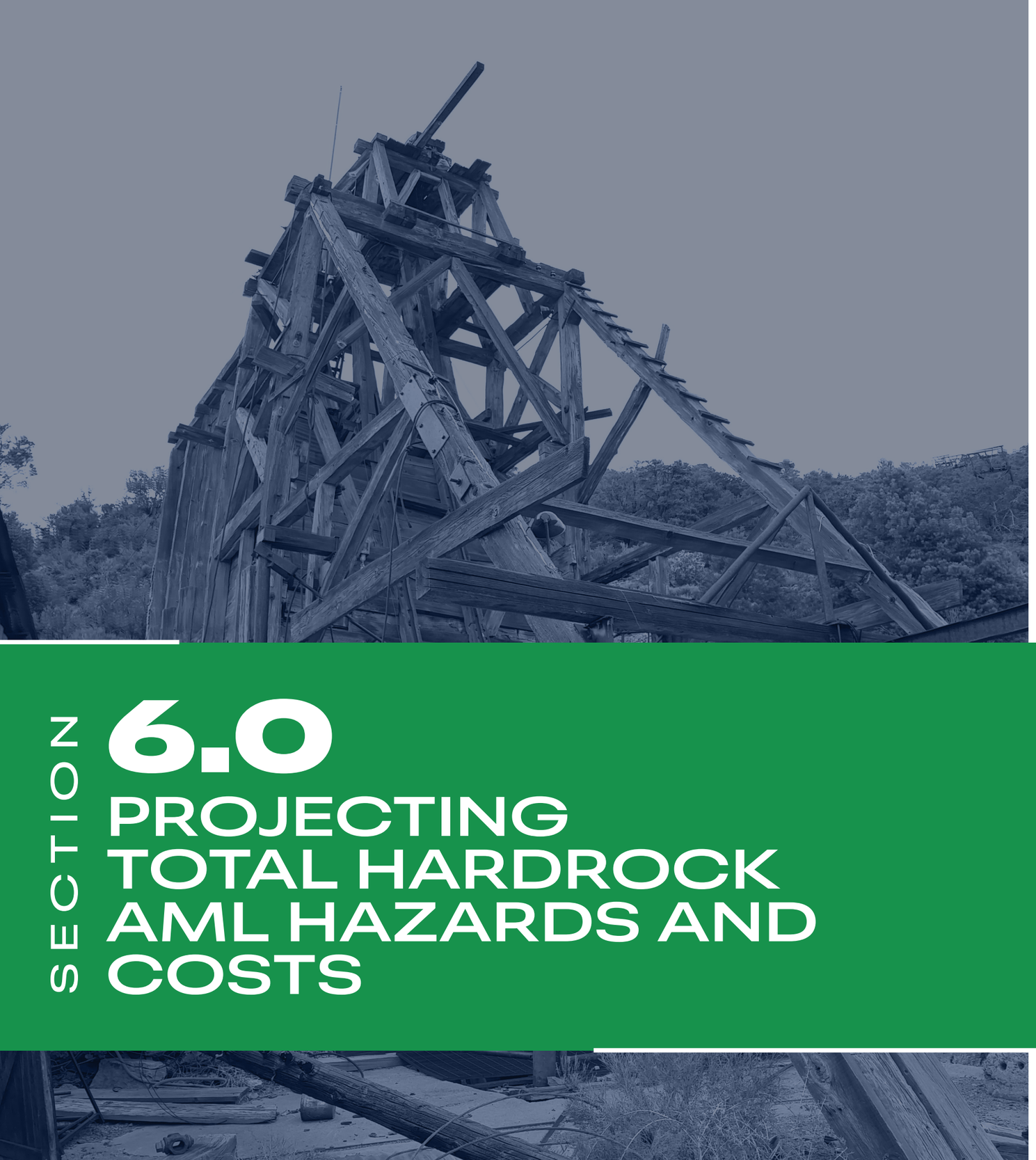
Over the next several years, this database will become a critical tool for tracking reclamation progress under the AHMR program. Ultimately, it has the potential to serve as a comprehensive nationwide AML inventory. However, achieving this goal will require sustained funding and extensive collaboration between federal, state, and tribal agencies. Even after incorporating existing state inventories, a true nationwide accounting of AML sites will only be possible through a large-scale, on-the-ground survey effort.

> ***A true nationwide accounting of AML sites will only be possible through a large scale, on-the-ground survey effort.***

8 United States Geological Survey, Mineral Resources Program. 2025. The Abandoned Mine Inventory of the United States - A Brief Summary. https://pubs.usgs.gov/publication/fs20253003



"Thousand Points of Light" map, displaying historic mine features throughout the country contained in the USMIN database



SECTION 6.0
PROJECTING TOTAL HARDROCK AML HAZARDS AND COSTS

6.0 Projecting Total Hardrock AML Hazards and Costs

Hardrock AML programs are often asked: "How many hardrock AML hazards are there?" It's an important question, but not one that is easily answered. This report uses the available information to attempt an answer, but it should be noted that these are projections based on estimates. For a more concrete answer, AML programs will have to be afforded the significant time and funding necessary to complete AML inventories.

Despite the fact that hardrock AML problems are not yet fully inventoried, there is significant information available on which to base an estimate of the total extent of the nationwide hardrock AML problem. IMCC and NAAMLP's analysis suggests there are more than 1.8 million hardrock AML features in the US, at least 750,000 of which are imminent hazards to safety and tens of thousands of which are health and environmental hazards.

> ***IMCC and NAAMLP's analysis suggests there are more than 1.8 million hardrock AML features in the US, at least 750,000 of which are imminent hazards to safety and tens of thousands are health and environmental hazards.***

IMCC and NAAMLP estimate the cost to address all physical safety hazards starts at $11 billion. With the addition of significantly more expensive environmental hazards, the estimate for total nationwide codes to address these issues could easily reach $50 billion. This estimate aligns with the figure cited in a 2023 letter signed by 13 Senators to the Committee on Appropriations signed in a bipartisan effort to increase funding to address this nationwide issue.[9]

> ***IMCC and NAAMLP estimate the cost to address all physical safety hazards starts at $11 billion. With the addition of significantly more expensive environmental hazards, the estimate for total nationwide costs to address these issues could easily reach $50 billion.***

The method IMCC and NAAMLP used to produce these estimates is described in the following section. The analysis utilizes state agency expertise and inventory data in combination with a recently completed dataset from USMIN, which is a collection of mine locations for all 50 states based on mine symbols on historic USGS topographic maps (For more on USMIN, see *Section 5.3 Progress toward a National Hardrock AML Inventory* above.) Notably, this approach yielded a significantly higher estimate than the GAO's January 2023 Abandoned Hardrock Mines report, because that report considered only federal agency inventory data.[10]

9 Senator Heinrich et al. "Letter to Senate Appropriations Committee re. Hardrock AML Funding." March 31, 2023: https://www.heinrich.senate.gov/imo/media/doc/fy24_approps_-_abandoned_hardrock_mine_reclamation_program.pdf

10 Government Accountability Office. (2023). Abandoned Hardrock Mines; Land Management Agencies Should Improve Reportinhttps://www.heinrich.senate.gov/imo/media/doc/fy24_approps_-_abandoned_hardrock_mine_reclamation_program.pdfg of Total Cleanup Costs.

> ***States have found that for every AML feature identified in the USMIN mine symbol dataset, there are in fact many more AML features on the ground.***

6.1 Method for Projecting Hardrock AML Hazards

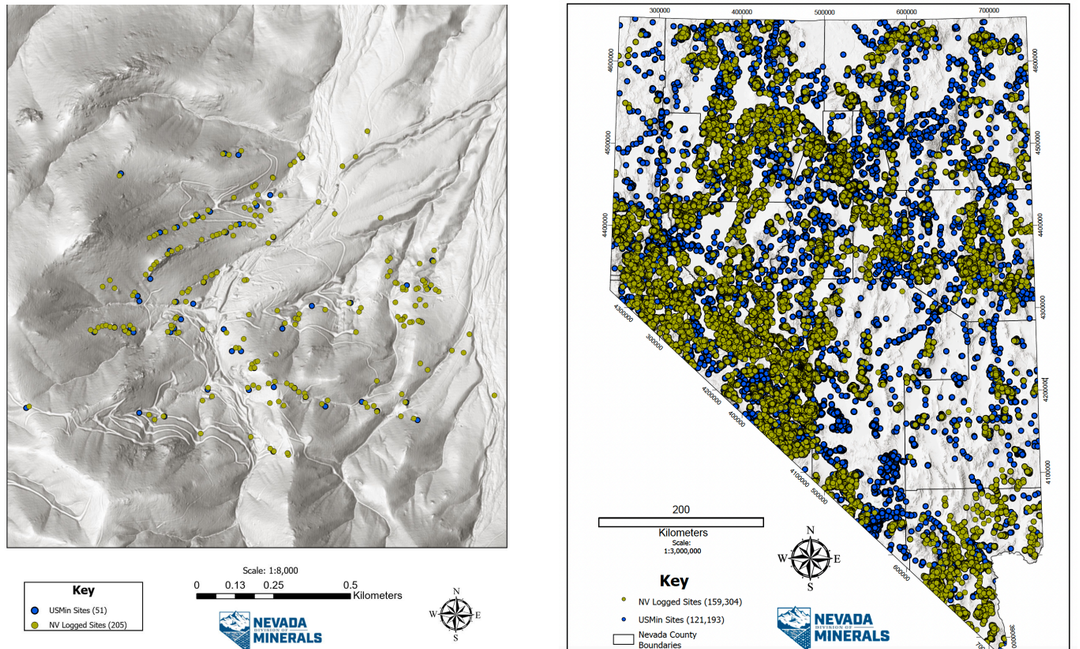
Number of Physical Safety Hazards

To project safety hazards, each state analyzed their current hardrock AML inventories in relation to the USMIN mine symbol dataset. Because the mine symbol dataset is a compilation from topographic maps while a state's inventory contains verified, in-person assessments of AML problems, there are currently many more sites in the mine symbol dataset than in state inventories. However, states have found that for every AML feature identified in the USMIN mine symbol dataset, there are in fact many more AML features on the ground. Comparing USMIN mine symbol data to state inventories in California, Colorado, Nevada, Utah, Virginia, and Wyoming found there are between 3 and 10 actual AML features per USMIN point, depending on the state. Assuming a conservative nationwide ratio of 3-1 actual sites to USMIN points suggests there are more than 1,800,000 features across the country. This analysis also found that 42% of USMIN features are imminent safety hazards, which suggests roughly 750,000 hardrock AML physical safety hazards exist across the United States.

Number of Environmental Hazards

For environmental hazards, states have significantly less information available due to the nature of these sites and limitations on funding often requiring a focus on safety hazards. However, based on state inventories, NAAMLP and IMCC estimate that there are potentially a hundred thousand or more environmental hazards across the country.

Safety and environmental hazards at Hillside Mine in Yavapai County, Arizona



Two examples showcasing the increase of mining related features on the ground vs known USMIN mine symbol data points. Left: A 4 sq km area in Western Nevada showing the 4:1 ratio of Nevada's hardrock AML inventory (yellow) against USMIN mine symbols (blue). Right: The entire state of Nevada showing the Nevada logged AML features (yellow) vs. the USMIN mine symbols (blue).

6.2 Method for Projecting Hardrock AML Costs

It is difficult to estimate nationwide costs of addressing hardrock AML hazards due to their many types of hazards and widely varying costs to address them. It is nevertheless important to have at least a ballpark estimate of what it will require to address the country's hardrock AML problems. To develop this estimate, IMCC and NAAMLP utilized the state hardrock AML programs' experience to estimate a cost range for addressing different kinds of hardrock AML hazards. It is important to note that the cost estimates provided here are based on current costs, but costs will change over time, typically becoming more expensive.

Cost of Physical Safety Hazards

The cost of addressing physical safety hazards varies based on the chosen method of addressing the problem, site accessibility, and the number of features in the area. Expenses for safety closures range from hundreds of dollars for simple backfills to tens of thousands for complex engineered structures. Based on the states' experience with physical safety hazards over the last decade, we determined that the average cost is $15,000 per feature. This includes a field visit, basic engineering, environmental compliance, contracting, and project management per feature. At an estimated $15,000 average per feature it would cost $11 billion to reclaim the roughly 750,000 hardrock AML safety hazards across the country.

> *At an estimated $15,000 average per feature it would cost $11 billion to reclaim the roughly 750,000 hardrock AML safety hazards across the country.*

Cost of Environmental Hazards

The cost of addressing environmental hazards varies even more widely than physical safety hazards. Environmental hazards require a more intensive process of study to design an appropriate way to resolve the problem. Treating water and removing and containing chemical contaminants is typically very cost-intensive and may require ongoing investment for long-term maintenance. For these reasons, a per feature average cost estimate is not practical. However, based on the states' experience with environmental hazards over the last decade, costs typically range from between $100,000 to $10,000,000 per site. At that cost per site, the total cost to reclaim all environmentally damaging hardrock AML sites across the country is conservatively in the range of $50 billion. At current funding rates, that means it could take in the neighborhood of 1,200 years to reclaim all hardrock AML hazards.

> *The total cost to reclaim all environmentally damaging hardrock AML sites across the country is conservatively in the range of $50 billion.*

Acid mine drainage at New Idria Mine in San Benito County, California

SECTION 6.0

COST OF ELIMINATING AML HAZARDS

Cost Range:
$7,500-$20,000

Air Grate
A rigid metal structure covering a shaft or incline that allows air flow into a mine but does not have flyways for bats or other animals.

Cost Range:
$5,000-$15,000

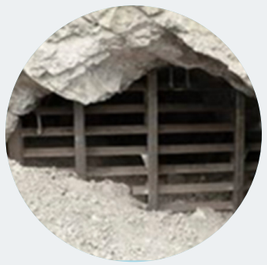
Culvert gate
Bat gate mounted inside or on one end of a culvert to prevent natural closure of a mine through subsidence, erosion, or rockfall. A culvert is typically corrugated metal pipe, but plastic and concrete can also be used.

Cost Range:
$500-$5,000

Backfill
Filling an adit, shaft, prospect, etc., with on-site material. Can be backfilled by mechanical means (heavy equipment) or by hand if shallow.

Cost Range:
$10,000-$30,000

Cupola
Metal structure built over the collar of a shaft or incline with horizontal bars forming bat flyways on at least one side. Can be mounted on concrete foundation or pinned directly to rock or soil.



Cost Range:
$7,500-$15,000

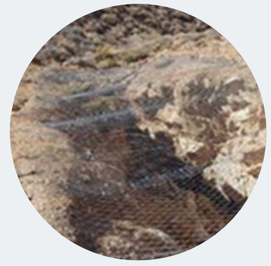
Bat Gate
Metal structure installed inside an adit or incline with gaps in the structure to allow for bats to exit the feature but prevent human access. Can have a removable bar and lock that allows for access for future studies.

Cost Range:
$500-$15,000

Fence
A barrier that is commonly installed around a fall hazard such as a shaft or deep pit. Prices vary drastically depending on the hazard the fence is protecting, e.g., a mine shaft versus an open pit.

Cost Range:
$5,000-$15,000

Polyurethane Foam Plug (PUF)
Rigid, self-supporting plug installed in vertical or steep workings to remove fall hazard. Poured as a liquid which then expands and hardens. Must be covered (typically with soil or rock) to prevent UV degradation.



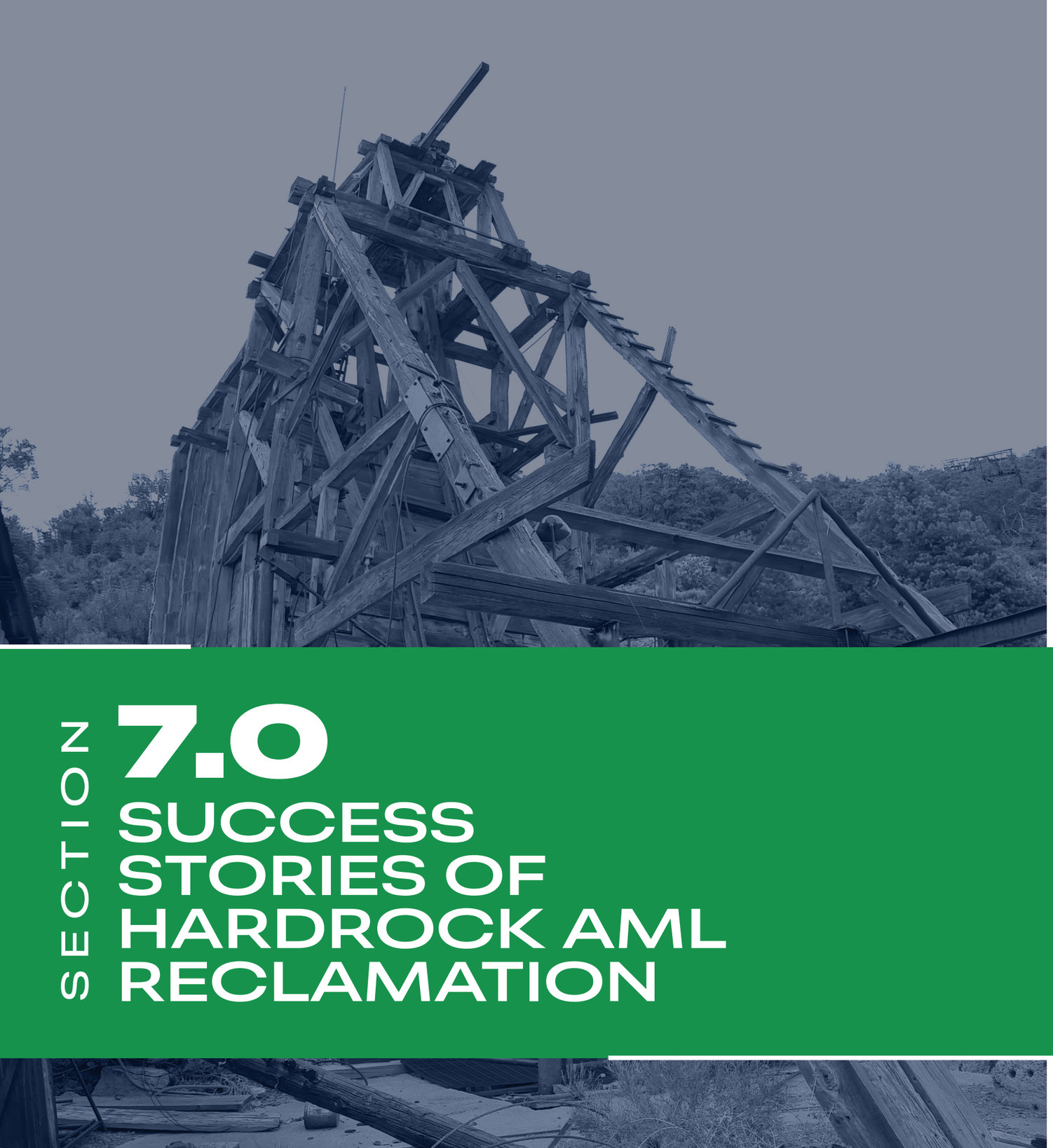
Cost Range:
$7,500-$25,000

Wire Net
Woven metal panel or net that can be draped over irregularly shaped features (stopes, shafts, etc) and anchored to the rock surrounding the feature.

Cost Range:
$2,000-$7,000

Wall
Cement block or native stone wall constructed inside the opening of an adit or decline. The wall is a hard closure that can be installed if there is not adequate backfill material or if it is desired to preserve the mine opening.

Before and after safeguarding steep mine entry in Death Valley National Park, Inyo County, California



SECTION

7.0 SUCCESS STORIES OF HARDROCK AML RECLAMATION

7.1 Mountain Copper Company, Contra Costa County, California

Problem

From 1899 to 1968, Mountain Copper Company operated a smelter adjacent to San Francisco Bay, contaminating a wetland area called the Peyton Slough with copper and zinc.

Massive waste piles sank deep into bay mud, acidifying groundwater and leaching metals into the slough. As the slough was dredged, contaminated sediments were piled along its banks, and tidal movements further spread the pollution.

Processing Plant (1960). At the top, San Francisco Bay; on the left, the three black mounds are massive cinder/slag piles. To the right, the channelized Peyton Slough draining into the Bay and light-colored adjacent piles of contaminated side-cast dredged sediments. (Source: SF Bay Regional Water Quality Control Board)

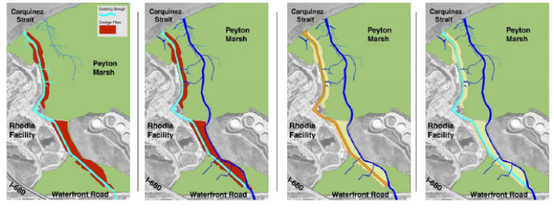
Copper and zinc are toxic to aquatic life, harming algae, fish, and other species. Tidal wetlands are vital habitats, especially given the >90% loss in the San Francisco Bay-Delta since 1850. Today, the Peyton Slough Marshes support special-status species like the California Black Rail (marsh bird), Sacramento Splittail (fish), and Mason's Lilaeopsis (rare flowering marsh plant).

Solution

Subsequent landowners led a $30 million reclamation under regulatory oversight. Surface mining waste was removed, while subsurface waste was contained with a pump-and-treat system to prevent groundwater contamination. Since excavating the slough's soft, slurry-like sediments was impractical, the slough was instead capped and a new channel was created in clean sediments nearby.

Outcome & Benefits

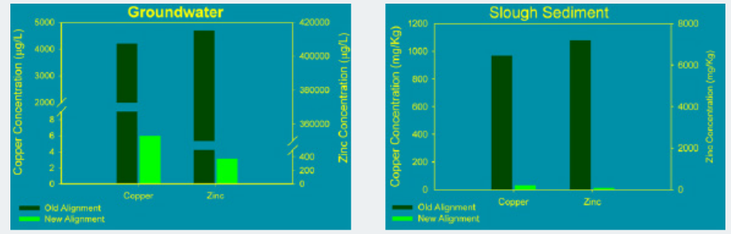
The project removed surface mining waste, stopped acidic groundwater generation, and prevented copper and zinc contamination. It significantly improved water and sediment quality in Peyton Slough, restored over 100 acres of wetland and created five new acres of wetland, and enhanced slough habitat by adding natural sinuosity.



Slough reclamation followed four phases: excavate a new channel in clean soils (blue), remove dredge piles (red/light blue), cap and isolate contamination (orange), and restore wetlands (tan). (Source: SF Bay Regional Water Quality Control Board)

Reclamation images show: excavating a new slough in clean soils (left), removing contaminated dredge piles (center), capping the old slough (top right), and installing cutoff walls (bottom right). (Source: Rhodia Inc. & Eco-Services Inc.

Before and after copper and zinc concentrations in groundwater (left) and slough sediments (right).



Aerial of Peyton Slough Marshes after reclamation and restoration. (Source: Solvay)

7.2 Foreman Shaft, Storey County, Nevada

Problem

Every spring, Virginia City hosts a dirt bike race called the "Virginia City Grand Prix," which attracts off-road motorcycle enthusiasts from around the world. Virginia City receives thousands of visitors and racers, who ride their dirt bikes over hundreds of miles of trails on BLM-managed land surrounding the historic town. In 2017, the Nevada Division of Minerals (NDOM) reached out to BLM to assess the AML hazards along the multiple race routes. A total of 24 dangerous abandoned mine hazards were found to be within a 100-foot buffer of a designated race route.

Late 1800's image of the Forman Shaft

Chief among these hazards was the Forman Shaft, the site of a former hoist house extending 2,200 feet into the ground. A fire in the early 1900's led to failure of timbers near the surface, collapsing the shaft. Its current depth is 165 feet and an unknown material acts as a false bottom. Easy road access to the feature, close proximity to Virginia City, and the size and depth of the shaft made this closure particularly important.

Solution

This project was initiated in 2017 by NDOM in coordination with BLM and other state and local partners. Wildlife surveys of the features were completed by the Nevada Department of Wildlife and cultural surveys by BLM. Due to the project being located within a National Historic Landmark, NDOM and a contractor worked closely with BLM archaeological staff to design hard-closure plans, which would have no adverse effect on cultural resources. Innovative closure designs were developed to minimize surface disturbance and use offsite fill material. Construction of safeguards began in March of 2023 and were completed by early July at a total project cost of $738,760. All 24 hard closures were completed on time and on budget.

Over head image of Forman Shaft before closure. Note the size of the shaft compared to the abandoned equipment on the site.

Outcome & Benefits

The project involved the creation of the largest known wildlife-compatible cupola, installed over the historic Forman Shaft with less than 120 square feet of surface disturbance surrounding the shaft, protecting the sensitive desert environment. This project earned the 2023 Hard Rock Award for Physical Safety Hazards from the National Association of Abandoned Mine Land Programs.

Skycrane flying one of the 80' long support beams

Completed cupola over Forman Shaft

Installation of expanded metal grating over the cupola structure

7.3 Carissa Gold Mine, South Pass City, Wyoming

Problem

First prospected by off-duty Union army soldiers in 1864, the Carissa Gold Mine is centered on Wyoming's oldest gold field. Owned and operated by several entities from 1867 through the 1950s, the site is the crown jewel of Wyoming's Sweetwater Mining District's history. This site contained 75 mine-related features, including derelict structures, hazardous mine shafts and adits, debris and solid waste dumps, as well as several fuel storage tanks. Derelict mills used to process gold ore presented unique toxicity challenges besides their attractive nuisance and physical safety hazards, with highly contaminated equipment and physical safety hazards scattered throughout. Toxic heavy metals at Carissa included arsenic, lead, thallium, mercury, and cyanide.

Solution

In 2003, the Wyoming Legislature purchased the parcel to preserve this important part of state history. Even before the site was purchased by the state, the Wyoming AML Division was on site conducting work to address safety issues. Over 18 years, 44 construction projects were completed. Open mine entries were safeguarded while preserving historical integrity using polyurethane foam plugs, steel closures, concrete, and stone facades. Historic structures, including the well-preserved mill building and trestle head frame, were leveled and stabilized to safely allow public access, reduce hazards, and preserve the site's historical character. Tailings and waste piles were either removed or encapsulated to ensure heavy metals would not impact the environment and wildlife.

Outcome & Benefits

In 2013, the site was opened to the public as the South Pass City State Historic Site. It is now a safe destination for the more than 34,000 visitors that have toured the site since its opening, including over 8,200 K-12 students from Wyoming schools. The State Historic Site is a huge cultural and educational asset to Wyoming, highlighting how much impact AML projects can have on the public. The Carissa Gold Mine project won an award from the National Association of Abandoned Mine Land Programs in the Hard Rock Physical Safety Hazards category in 2024.

Top: The main shaft at Carissa was extremely hazardous prior to WY AML efforts.
Bottom: The Carissa Mill's stacked rock foundation was compromised, with the entire structure at risk.

Top: The stacked rock foundation was grouted and reinforced with soil nails and shotcrete, protecting the structure for generations to come.

Bottom: One of many shafts at the South Pass City property in process of being permanently safeguarded with a concrete plug.

7.4 Hillside Mine, Yavapai County, Arizona

Problem

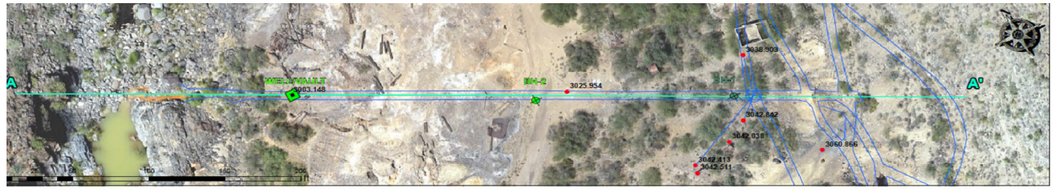
In 2000, Boulder Creek was listed on Arizona's Clean Water Act 303(d) list as impaired for arsenic, copper, and zinc. Flowing seasonally, it is located in a rural, mountainous area about 2 hours northwest of Phoenix, Arizona. Water in Boulder Creek is important to wildlife and drains into highly recreated areas downstream, including lakes and rivers that eventually flow into the Colorado River. Historic metal mining features from the now inactive Hillside Mine were identified as sources for the Boulder Creek impairments. An adit was continuously discharging contaminated water at a rate of five gallons per minute, and stormwater would interact with the tailings piles to release additional pollutant metals into the creek. The historic mine was spread out over three different properties; two were owned by government entities, BLM and Arizona State Land Department (ASLD), and one was privately owned.

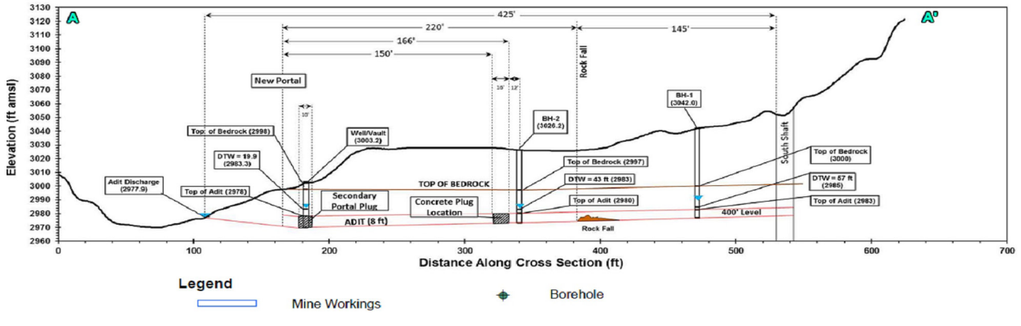
Solution

BLM completed reclamation of the upper tailings pile in 2015. The lower tailings pile was reclaimed in 2017 as a coordinated effort between ASLD, Arizona Department of Administration (ADOA), and ADEQ. The middle tailings pile and discharging adit were located on private land, on which ADEQ coordinated reclamation completed in 2019.

Outcomes & Benefits

After reclamation of the Hillside Mine, murky water originally in the creek turned clear and blue; cattails and other vegetation were reestablished; and fish returned to the creek. Data collected showed an improvement of 90 percent for zinc, 74 percent for copper and 21 percent for arsenic. These improvements also led to delisting metal pollutants for Boulder Creek from the 2022 Clean Water Act 303(d) impaired waters list.





7.5 Chief No. 1 Subsidence, Eureka, Utah

Problem

The Chief No. 1 mine shaft is located in the Tintic mining district of Juab County in the town of Eureka. Chief Consolidated Mining developed the shaft between 1909 and 1957, which reportedly extends to a depth of 1,800 feet. In 2002, the town and the surrounding areas were listed as an EPA Superfund site. Cleanup began shortly after, during which the Chief No. 1 shaft was closed by unknown means and the surrounding dump contoured and covered with geotextile, clean soil, and crushed limestone. The EPA determined "no further action" was required in 2011.

Subsidence in the waste rock at the shaft location was noted in 2016 and had grown to 100 ft diameter and 80 ft deep by spring 2017. Not only did the massive hole create a physical safety hazard for the local community, it also exposed lead contaminated waste rock presenting an environmental hazard of wind-born lead contamination.

Solution

The Utah Abandoned Mine Reclamation Program (AMRP) contracted Spectrum Engineering to design a safeguard for the subsidence. Nelco Contractors of Price, Utah, was awarded the contract to implement the design through a competitive bid process. The work included installation of a one- foot thick, reinforced concrete plug approximately 30' x 100' near the bottom of the subsidence hole; excavation, haulage, and dumping of approximately 12,800 cubic yards of contaminated waste soil for backfill from a repository located 1,000 feet from the site; and installation of a protective cap consisting of 16,000 square feet of geotextile and 440 cubic yards of crushed limestone. By using a nearby repository of contaminated soil, the project had an estimated savings $1 million in haulage costs. The total project cost was only $229,797.

Outcomes & Benefits

The Chief No. 1 Subsidence Project demonstrates how a deep shaft connected to extensive underground mine workings can unexpectedly subside even when it appears backfilled and stable for years. The successful and rapid response to address the issue was the result of AMRP's effective coordination with the landowner, the City of Eureka, Utah DEQ, and the EPA. This site no longer poses a public safety threat to people living nearby and visiting this area.

Subsidence of the Chief No. 1 shaft. Note the unconsolidated waste rock and native soil that has sloughed into the 1,800-ft deep shaft accessing extensive mine workings. The frayed geotextile and crushed limestone of the engineered cap can be seen on top.

Aerial image of the Chief No. 1 shaft subsidence. The subsidence feature in the center is approximately 100 ft. diameter.

Early stage of the dumping of repository waste to fill the subsidence.

Construction of reinforced concrete plug on top of leveled fill. Once the concrete cured, additional fill material was placed and compacted to near the surface.

Backfill is complete. Preparing to replace the cap of geotextile and crushed limestone.

7.6 London Mine Tailings Reclamation Project, Park County, Colorado

Problem

The historic London Mine is located in the headwaters of South Mosquito Creek, approximately four miles west of the Town of Alma in Park County. Mining and milling operations have been intermittently active at the London Mine since 1875. The site contained three mill tailings piles and a number of waste rock piles that were immediately adjacent to South Mosquito Creek. The tailings continually leached acidic, metal-laden water into the perennial stream. In the spring, the creek eroded the tailings piles and contributed metal-laden sediment to the creek.

In 2011 and 2012, the Colorado Inactive Mine Reclamation Program (CIMRP) performed sampling of surface water and tailings to determine the extent of contamination. This was followed up with a more spatially comprehensive geochemical evaluation of the tailings area by X-ray Fluorescence (XRF). The results of data collection indicated elevated levels of both zinc and lead in the tailings and downstream in Mosquito Creek.

Due to the extensive amount of tailings that had been deposited adjacent to Mosquito Creek over the course of more than 100 years and the ongoing impacts to the watershed, a large scale reclamation project capable of addressing the impacts required significant funding and partnerships. CIMRP developed and implemented an $820,000 reclamation project in partnership with Freeport McMoRan (~$431,000), Colorado Water Resources and Power Development Authority (~$371,000), and the Colorado Department of Public Health and Environment (~$18,000).

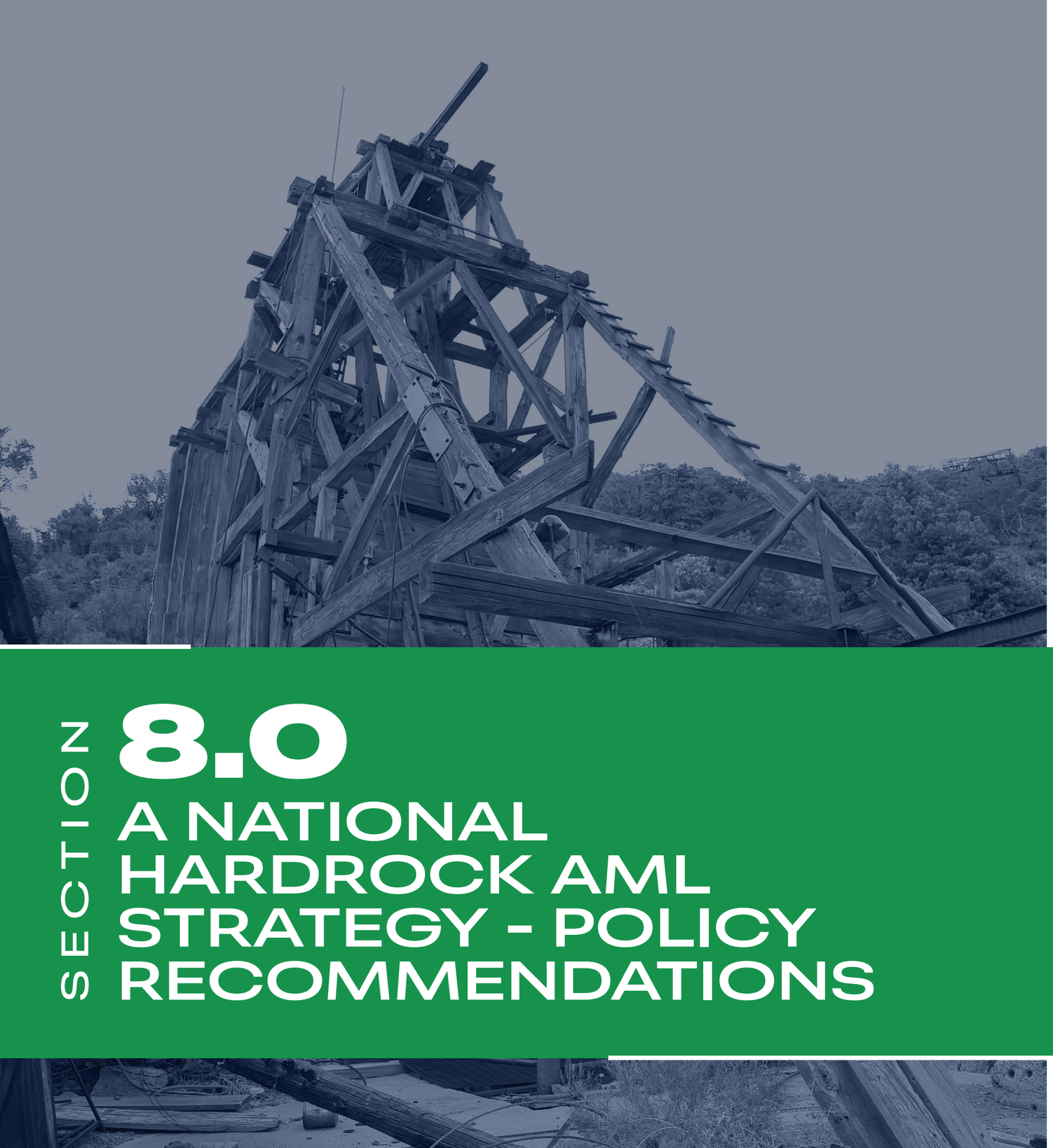
Solution

McCollum's Excavating, LLC, mobilized to the site in August of 2013. Tailings material was removed down to creek level, a removal depth of approximately three to five feet. Excavated material was placed into a large depression within the tailing area and consolidated. Geosynthetic materials were placed over soft subgrade prior to placement of backfill and cover materials. Backfill and cover material came from the consolidation area, limited material from the tailings impoundment, and a borrow source north of the creek.

As tailings removal reached final grade, the area was simultaneously backfilled with clean borrow material. Tailings were eventually removed from the south bank of Mosquito Creek, which was reconstructed with rock and clean fill material. A French drain was installed to capture water that was flowing from springs and seeps through the tailings.

Outcomes & Benefits

The total area reclaimed upon final completion was 8.5 acres. The work included excavation of over 80,000 cubic yards of tailings from the removal area and placement in the consolidation area. More than 32,000 cubic yards of raw clean fill was excavated and used to cover the reclamation area, 11,330 cubic yards of clean fill screened and placed, and 4,000 cubic yards of rock generated by screening and selective excavation was used for armoring and stream bank reconstruction. An additional 400 cubic yards of locally sourced biosolids were incorporated into the cover material to facilitate revegetation with a subalpine seed mix. As a result of the project, tailings material was isolated from contact with Mosquito Creek, reducing erosion and downstream water quality impacts.



SECTION

8.0 A NATIONAL HARDROCK AML STRATEGY - POLICY RECOMMENDATIONS

8.0 A National Hardrock AML Strategy - Policy Recommendations

A cohesive national strategy is needed to stimulate greater progress with hardrock AML reclamation. The United States' pervasive hardrock AML problem is currently being addressed by a capable, but limited set of state, federal, and tribal agencies through piecemeal efforts. Their efforts can be supported and their accomplishments expanded without need for creating an extensive new government program.

The newly established Abandoned Hardrock Mine Reclamation (AHMR) program for state, federal, and tribal grants has laid the foundation well for a vigorous national hardrock AML strategy. With additional funding and policy support, it can fulfill its potential in ensuring our country's natural resources have the most benefit possible, with restored landscapes, clean water, and abundant economic opportunity for all.

> ***A cohesive national strategy is needed to stimulate greater progress with hardrock AML work.***

Key Recommendations for a National Hardrock AML Strategy:

- Develop a comprehensive national strategy to accelerate hardrock AML reclamation.
- Secure appropriate funding for hardrock AML work through the allocation of excess claims maintenance fees to the AHMR program.
- Empower state and tribal hardrock AML programs to assume primary responsibility for reclamation activities, leveraging their localized expertise and understanding.
- Set the AHMR program up for long-term success through strong collaboration with states and tribes, a broad and inclusive scope, streamlined administrative processes, and continued effective federal management by OEPC.
- Prioritize and expedite the ongoing development of a comprehensive national inventory of hardrock AML sites by USGS.
- Establish a permanent "Good Samaritan" program to facilitate water pollution remediation at hardrock AML sites by states, tribes, and qualified third-parties such as conservation groups and the mining industry.
- Facilitate the recovery of critical minerals from AML mine waste, contributing to domestic supply chain resilience.

8.1 Increase Funding for Hardrock AML Programs

To invigorate hardrock AML reclamation in the United States, the most important need is reliable, dedicated funding on a level that matches the scale of the problem. IMCC and NAAMLP estimate the cost to address all physical safety hazards is in the range of $11 billion, and with the inclusion of environmental hazards, an estimated $50 billion (For more on reclamation cost estimates, see *Section 6.0 Projecting Total Hardrock AML Hazards and Costs*.) Meanwhile, state AML programs are equipped with only $1 to 2 million per year on average, and many have no regular hardrock AML funding at all. This is not enough funding to make significant progress. The state of Nevada, which has one of the more robust state hardrock AML programs, estimates that at current funding levels it would take 120 years to address all its physical safety hazards.

Policymakers have recognized the need for greater funding for hardrock AML but action has been delayed for many years. The delay has been partly a result of protracted policy debate as the issue has often been considered in the context of broader, more complicated discussions of Mining Law and permitting reform. While broader policy considerations surrounding mining policy are important, IMCC and NAAMLP believe that the need for hardrock AML work is too urgent to wait for them to be resolved.

Identifying an appropriate funding source for hardrock AML has also been a challenge, but a clear solution has recently become apparent: excess claims maintenance fees. From the 516,716 mining claims currently active as of February 2025, roughly $100 million will be generated in fees. BLM utilizes roughly $40 million per year from this source and the rest is deposited into the General Treasury.

> ***IMCC and NAAMLP recommend Congress direct the excess claims maintenance fees revenue, around $60 million per year, to the AHMR program.***

In similar fashion, the Mining Regulatory Clarity Acts of 2025 (H.R. 1366 and S.554) proposes creation of a new type of mill site claim and would direct the new revenue generated to hardrock AML work. Funding from existing, excess claims maintenance fees in addition to new mill site claims fees would be a very good start toward fully funding hardrock AML work without having an impact on the federal deficit.

The need for hardrock AML work is clear, there is bipartisan support to fund it [11], and the AHMR program is in place and ready. Now that an appropriate funding source has been identified, it should be fully funded without delay.

8.2 Rely on State AML Program Leadership

The United States' national hardrock AML strategy will be most effective if state hardrock AML programs serve as its primary implementers. State programs have the local level expertise and insight to address hardrock AML problems in the best and most efficient way possible.

States should therefore receive the majority of funding for hardrock AML work and should be granted autonomy to choose the projects that best fit their priorities. This "state primacy" model has been successfully employed in the SMCRA coal AML program for 45 years. With hardrock AML sites being even more geologically and chemically varied than coal AML sites, localized expertise in the states and tribes is even more important in the case of the AHMR program.

> ***State programs have the local level expertise and insight to address hardrock AML problems in the best and most efficient way possible.***

State hardrock AML programs are heavily relied upon by federal agencies conducting hardrock AML projects on federal lands, which often enlist state programs to do projects on their behalf. Federal agency hardrock AML work should continue to receive support and cooperation between federal and state AML programs should be further encouraged.

11 Senator Heinrich et al. "Letter to Senate Appropriations Committee re. Hardrock AML Funding." March 31, 2023: https://www.heinrich.senate.gov/imo/media/doc/fy24_approps_-_abandoned_hardrock_mine_reclamation_program.pdf

8.3 Set the Hardrock AML Program Up for Success

The continued success of the AHMR program depends on maintaining the right implementation approach. IMCC and NAAMLP recommend the following priorities guide its development:

Maintain Strong Collaboration
Strong collaboration between policy makers, overseeing federal agencies, and state and tribal AML programs is critical. State and tribal AML programs are in the best position to know what the program needs to thrive.

Maintain Broad Scope
Hardrock AML reclamation is needed in every region of the country. Eligibility for the program should remain broad enough to include all non-coal AML impacts and all states and tribes should continue to be given opportunity to apply for funding. This approach will create a strong base of support and make the AHMR program the perfect complement to the existing coal AML program under SMCRA, ensuring no historic mining community is excluded from the opportunity to have their AML-impacted lands and waters restored.

Streamline Grants Process
Hardrock AML programs should be allowed to focus as much as possible on fulfilling their core mission of reclamation. Care should be taken to establish program management and grants processes that are simple and streamlined. For example, categorical exclusions should be established so that time-intensive environmental assessments (EA) under NEPA are not required for every hardrock AML project, which have clear enough benefits to the public and the environment that EAs are often not necessary.

Maintain OEPC as Federal Managing Agency
The Office of Environmental Policy and Compliance's (OEPC) management of the hardrock AML program has put the AHMR program on a path to success. OEPC has proven its ability and willingness to consult closely with state and tribal AML programs and is in a good position to coordinate among federal hardrock AML agencies. This good progress should be maintained.

8.4 Continue Development of National AML Inventory

Funding should continue to be provided to the United States Geological Survey (USGS) for development of a nationwide inventory of hardrock AML features. This will be a valuable resource for effective reclamation efforts, eventually providing Congress and the public a comprehensive view of the scope and distribution of the hardrock AML problem while also aiding state and federal hardrock AML programs in planning and tracking reclamation efforts. USGS has been doing an exemplary job of cooperating with state and federal hardrock AML programs to consolidate data from dozens of dispersed sources.

> ***Though the National Hardrock AML inventory is important, hardrock AML work can not wait for it to be completed.***

Though the National Hardrock AML inventory is important, hardrock AML work can not wait for it to be completed. Achieving a comprehensive national inventory will require extensive on-the-ground work by state, federal, and tribal AML programs, so it can not in fact be completed without AML programs being more fully funded. AML programs are generally already aware of the most dangerous, polluting sites in their jurisdictions and are ready to address them when funding becomes available.

8.5 Establish Protections for Good Samaritan AML Cleanups

State and tribal hardrock AML programs and their potential non-governmental organization (NGO) and mining industry partners need a Good Samaritan program to effectively restore water polluted by pre-regulation mining. Current environmental laws impose full liability on states and tribes for pre-existing water pollution at AML sites, even when their efforts improve conditions and when full cleanup is impractical. Charitable third-party groups face similar liability risks when they help clean up AML sites, even when they have no prior connection to the site.

> ***The possibility of undeserved liability has stalled AML water pollution cleanup for decades, particularly in the water-scarce Western US.***

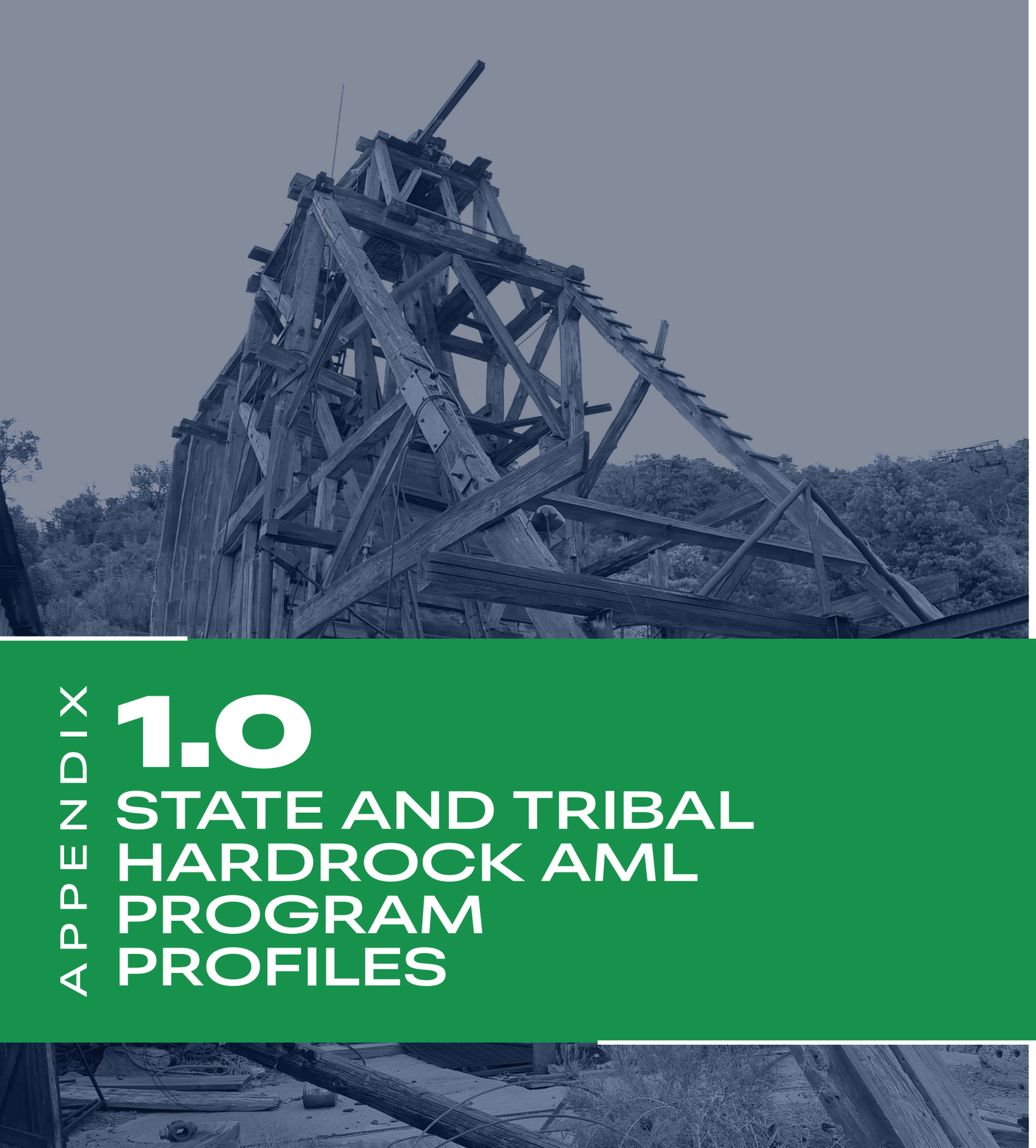
The possibility of undeserved liability has stalled AML water pollution cleanup for decades, particularly in the water-scarce Western US. The solution is "Good Samaritan" legislation, which provides a pathway for states, tribes, and qualified third parties to do hardrock AML water pollution cleanups with carefully tailored liability protection under oversight from the federal government. Encouragingly, Congress enacted a "pilot" Good Samaritan program for hardrock AML, The Good Samaritan Remediation of Abandoned Hardrock Mines Act of 2024 (S. 2781). IMCC and NAAMLP strongly supported this well-crafted, much-needed bill. The program is limited - it is authorized for only 7 years, and only authorized to provide 15 permits for Good Samaritan hardrock AML projects - but is a significant and exciting step in the direction of establishing a Good Samaritan program. Once the success of the pilot program is demonstrated, IMCC and NAAMLP recommend it be made permanent and expanded as appropriate.

8.6 Facilitate Recovery of Critical Minerals from AML Mine Waste

Recovering minerals from mine waste at AML sites is an opportunity for a policy win-win. These kinds of projects can restore AML sites while recovering ore from waste rock and minerals suspended in mine drainage water as part of the restoration process. Recovered waste material can then be reprocessed to isolate critical and rare earth minerals essential to US interests in technology and national security. Money earned on reprocessed minerals can be used to offset the costs of the project, allowing more AML sites to be restored in turn.

Policy and funding support is needed to facilitate these kinds of projects. Continued funding is needed for the USGS' Earth MRI program, through which State Geological Surveys are collaborating with USGS to characterize the mineralogy and geochemistry of mine waste features and to develop a national inventory of hardrock mine waste. Continued funding is also needed for research and development of recovery and reprocessing techniques. A Good Samaritan program (as discussed in the previous section) is needed to enable water treatment projects to be done without fear of liability for pre-existing pollution.

Hardrock AML programs must be better funded to take full advantage of the opportunity provided by critical minerals in mine waste. They are integral to the process; they inventory and assess AML sites, work with researchers and firms to develop recovery and reprocessing techniques, and ultimately, implement and coordinate the AML projects themselves.



APPENDIX 1.0
STATE AND TRIBAL HARDROCK AML PROGRAM PROFILES

ALABAMA

State Agencies with responsibility for AML: Alabama Department of Labor Abandoned Mine Reclamation Division is responsible for Title IV reclamation of SMCRA eligible abandoned coal mines. Alabama Department of Labor Mine Safety and Inspections is responsible for oversight of bonded reclamation of non-fuel minerals such as sand, gravel, clay, and bauxite.

Full-time state employees devoted to AML: 20 (13 in Abandoned Mine Reclamation, 7 in Mine Safety and Inspections).

Funding available to agencies for hardrock AML: Non-fuel mineral reclamation is funded solely by bond forfeitures.

Minerals most commonly associated with hard rock AML: Iron, aluminum, zinc, lead, gold, bauxite, manganese, marble, and sand and gravel (non-fuel mines).

Most common types of AML hazards: Physical safety hazards include shafts, pits, highwalls, ponds, impoundments, and abandoned structures. Environmental hazards consist of tailing piles, acid mine drainage, tailings, and contamination from heavy metals.

Alabama Department of Labor Abandoned Mine Land Reclamation Division (ADOL/AML):
The Alabama Legislature established the Division's AML program in 1981 to address issues related to the safety and environmental hazards left by historic coal mining activities in accordance with Title IV of SMCRA. **The primary functions include**:

1. Identification, inventory, and prioritization of hazards left from historical coal mining sites.
2. Reclamation of abandoned coal mine lands where no responsible party can be found, including securing, removing, or closing physical hazards.
3. Education and outreach to increase public awareness about the dangers of abandoned mine lands.

Alabama Department of Labor Mine Safety and Inspections Division (ADOL/MSI):
The ADOL/MSI, was established under the Alabama Coal Mine Safety Law of 1975. The ADOL/MSI's primary focus is mine safety. **This activity consists of the following specific tasks:**

- **Inspections:** The division is responsible for inspecting all working places in mines to ensure compliance with state laws and rules which protect the safety of persons working in the mine industry. This includes both underground and surface for coal and non-fuel minerals.
- **Training Programs:** They provide training to miners in areas such as mine safety rescue and first aid; This includes certification programs for mine foremen and fire bosses through the Board of Examiners of Mine Personnel.
- **Accident Investigation:** The division coordinates rescue efforts during mine disasters and investigates fatal mine accidents to understand causes and prevent future occurrences.
- **Record Keeping:** The division maintains production records for coal and other minerals and manages a large collection of mine maps dating back to the late 1800's, which are valuable for developers assessing land for potential construction.

General Mining Records for the State indicate Alabama has approximately 3,536 identified non-coal mines with iron being one of the primary commodities alongside aluminum and gold. The Birmingham area alone has reference to more than 60 iron mines located beneath the city. Identifying the full extent of non-coal hard rock mines within the state would take a substantial inventory effort that to date has not been initiated.

Both ADOL/AML and ADOL/MSI programs work closely together and with our federal partners including the OSMRE, USACE, USEPA, USFWS, and MHS to maximize the expertise, funding, and sharing of data on sites of interest to all agencies.

ALASKA

State Agency Responsible for AML: Alaska Department of Natural Resources, Division of Mining, Land, and Water. https://dnr.alaska.gov/mlw/mining/aml/.

Full Time State Employees devoted to AML: 3.5 (all coal AML employees)

Funding available to agency for hardrock AML: There are no state general funds available to operate the Alaska AML program. Alaska has a small federally funded coal AML program.

Minerals commonly associated with hardrock AML: Silver, lead, zinc, gold, and copper.

Most common types of hardrock AML hazards: Physical safety hazards including shafts, slopes, audits, pits, highwalls, and spoil piles.

Program description:
The Department of Natural Resources administers and oversees the Abandoned Mine Lands Program in Alaska. AML is responsible for the reclamation of abandoned coal mines. Typical features include mine fires, mine subsidence, dangerous highwalls, open shafts and portals, mining-impacted water supplies and other hazards which have resulted from past mining practices in accordance with requirements established by the federal Office of Surface Mining under authority of the Surface Mining Control and Reclamation Act. Alaska is on target to complete the remaining inventory as identified in e-AMLIS by 2034.

ARIZONA

Arizona State Mine Inspector's Office (ASMI)
https://asmi.az.gov/

Arizona Department of Environmental Quality (ADEQ): https://azdeq.gov/

Full-time state employees devoted to AML: 14 (total for both ASMI and ADEQ)

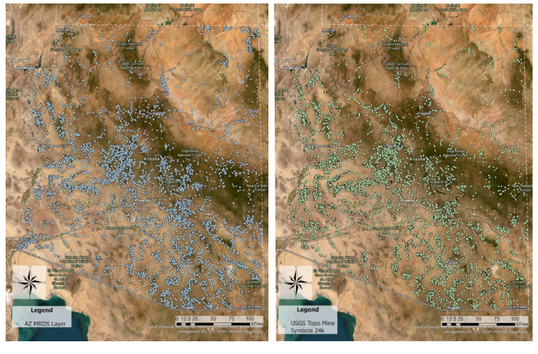
Funding available to agencies for hardrock AML:
ASMI: Minimal
ADEQ: Average $650,000 per year via Clean Water Act Section 319 (nonpoint source)

Projects Per Year:
ASMI: Varies by need and available funding
ADEQ: Average around 4 remediation projects

Contaminants most commonly associated with hardrock AML: Antimony (Sb), Arsenic (As), Cadmium (Cd), Copper (Cu) Lead (Pb), Mercury (Hg), Nickel (Ni), Silver (Ag), Thallium (Tl), Zinc (Zn), Acid (low pH)

Most common types of AML hazards: Physical safety hazards including shafts, adits, stopes, inclines, declines, pits, highwalls and abandoned explosives. Environmental hazards include tailing piles, groundwater contamination, chemical hazards, waste rock piles, acid mine draining including acid generating rock piles/tailings and draining from adits, abandoned chemical stockpiles, radionuclides, process fluids (e.g. HLP drain-down), and process ponds.

Program description:
Arizona Revised Statue Title 27 Chapter 3 Article 1 (ARS § 27-318) authorizes the State Mine Inspector to place warning signs and conduct closure activities at mine openings that threaten public safety. For public health and environmental concerns, neither the ASMI nor ADEQ have a formal program outlined in statute. ADEQ fills this gap through a variety of programs within the agency, including with federal Clean Water Act Section 319 program funding granted to the state from the EPA, actions under CERCLA, and the state's Water Quality Assurance Revolving Fund (WQARF). Companies and entities, such as non-profits, can also conduct and pay for remediation activities via ADEQ's Voluntary Remediation Program and the Prospective Remediator Agreement as defined in Arizona Revised Statues Section 49-281 (A.R.S. § 49-281).



AML features available from USGS MRDS (Mineral Resources Data System) (Left) and AML features depicted from USGS TopoMine Symbols (Right).

Both ASMI and ADEQ work closely with federal partners including the BLM, NPS, U.S. Army Corps of Engineers, EPA, USFS, and USGS to maximize the expertise, funding, and sharing of data on sites of interest to the agencies.

Examples of Successful Projects:

Hillside Mine: Private land ownership. Located near a Clean Water Act Section 303(d) Impaired Waterbody, Boulder Creek, near Bagdad, Arizona. Total cost more than $2.35 million. Regraded and capped waste and tailings pile; plugged a draining adit. Several waterbody parameters decreased post-remediation resulting in a 98% reduction of metal contamination to Boulder Creek.

Three R Mine: Public and private land ownership. Located near Clean Water Act Section 303(d) impaired waterbody, Three R Creek, approximately four miles south of Patagonia, Arizona. Total cost more than $2.8 million. Regraded and capped waste rock; lined and armored two ephemeral drainages to prevent further erosion and protect capped waste rock. Plugged and covered shaft.

McCleur Mine: Private land ownership. Located near Clean Water Act Section 303(d) impaired waterbody, Cash Mine Creek, south of Prescott, Arizona. Total cost over $1 million. Capped waste rock and installed a gabion wall and riprap for storm water control; removed leaching tailings to offsite location.

Gibson Mine: Private land and USFS land ownership. Located near Bellevue, Arizona. Total cost more than $1.4 million. Contaminated soil excavation and consolidation; improvements to stormwater controls and erosion controls; reseeding. Copper concentrations are now attaining water quality standards.

Salero Mine: Private land ownership. Located in Patagonia, Arizona. 470 acre ASARCO Trust site in highly undulating terrain, mined historically from 1887 through 1959. Total cost more than $4.5 million. Plugged two adit discharges; closed 15 adits/shafts; capped five waste rock dumps; revegetation; remediation of an old evaporation pond and discharge pipe with periodic monitoring of downgradient private well. Site perimeter fencing and signs installed.

What is Arizona's AML universe?
USGS shows 12,948 AML sites in Arizona in the MRDS database and 31,954 mine symbols in the topographic maps database. A GIS analysis of the layers showed only 13 of those points overlapped directly and just 965 were within 15 meters of each other.

The ASMI has hardrock AML site data as well, but it's currently not in a usable format to incorporate into USMIN's national AML inventory.The ASMI is seeking funding to complete this effort. Additionally, ADEQ is aware of USFS, BLM and potentially other federal agency databases and is working on data sharing agreements when appropriate to gain a more comprehensive understanding of hardrock AML hazards in the state.

Arizona's Needs:
If provided additional funding and resources, Arizona will be able to fill the following gaps that are affecting the state's ability to address longstanding public health and safety issues and environmental degradation:

- Establish a statewide comprehensive and accurate inventory of AML sites
- Hire personnel or contractors to field verify AML sites
- Increase environmental remediation and reclamation efforts
- Increase public safety closures
- Conduct ongoing maintenance post-remediation and/or closure
- Educate the public on the dangers of AML sites

ARKANSAS

State Agency with responsibility for AML: Division of Energy and Mineral Resources, Arkansas Department of Energy and Environment.

Full-time state employees devoted to hardrock AML: <5 FTEs

Funding available to agency for hardrock AML: 0

Minerals most commonly associated with hardrock AML: Bauxite, bromine brine, limestone, sandstone, and dolostone.

Most common types of AML hazards: Highwalls, spoil piles, hazardous water bodies, and acid mine drainage.

Program description:
Arkansas has old zinc, limestone, and bauxite mine sites as well as gray rock quarries that were active in the WWII era and were abandoned soon thereafter. Most of the known sites are north of I-30 and I-40 in the northern half of the state. There has been no effort in our state to reclaim these sites to date.

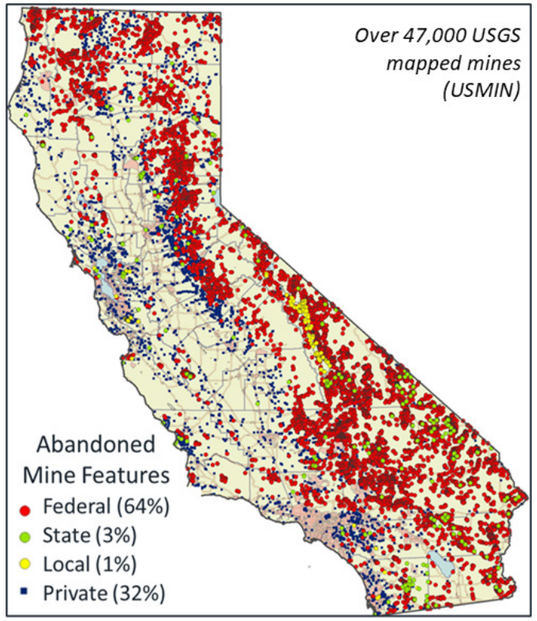
Arkansas Division of Energy and Mineral Resources applied to receive $50k through the AHMR program to begin a statewide inventory of those sites. After inventorying, we will prioritize identified AML sites into categories and address the sites making the most environmental impact and those that are most dangerous to humans and wildlife.

CALIFORNIA

It is no coincidence that California statehood was granted in 1850; one year after discovery of gold in the Sierra precipitated an explosion in population. Yet the Gold Rush was a small fraction of California's mining history. Prior to modern mining regulation, demand for 50 commodities (e.g., silver, iron, mercury, copper, lead, and zinc) produced an estimated 47,000 abandoned mines, located in every county. Today, more than 20 state and federal agencies, and dozens of local governments, grapple with the resulting hazards.

Starr and Red Dog Hydraulic Gold Mine

Acidic copper mining waste at Newton Mine, Amador County



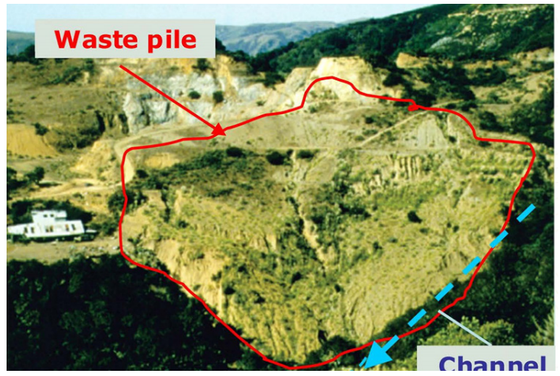
Without a comprehensive inventory, it is impossible to quantify the scope of the problem in California, yet progress has been significant nonetheless. **84,000 mine features have been inventoried and 2,887 reclaimed** (1,782 safety and 1,105 human health and/or environmental hazards), including the Petaluma Superfund site Gambonini Mercury Mine remediated in 2004 to protect wildlife and humans that consume fish downstream in Walker Creek and Tomales Bay, part of the Greater Farallones National Marine Sanctuary. AML programs anticipate thousands of smaller human health or environmental hazards may exist. Agencies are aware of and have prioritized 155 mines due to water quality impacts from acidic drainage and other mine influenced water with elevated metal(loid) concentrations (arsenic, cadmium, copper, and mercury), sedimentation (including hydraulic mining debris), or air quality impacts (inhalation risk from silica

dust). Of the 155 human health and environmental priorities, **approximately 70% are on public land** and 80% have not been fully remediated. **Most await funding**. Anticipated costs for cleanup range from around $100K to greater than $10 million for Superfund sites such as Iron Mountain and New Idria Mines. We estimate as many as **28% of California's 100,000's of abandoned mine features pose a threat to public safety** due to fall hazards (shafts, adits, stopes, excavations), subsidence, highwalls, and oxygen deficient atmospheres. The Department of Conservation and federal partners (NPS, BLM, USFS) have made significant progress with around 50% of accessible AML features on public lands inventoried and, when needed, safeguarded against safety hazards at costs ranging from $500 to $30,000.

Interagency partnerships are key to AML remediation in California. Where missions align, we leverage individual expertise and resources to efficiently plan and execute remediation projects. In total, California's state AML programs have 10 full-time equivalent employees working on AML, **though most programs have less than 1 full time equivalent (FTE) and no dedicated funding.** State agencies include:

- Administrators - Department of Conservation, which partners with agencies to conduct inventory and remediation of AML and coordinates state AML programs. DOC receives approximately $1 million in special funds from a state fee assessed on modern gold and silver mining. Additionally, DOC contracts with federal land management agencies to receive approximately $500,000 in federal funds to conduct inventory and remediation on federal public lands in California.
- Regulators - State Water Resources and Regional Water Quality Control Boards and the Department of Toxic Substances Control oversee cleanup of mines primarily via cost recovery from responsible parties. They receive no dedicated funding for AML and therefore can commit <1FTE to remediation.
- Land Managers – State Lands Commission, California Department of Parks and Recreation, and California Department of Fish and Wildlife work to address hazards associated with abandoned mines. They receive no dedicated funding for AML and therefore can commit <1FTE to remediation.

Federal partners include BLM, NPS, USACE, USFS, USEPA, and USGS.



Top: Before remediation of Gambonini
Bottom: after remediation of Gambonini

COLORADO

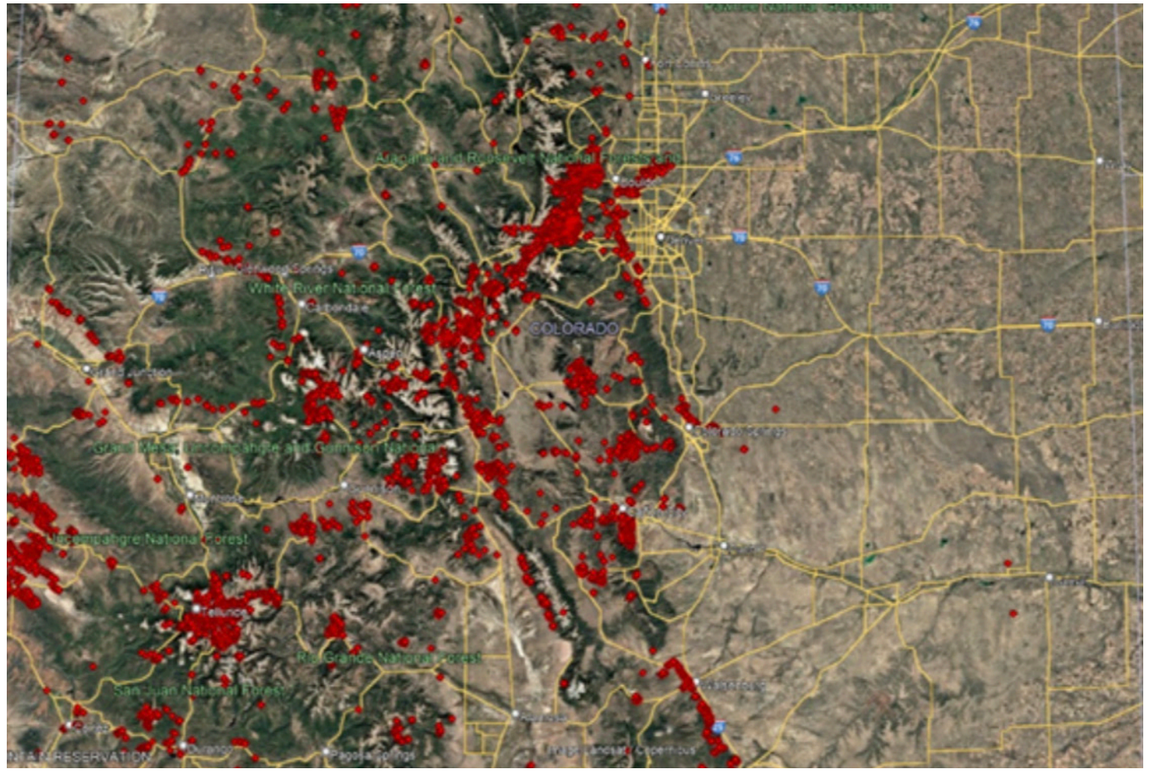
The Colorado Division of Reclamation, Mining and Safety's Inactive Mine Reclamation Program (CIMRP) was established in 1980 to address the hazards and environmental problems that arise from abandoned mines across Colorado. Colorado has a long and rich mining history; from gold discovery in 1858, to expanding exploration and production of precious minerals through the early 1900s, to becoming a primary source for uranium during the cold war. That history of mining has resulted in a legacy of over 23,000 hazardous mine features and impacts to 1,300 miles of streams. There is no other state program to address these hazards.

The major program activity is to identify the hazards and environmental problems arising from abandoned mines, design appropriate closure methods and reclamation techniques for project sites, reclaim or safeguard abandoned mine hazards, and address environmental problems. Project activities include field investigations, project development, project design, realty work, construction contract bidding and management, site construction and reclamation, construction inspection, site monitoring and maintenance of prior project work. To date, the program has been responsible for safeguarding over 13,000 hazardous features, reclaiming over 4,100 acres of mining disturbed lands, and improving water quality at more than 220 sites throughout the State of Colorado.

The Program's annual budget for hardrock (non-coal) related work is approximately $2.5 million and supports about 8 FTE dedicated to hardrock related work. Funding is received from the Department of the Interior's Office of Surface Mining, Reclamation and Enforcement, and Bureau of Land Management, along with the United States Forest Service and Department of Energy. Nearly half of all hardrock funding is tied to State Severance taxes collected on energy and mineral production within the State. Additional funding is received from mining companies, landowners, and municipalities.

Bat Accessible Closure, Fremont County, CO.

Large stope closures, San Juan County, CO.



Distribution of known AML sites in Colorado

ILLINOIS

State Agency with responsibility for AML: Illinois Department of Natural Resources, Office of Mines and Minerals, Abandoned Mine Land Division https://www2.illinois.gov/dnr/xxmines/AML/Pages/AMLProgram.aspx

Full-time state employees devoted to AML: 36

Funding available to agency for hardrock AML: 5-year average funding: $470,323. Funding for the AML program is derived from a letter from the Governor authorizing 2% of the total AML budget per year to be allocated to hardrock reclamation projects. No state general funds are used to operate the Illinois AML program.

Minerals most commonly associated with hardrock AML: Zinc, lead, limestone, fluorite, industrial sand/gravel, peat, Tripoli, common clay, construction sand/gravel, crushed/dimension stones, montmorillonite, gemstones, & portland cement.

Most common types of AML hazards: Physical safety hazards include shafts, adits, stopes, inclines, declines, pits, highwalls and abandoned explosives. Environmental hazards consist of tailing piles, groundwater contamination, chemical hazards, waste rock piles, acid mine draining including acid generating rock piles/tailings and drainage from adits, abandoned chemical stockpiles, radionuclides, process fluids (e.g. HLP drain-down), and process ponds.

Program description:
The State of Illinois recognizes the severe dangers and environmental problems associated with abandoned mined lands. The Illinois General Assembly created the Illinois Abandoned Mined Land Reclamation Council in 1975 with the enactment of the Abandoned Mined Lands Reclamation Act. The Abandoned Mined Lands and Water Reclamation Act, P.A. 81-1020, effective June 1, 1980, was drafted to implement an Illinois abandoned mined lands program which satisfied the requirements of P.L.95-87 and makes the State eligible for federal AML funds to carry out the program; inventory and rank dangerous conditions that result from mining practices that took place at a mine that is no longer operating; and identify and notify the owner or other person responsible for the condition, if feasible.

Since the non-emergency AML Reclamation Program was approved in 1982, Illinois has completed 10,115 high priority projects at a cost of over $153.1 million. The abatement of high-priority hazards included sealing 993 mine openings, removing 600 mine structures, and addressing more than 107,555 feet of hazardous highwalls. Other hazards abated included 2,778 acres of dangerous piles and embankments, 188 dangerous impoundments, 36.5 miles of clogged streams, and issues caused by clogged stream lands and water problems totaling over 2,213 acres and nearly 1 million gallons. Illinois estimates that approximately 5,560 acres of eligible lands and waters containing significant problem features remain in the state and are still in need of reclamation.

Illinois estimates that just over 7,780 acres of eligible lands and waters containing significant problem features remain in the State and are in need of reclamation.

KANSAS

The Kansas Department of Health and Environment (KDHE) Surface Mining Unit, with its 7 employees, is responsible for the Title IV and Title V coal programs within the state. The Surface Mining Unit currently receives roughly $7.6 million in total funding that is almost completely dedicated to coal-related issues, primarily AML.

The only hardrock related work we are responsible for is the filling of vertical openings that appear in the tri-state, lead & zinc area of SE Cherokee County, KS.

The Surface Mining unit's yearly contribution to this is $160,000 from our SMCRA AML fee funding for non-coal reclamation and the partial salary of one (1) employee.

All other mining activities that could be considered “hardrock”, including rock quarries, salt, gypsum, etc. are in the hands of the Kansas Geological Survey (KGS) and the Division of Conservation (DOC), within the Kansas Department of Agriculture.

The Surface Mining Unit is unaware of any Kansas inventory of non-coal AML sites.

MARYLAND

State Agency Responsible for AML:
Maryland Department of Environment, Mining Program

Full Time State Employees devoted to AML: 9 (all coal AML employees)

Funding available to agency for hardrock AML: Non-coal bond forfeiture funds from hardrock sites where the permits have been revoked. No state general funds are available to operate the Maryland AML program. Maryland has a coal AML program which is federally funded. Maryland is a non-certified AML Program under SMCRA, therefore hardrock sites are only eligible in extreme cases at the request of the Governor and approval by the Secretary of DOI.

Minerals commonly associated with hardrock AML:
Copper, clay, sand, dolomite, sandstone, slate and limestone.

Most common types of hardrock AML hazards:
Physical safety hazards including shafts, slopes, pits, highwalls, spoil piles, and hazardous water bodies.

Program description:
The Abandoned Mine Land Division (AMLD) administers and oversees the Abandoned Mine Reclamation Program in Maryland. The AMLD is responsible for resolving problems such as mine fires, mine subsidence, dangerous highwalls, open shafts and portals, mining-impacted water supplies, and other hazards which have resulted from past coal mining practices in accordance with requirements established by the federal Office of Surface Mining under authority of the Surface Mining Control and Reclamation Act.

Maryland estimates there are over 250 abandoned hardrock mines located throughout the state.

Maryland AML staff have worked with other state agencies including, the Bureau of Abandoned Mine Reclamation, West Virginia Department of Environmental Protection, Maryland Department of Natural Resources (parks and forestry), Natural Resource Conservation Service, watershed groups, and county and local municipalities to reclaim high priority AML sites.

MICHIGAN

State Agencies with responsibility for Hardrock AML:

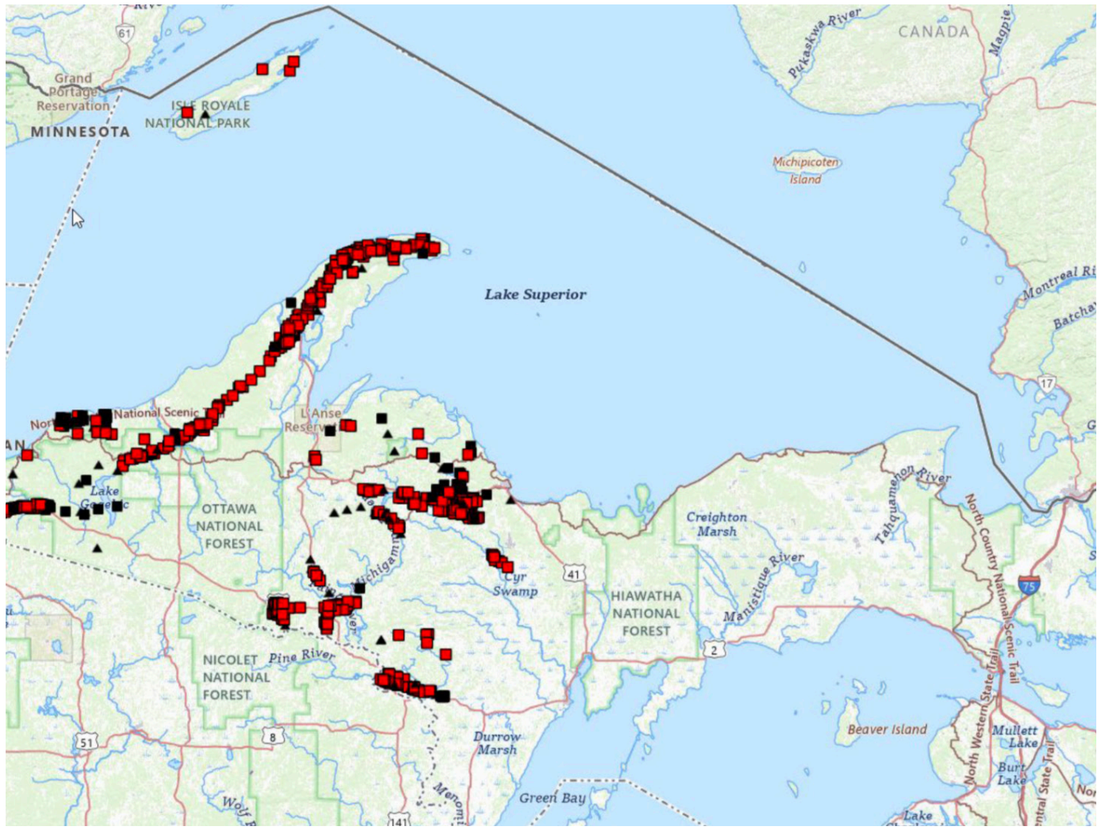
Environmental Focus
Michigan Department of Environment, Great Lakes and Energy (EGLE): authority to regulate impacts to the environment including soils, groundwater, and surface waters as a result of industrial processes, including historic mining. Regulates permitting and reclamation of mines that have been permitted under modern mining laws.

Public Health and Safety Focus
County Mine Inspectors: elected officials, not affiliated with a state agency, in any county where iron or copper mines are situated. The duties of the County Mine Inspectors have transformed over the last century from inspections of active and operating mines to inspections of abandoned mine lands. In some counties, the County Mine Inspector position is vacant.

Both Environmental and Public Health and Safety Focus
Michigan Department of Natural Resources (DNR): manages state-owned property that contains AML sites and features.

Hardrock AML Projects and State Funding
Michigan does not have a hardrock AML program and there are no known active state- or federally- funded hardrock AML projects. The state agencies, EGLE and DNR, do not have FTE staff dedicated to AML and there is no state funding available to complete AML projects. Michigan's County Mine Inspectors have unique challenges that vary county by county. These positions are often underfunded, and Inspectors may not have county board support to fund and maintain public safety mitigation measures.

State Hardrock AML Collaboration
The Michigan AML Workgroup is composed of representatives from EGLE, DNR, and the Michigan Geological Survey (MGS). The workgroup meets regularly to discuss funding opportunities and strategic planning for a future state AML program. County Mine Inspectors and other stakeholders (e.g. local units of government, United States Forest Service) will be added to the workgroup as the state program matures.



Known hardrock AML site locations in Michigan's Upper Peninsula

Locations of Hardrock AML in Michigan
Hardrock AML sites are largely located in Michigan's Upper Peninsula. In the 1990s, the state legislature funded an inventory of underground hardrock mine sites that included inspection of the shafts and openings of these abandoned mines to identify those needing attention in terms of public safety. The sites were ranked from "Adequate (1)" to "Inadequate, requires priority attention (4)". Surface mining sites were not included in this inventory.

The historic inventory included the review of **more than 10,000 mine maps**, and the digitization of **more than 3,000 maps** and resulted in the following conclusions:
1. Sites: **more than 800 mines** and mining explorations were identified
2. Features: **more than 2,300 shafts, adits, and openings** were documented

Michigan intends to modernize the historic inventory with the first round of AHMR Program grant funds. Additional AHMR Program grant funds will be used to field verify the decades-old rankings of these sites and features, add surface mining site data, and subsequently prioritize and complete imminent public health and safety mitigation and environmental reclamation projects.

MISSOURI

State Agencies with responsibility for AML:
Department of Natural Resources https://dnr.mo.gov/

Missouri Geology Survey, Land Reclamation Program https://dnr.mo.gov/land-geology/mining-land-reclamation

Full-time state employees devoted to AML: There are 7 staff assigned to the coal AML unit. There are currently no staff dedicated to hardrock AML.

Funding available to agencies for hardrock AML: The only funding available is through bond forfeiture funds for permitted non-coal sites for which the permits were revoked. Bonding for these sites was calculated at $500 per acre. There are currently 6 sites in Missouri's inventory with $305,190.22 available for reclamation. There are no dedicated staff for reclamation design and contracting so staff can only work on hardrock sites when time is available.

Minerals most commonly associated with hardrock AML: Barium, clay, granite, iron, lead, limestone, sand and gravel, and zinc.

Most common types of AML hazards: In total there are 31,190 sites identified as having been mined or prospected, however, there is no assessment of the inventory of the sites to determine if any hazards exist. Most site hazards are expected to be highwalls or steep banks. To date, the investigation of these sites has not been a priority for any federal or state agency to fund.

Program description:
Missouri Land Reclamation Program: Coal and non-coal statutes were introduced in 1971 requiring mine permits. Statutes under the surface coal mining law established the AML program in 1979 due to the number of acres and water resources adversely affected by past coal mining. Since 2001, the AML program has been allowed to use coal funding to address 168 dangerous non-coal mine shaft hazards.

MONTANA

State Agency Responsible for AML:
Montana Department of Environmental Quality (MT DEQ), Abandoned Mine Lands Program https://deq.mt.gov/cleanupandrec/Programs/aml

Agency Focus:
MT DEQ's mission is to champion a healthy environment for a thriving Montana. Our work focuses on environmental health and public safety.

Program Description:
Abandoned Mine Lands are plagued by health and safety hazards as well as diminished economic opportunities. The Montana AML Program is responsible for the monitoring and reclamation of Montana's abandoned coal and hard rock mines. They address a variety of mine problems, including acid mine drainage, industrial/residential waste, subsidence, portals, polluted water, and burning coal seams. AML staff administer abandoned mine reclamation projects that are funded by federal grants derived from a fee on coal. If SMCRA funds are to be used for a reclamation project, Montana AML works closely with the Office of Surface Mining Reclamation and Enforcement (OSMRE) to meet the intent of SMCRA.

The AML Program has an incomplete hardrock inventory, but our GIS data identifies 8,524 hardrock features with 6,173 being documented problems.

Program FTE:
Three program managers and one section supervisor.

Funding Available for Hardrock AML per Year:
MT DEQ has spent approximately $56 million over 20 years on hardrock, which equals an approximate $2,800,000 annual hardrock budget. We receive $100,000 per year from an Orphan Share fund that can be used for hardrock and are eligible to apply for grants for specific projects up to $500,000 biannually under a state grant. MT does not have other regular streams of funding that are eligible for hardrock projects.

AML Funding Sources: SMCRA Fees, IIJA (coal only), DEQ Orphan Share, and State Grants.

Common State and Federal Partners:
MT Department of Natural Resources and Conservation, Bureau of Land Management, and US Forest Service.

Most common ore types:

Gold	26%
Silver	25%
Lead	18%
Copper	12%
Zinc	10%
Manganese	2%
Tungsten	1%
Iron	1%
Uranium	1%

Current Hardrock AML Projects:
The AML program is currently operating primarily with funding that may only be used on coal activities. The program has not recently been working on hardrock projects, with one small subsidence as an exception. The program is, however, planning to begin focusing on hardrock AML projects again soon.The focus for future projects will be water quality impacts. The AML program recently began an inventorying effort and reassessment of priorities. The AML Program was able to utilize existing funding to start a hardrock inventory in 2024, and will continue this effort in 2025. As part of this effort, a planning tool for prioritization was developed. The program plans to take a watershed-level approach to prioritizing future projects.

Successful Projects:

Forest Rose Mine: USDA/USFS
Forest Rose Mine is an abandoned silver and lead mine. It contained tailings that were impounded in Dunkleburg Creek, waste rock piles, collapsed mining structures, and collapsed adits (passageways). Reclamation included offsite removal of mining structures, removal of tailings and waste rock, and placement in a repository on Forest Service land, capping the repository, revegetating the mine site and repository, backfilling and regrading open adits, and regrading and reconstructing a portion of Dunkleberg Creek as a step pool system for grade control and fish passage.

Soda Butte Creek and McClaren Tailings
The five-mile segment of Soda Butte Creek from Cooke City to the border near Yellowstone National Park is an impaired water body identified under Section 303(d) of the Clean Water Act and is the only Clean Water Act–impaired water body entering Yellowstone National Park (O'Ney et al., 2011). It was determined to be impaired because of elevated levels of copper, iron, lead, and manganese (Montana Department of Environmental Quality, 1996). Mining related disturbances are the source of increased metals loading above natural background conditions in the Soda Butte Creek drainage (Boughton, 2001).

The contaminated water was treated using calcium hydroxide to increase the pH and precipitate dissolved metals. Treated water was discharged to Soda Butte Creek with daily field monitoring and weekly laboratory analysis to document water quality (Montana Department of Environmental Quality, 2015). Restoration was also completed with channel reconstruction, amended soil covers, and revegetation.

In 2015, National Park Service Inventory and Monitoring scientists teamed with the Montana Department of Environmental Quality to conduct a comprehensive characterization of water quality in Soda Butte Creek. This investigation followed the reclamation of the McLaren Mill and Tailings site, a long-sought-after objective by Yellowstone National Park, the State of Montana, and local environmental groups.

NAVAJO NATION

Program description:
The Navajo Nation is a vast Native American reservation that spans three states and has boundaries that encompass 27,000 square miles of traditional Navajo homelands, occupying northeastern Arizona, into the southeastern portion of Utah, and northwestern New Mexico. Its mining legacy dates to the late 1800's for coal and the early 1900's for non-coal minerals like uranium, copper, limestone and sand & gravel (Fig. 1).

Since 1988, the Navajo Abandoned Mine Lands Reclamation Department (NAMLRD) has provided technical and public relation services to the Navajo people. NAMLRD operates under the Navajo Division of Natural Resources to ensure public health and safety from abandoned mine lands (AML) and assists the U.S. Department of Energy (DOE) with environmental and groundwater remediation efforts.

The Navajo Nation AML program has been funded by SMCRA Title IV grants for several decades. Since certifying under SMCRA Title IV in 1994, the Navajo AML program began focusing on noncoal AML sites, reclaiming many safety hazards. There are significant environmental hazards that remain unaddressed due to lack of funding.

Common AML Hazards
The goal of Navajo AML is to reclaim AML problem areas, and since its inception, 913 uranium and 33 copper mines with physical hazards have been reclaimed. Minerals most commonly associated with hardrock AML include: uranium, copper, limestone, and sand and gravel.

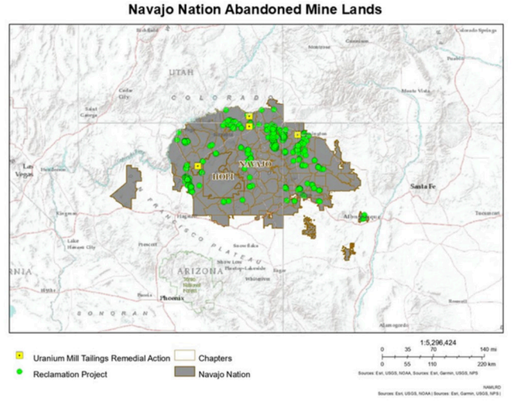


Figure 1. Map showing the total extent of the Navajo Nation and non-coal related reclamation projects, green dots. The four yellow squares represent the Uranium Mine Tailing Remedial Action (UMTRA) site.

The most common types of AML hazards include: subsidence, underground and open portals and shafts; adits, inclines, and surface open pits and highwalls.

Examples of your agency collaborating with other state or federal agencies on hardrock AML or related work.

Navajo AML is a part of the Abandoned Mine Lands Southwest Partnership, focusing on Navajo Nation efforts, through which there is collaboration with OSM, Navajo EPA, USEPA, and other partnership including New Mexico, Colorado, Texas, Hopi, Crow, and others. The AML Southwest Partnerships undertaking is a significant effort to verify and validate the condition of over 3,400 abandoned mine sites across the United States, with a particular focus on sites within the Navajo Nation. This initiative is rooted in the historical context of uranium mining, which had profound environmental

and health impacts from World War II through 1971.

To address the long-standing consequences of these activities, the partnership seeks to foster community dialogue especially involving older generations on the reservation to build advocacy and momentum for accelerated cleanup of abandoned uranium mines.

This initiative highlights how hardrock mining historically drove exploration and settlement throughout the American West, leaving a legacy that communities and agencies are now working together to address.

Navajo AML also works in partnership with the U.S. Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC) on non-hard rock mine related remedial actions at four Uranium Mill Tailings Radiation Control Act (UMTRCA) sites located on the Navajo Nation: Tuba City Disposal Site, Arizona; Mexican Hat Disposal Site, Utah; Shiprock Disposal Site, New Mexico; and Monument Valley Processing Site, Utah. Surface remediation at these sites began in October 1984 and was completed by February 1995. Due to historical uranium milling operations, these sites are contaminated with uranium, nitrate, sulfate, and other constituents that have impacted groundwater quality. As a result, long-term groundwater monitoring, sampling, and disposal cell maintenance will be required in perpetuity to ensure public and environmental safety.

The U.S. Department of Energy (DOE) Defense Related Uranium Mining (DRUM) Program and Navajo AMLRD are in partnership focused on verifying and validating abandoned uranium mines that provided ore to the U.S. Atomic Energy Commission, for defense related activities. Ultimately, the information will help assess whether each mine possesses a risk to nearby communities and the environment. Under the 1980 Comprehensive Environmental Response, Compensation, and Liability Act, the U.S. and Navajo EPA have the authority to assess and act on Abandoned Uranium Mine (AUM) sites. Navajo AMLRD, under the Surface Mining Control and Reclamation Act of 1977, has performed and administered reclamation and restoration of abandoned surface and underground AUM sites. As of 2025, NAMLRD has successfully completed GIS mapping of all AUM sites and reclaimed a total of 913 AUM sites on Navajo Nation tribal trust lands.

How many hardrock AML projects do you currently do per year?

DOI/OSMRE AML: Currently, no hard rock AML projects are conducted due to extremely limited SMCRA AML fee-based funding due to the Navajo coal revenue decline and is only sufficient to cover operating costs. As a result, there is little to no funding available for hard rock mine reclamation or maintenance.

For perpetuity, there is a grant award from DOE in the UMTRA program to fund four UMTRA sites that require regular yearly monitoring and groundwater sampling, while the DRUM program performs verification and validation fieldwork on approximately 40 abandoned uranium mines yearly. The DRUM program, which ends in 2026, has provided a short-term grant to Navajo AML to locate additional unknown AUM's on the Navajo Nation that have no responsible parties. A final summary report on DRUM activities will be provided by DOE to USEPA to determine how to address these AUM's in the future. All uranium mines fall under the authority of US EPA.

How much funding is available to you for hardrock AML each year, and what is the source of that funding?

There is no funding available for hard rock AML work. Funding from the U.S. Department of the Interior's Office of Surface Mining Reclamation and Enforcement (OSMRE) is extremely limited, only sufficient to cover administrative and operational costs. As a result, there is no funding available or at most, very minimal for actual reclamation or maintenance of hard rock AML sites.

DOE / UMTRA Funding: Department of Energy (DOE) Uranium Mill Tailings Remedial Action (UMTRA) funds are continuous and will support long-term monitoring and maintenance at four UMTRA sites indefinitely.

DRUM Program Funding: In contrast, the Defense-Related Uranium Mines (DRUM) program funding is currently scheduled to end in Fiscal Year 2026.

How many FTEs are currently available to your agency for all AML work (not just hardrock AML but all AML work)?

Navajo AMLRD has a total of 14 full-time employees with priorities ranging from office administration to environmental, inventory, construction and scientific staff. Seven employees are tasked with AML work focused on hydrology, environmental science, GIS technology, and engineering.

Example of especially successful, impactful AML project

In 2016, Navajo AMLRD was awarded a USEPA grant to provide technical assistance for AUM project efforts in the areas of field data collection, engineering, remediation, and community outreach efforts. One of these projects involves the closure of the Cove Mesa V Haul Shaft, a former uranium mine. Numerous closure designs were developed and by fall 2018 US and Navajo EPA accepted conceptual designs, with construction beginning in Winter 2019. Construction was completed in late Winter 2019, and as of now, warranty inspections have shown no discrepancies to report.

Other things to highlight about the Navajo Nation's hardrock AML program.

The Navajo Nation is one of only three tribes in the United States with a federally certified AML program, alongside the Hopi and Crow Tribes.

The Navajo AML program has earned national recognition for its exemplary work in mine reclamation and environmental restoration. To date, the program has received seven national awards for its achievements, including the most recent Federal Facility Excellence in Site Reuse Award presented by the U.S. Department of Energy in 2024.

NEVADA

State Agencies with responsibility for AML:
Nevada Division of Minerals, Commission on Mineral Resources https://minerals.nv.gov/

Nevada Division of Environmental Protection, Department of Conservation and Natural Resources https://ndep.nv.gov/land/abandoned-mine-lands

Full-time state employees devoted to AML: 8 (4 each agency)

Funding available to agencies for hardrock AML:

Division of Minerals: 5-year average funding: $1,348,000. Funding for the AML program is derived from:

- A $4 fee collected by county recorders and remitted to the Division for each unpatented mining claim filing
- A one-time fee of $20 per acre for every acre of permitted disturbance associated with new or amended mining or exploration plans of operation on public lands
- Assistance agreements with partnering organizations including the Bureau of Land Management (BLM), the United States Forest Service (USFS), and the National Park Service (NPS)

Division of Environmental Protection: 5-year average funding (excluding specific projects funded by Responsible Parties: Approximately $400,000 for AML activities derived from:

- EPA PA/SI grant program for inventory of AML sites
- Subgrant for critical minerals inventory work from USGS through the Nevada Bureau of Mines and Geology (NBGM) (providing supplemental AML inventory
- State Hazardous Waste Fund (used where no funding source is available)

No state general funds are used to operate either Nevada AML program.

Minerals most commonly associated with hardrock AML: Gold, silver, copper, mercury, antimony, zinc, lead, manganese, tungsten, barite, gypsum, dolomite, barium, and diatomite.

Most common types of AML hazards: Physical safety hazards include shafts, adits, stopes, inclines, declines, pits, highwalls, and abandoned explosives. Environmental hazards consist of tailing piles, groundwater contamination, chemical hazards, waste rock piles, acid mine draining including acid generating rock piles/tailings and drainage from adits, abandoned chemical stockpiles, radionuclides, process fluids (e.g. HLP drain-down), and process ponds.

Mercury retort in Mineral County Nevada

Program description:

Nevada Division of Minerals:
The Nevada Legislature established the Division's AML program in 1987 due to incidents at abandoned mines. The Legislature established three main functions of the program.

1. Inventory and rank dangerous conditions that result from mining practices that took place at a mine that is no longer operating; and identify and notify the owner or other person responsible for the condition, if feasible.
2. Secure hazardous conditions on open public lands where no claimant or property owner could be identified.
3. Develop a public awareness campaign to educate the public about dangerous conditions that exist as a result of historic mining activities.

Nevada estimates 300,000 historic mining related features within the state and 40,000-50,000 physically dangerous hazards. To date, 26,020 physical hazards have been inventoried. 3,954 hazards have been safeguarded, for example with a fence or barricade and signage. 7,209 have been permanently closed, for example with a backfill or bat compatible closure. 133,560 historic mining features have been identified as non-hazardous.

Nevada Division of Environmental Protection:

The NDEP AML program has operated within the Bureau of Corrective Actions since 2013, first as a subgroup of the Superfund Branch, then as a separate branch unto itself since 2017. The NDEP AML program is focused on remediation of environmental impacts due to legacy mining activities to mitigate risk to human health, wildlife, and the environment. This activity consists of the following specific tasks:

1. Inventorying and screening of AML sites.
2. Further investigation of sites which show potential for environmental impact.
3. Remediation of sites with identifiable risk to human health, wildlife, and the environment.

Inventorying, screening, and remediation are currently funded through grants and/or through responsible parties. Major sites where investigation and remediation are currently funded by responsible parties include:

- Anaconda Copper Mine Site, Yerington
- Rio Tinto Copper Mine, Mountain City
- Caselton Mine and Mill, Pioche
- McGill Copper Mill, McGill

Both Nevada AML programs work closely together and with our state and federal partners including the NBGM, BLM, NPS, USACE, USEPA, USFS, and USGS to maximize the expertise, funding, and sharing of data on sites of interest to all agencies.

Finishing a bat cupola over a shaft with tarps protecting the timber below

NEW MEXICO

State Agencies responsible for abandoned mines:
New Mexico Abandoned Mine Land Program - https://www.emnrd.nm.gov/mmd abandoned-mine-land-program/

- 14 FTE employees, salaries federally funded by OSMRE (minimum program state)
- Tasked with reclaiming and safeguarding abandoned coal mines
- Can work on abandoned hardrock mine safeguarding
- Has received variable grant funding from the BLM for hardrock mine safeguarding, lately approximately $1 million per year

New Mexico Environment Department (NMED) – Office of Strategic Initiatives https://nmenv.maps.arcgis.com/apps/dashboards/690621694d4e4906b2ae2886f528eec1

- Two NMED employees and one additional employee with the Mining & Minerals Division, salaries funded by state general funds
- Tasked with identifying and reclaiming abandoned uranium mines
- Targets "neglected" abandoned uranium mines that fall through the jurisdictional cracks between regulatory agencies

New Mexico Bureau of Geology & Mineral Resources - https://geoinfo.nmt.edu/

- Tasked with identifying mineral resources, which overlap with locating existing mines
- Critical minerals research and other activities are conducted by this agency

- ·According to NBGMR website, there are tens of thousands of abandoned mine features but they have only inventoried 9,000

(Navajo Nation, Bureau of Land Management, USDA Forest Service also address abandoned mines within the state boundary.)

Minerals most commonly associated with hardrock AML:
Gold, silver, copper, fluorite, zinc, manganese, iron, lead, pegmatite, potash, uranium, and sand & gravel.

Most common types of AML hazards:
Physical safety hazards include shafts, adits, stopes, trenches, inclines, declines, fractured rock, pits, and highwalls. Environmental hazards consist of waste rock piles, tailings piles, mill sites, sediments in drainage channels, wind-blown sediments containing metals, groundwater contamination, acid mine residues, and radionuclides.

Mining Districts in the state:
There are 274 mining districts in the state, approximately 46 of which have been inventoried.

Number of features in the USMIN database:
16,815 features, of which 4,045 are shafts and adit symbols. Some of these USMIN points represent sand & gravel operations, which are an eyesore and ecologically unstable but are not immediately dangerous to the public.

Mine Features Inventoried to date:
New Mexico AML and the BLM have together identified 26,542 abandoned mine features. Of those, approximately 25% are deemed dangerous enough to safeguard. Approximately 3,200 of these hardrock features have been safeguarded to date.

Approximate distribution of abandoned mines by land ownership:

Private Land - 39%
State land - 6%
BLM - 41%
USDA Forest Service - 11%
Tribal land - 1%
Other - 2%

Left photo: A bat-compatible cupola is southern New Mexico. The bats live in the mine and fly between the bars to access the mine. Right photo: Historic mine shaft with steel mesh closure with viewing platform at the Cerrillos Hills State Park in Santa Fe County, New Mexico. The platform allow park users to look down the shaft in a safe manner.

NEW YORK

State Agency Responsible for AML:
Department of Environmental Conservation, Bureau of Mines, Facilities, and Technology, Mined Land Reclamation Section.

Full Time State Employees devoted to AML: 27 (all Mined Land Reclamation Specialist titles)

Funding available to agency for hardrock AML:
Seized financial security from sites where the permittee has forfeited the funds. No state general funds are available to operate a New York AML program. As financial security seizures arise, those funds are utilized to solicit contractors or pay for equipment and supplies used by state employees to perform reclamation.

Minerals commonly associated with hardrock AML:
Clay, peat, sand and gravel, iron ore, lead, zinc, talc, gypsum, sandstone and bluestone, dolostone and limestone.

Most common types of hardrock AML hazards:
Physical safety hazards including unsafe slopes and highwalls, shafts and adits, spoil piles, and pits and retention ponds.

Program description:
The Mined Land Reclamation program administers and oversees the Abandoned Mine Reclamation projects in New York. The program is responsible for using seized financial security funds to ensure sites are reclaimed in accordance with the approved plans and to the standards specified in regulations, including resolving safety issues related to unsafe slopes, dangerous highwalls, and mining-impacted water bodies.

New York estimates there are approximately 1,600 abandoned hardrock mines located throughout the state. There are approximately 24 mines sites where the state has seized the financial security and reclamation work remains to be done.

OHIO

State Agency Responsible for AML:
- Ohio Department of Natural Resources (ODNR), Division of Mineral Resources Management.

Full-time state employees devoted to AML:
- The Coal AML program has 53 FTE staff members.
- The Industrial Mineral program, which permits and regulates non-coal mineral extraction, has 11 FTE staff members.

Funding available to agency for hardrock AML:
- A state-funded abandoned mine land reclamation program for Ohio was realized with the establishment of the Unreclaimed Lands Fund in 1972.
- The Unreclaimed Lands fund is utilized to complete reclamation projects on public and private lands affected by surface mining prior to April 10, 1972. A state severance tax is imposed on active surface mine operators who extract coal and industrial minerals. This state severance tax provides approximately $1.0 million annually to the Unreclaimed Lands Fund. This fund is mostly used to support the Industrial Minerals regulatory program and to reclaim industrial minerals mine forfeitures but can be used for high priority AML sites if sufficient funds are available.

Minerals commonly associated with hardrock AML:
- Clay and shale, sand and gravel, salt, limestone, dolomite, sandstone.

Most common types of AML hazards:
- Physical safety hazards including shafts, mine entrances, subsidences, pits/quarries, landslides, waste rock piles, and highwalls.

Program description:
- The Ohio Department of Natural Resources, Division of Mineral Resources Management (ODNR-DMRM) administers both a state AML program and a federal AML program. The Coal AML program reclaims land and water resources adversely affected by past coal mining and left abandoned or inadequately restored. There is not a specific hardrock AML program in Ohio but the AML Program has the ability to address AML hardrock sites with the state Unreclaimed Lands Fund authority if funds are sufficient from state severance taxes.
- ODNR-DMRM also manages an industrial mineral program that regulates Ohio's industrial minerals surface mining operations under Ohio Revised Code Chapter 1514 (the law) and Ohio Administrative Code 1501:14 (the rules). Underground extraction of industrial minerals (non-coal) does not require a surface mine permit.

Examples of Successful Projects:

- In March 2024, a sudden subsidence occurred in a roadway in Ottawa County near Lake Erie. Both abandoned mine land and industrial mineral staff investigated the site and determined an abandoned gypsum mine located below the roadway was the cause. The area was riddled with subsidence features, but the most concerning was a large 10ft wide by 10ft long and 20 feet deep open depression in the road itself. After design considerations, a stabilization technique utilizing drilling into the void and filling with high-flow grout mixture was determined to be the most effective repair for the site. AML staff designed the project and oversaw the project development. The Plasterbed Road Subsidence project was completed on December 17th, 2024, for a total of $261,639. Funding for the project came from the state Unreclaimed Lands fund.

Ohio's Needs:

- Establish a statewide comprehensive and accurate inventory of hardrock AMLs
- Increase public safety closures
- Conduct ongoing maintenance post-remediation and/or closure
- Educate the public of the dangers on historic industrial mineral extraction sites

PENNSYLVANIA

State Agency Responsible for AML:
Pennsylvania Department of Environmental Protection, Bureau of Abandoned Mine Reclamation for coal AML and Bureau of Mining Programs non-coal active mining I Department of Environmental Protection I Commonwealth of Pennsylvania.

Full Time State Employees devoted to AML:
244 Bureau of Abandoned Mine Reclamation employees and 24 Bureau of Mining Programs employees. Up to 10 to 15 from either agency may work on non-coal hardrock projects at any time.

Funding available to agency for hardrock AML:
Pennsylvania has very limited funding for hardrock reclamation. As emergencies or non-coal forfeitures arise state funds and/or non-coal forfeiture funds are utilized to pay staff and perform reclamation.

Minerals commonly associated with hardrock AML:
Bluestone, iron ore, clay, sand, fire clay, mica, dolomite, silica, and limestone.

Most common types of hardrock AML hazards:
Physical safety hazards including shafts, slopes, audits, pits, highwalls, and spoil piles.

Program description:
The Bureau of Abandoned Mine Reclamation administers and oversees the Abandoned Mine Reclamation Program in Pennsylvania. The Bureau is responsible for resolving problems such as mine fires, mine subsidence, dangerous highwalls, open shafts and portals, mining-impacted water supplies, and other hazards which have resulted from past mining practices in accordance with requirements established by the federal Office of Surface Mining Reclamation and Enforcement under authority of the Surface Mining Control and Reclamation Act.

Pennsylvania estimates there are over 2,800 abandoned hardrock mines located throughout the state. There are approximately 50 non-coal forfeiture sites to be reclaimed in Pennsylvania.

Pennsylvania AML staff have worked with other state agencies including Pennsylvania Game Commission, Department of Conservation and Natural Resources (parks and forestry), and local municipalities to reclaim high priority AML sites.

TENNESSEE

State Agency Responsible for AML:
Tennessee Department of Environment & Conservation, Division of Mineral & Geologic Resources, Land Reclamation Section – https://www.tn.gov/environment/mineral-geologic/amlp.html

Full Time State Employees devoted to AML: 10 (all coal AML employees)

Funding available to agency for hardrock AML:
There is currently no dedicated funding for non-coal AML reclamation in Tennessee and available funding is limited. Non-coal reclamation work would be funded from the approximately $250,000 in state general funds the program receives each year to cover all non-federal expenditures or from the Tennessee Surface Mine Reclamation Fund, which collects approximately $20,000 each year from non-coal permit and acreage fees. When non-coal emergencies arise, state general funds and/or the Tennessee Surface Mine Reclamation Fund have been utilized to perform non-coal reclamation and cover associated personnel costs.

Non-coal minerals mined in Tennessee: Limestone, dimension stone, zinc, sand & gravel, clay, shale, quartzite, granite, and titanium. Historically mined minerals include lead, phosphate, barite, fluorite, copper, iron, manganese, gold, mica, tripoli, celestine, and bauxite.

Most common types of hardrock AML hazards:
Physical safety hazards including shafts, slopes, adits, subsidence, pits, highwalls, and spoil piles.

Program description:
The TDEC Land Reclamation Section administers and oversees the Abandoned Mine Reclamation Program in Tennessee. The AML Program addresses high-priority health and safety problems such as dangerous highwalls, open shafts and portals, mining-impacted water supplies, mine refuse fires, mine subsidence and other hazards associated with those mine sites that have been designated as "abandoned", meaning those sites which have been mined prior to surface mining laws, those sites with no reclamation bond, or those sites where there is no continuing obligation to the mine operator.

The AML Program has completed five non-coal AML reclamation projects since 1994 to address high priority health and safety hazards present at those sites. Tennessee does not have a complete inventory of current non-coal AML sites.

Atoka Sand & Gravel Non-Coal AML Site (Before)

Atoka Sand & Gravel Non-Coal AML Site (After)

Mascot Zinc Mine Subsidence (120 feet deep)

TEXAS

State Agency with responsibility for AML:
Railroad Commission of Texas

Full-time state employees devoted to AML: 4

Funding available to agency for hardrock AML:

OSMRE Fee Grant: 2024 funding: $489,762. Texas is a certified state, so we can use our SMCRA AML fee grant for noncoal as well as traditional coal projects. The fee distribution amount lessens every year as it is funded through a tax on active coal mines. As the coal mines shut down, and less tax is collected, this funding will end. It is anticipated this funding will end in the next 5-10 years.

No state general funds are used to operate the Texas AML program.

Minerals most commonly associated with hardrock AML: Cinnabar, uranium, copper, and tin.

Most common types of AML hazards:
Health and safety hazards associated with abandoned hard rock mines include fall risks at open shafts, roof cave-ins, and collapse of mine facilities and equipment.

Health and safety hazards associated with abandoned surface uranium mines include unstable highwalls, deep steep-sided pit impoundments, unstable spoil, and localized areas of radioactive spoil. The highwalls and spoil piles are often poorly vegetated and severely eroded. Mine spoil erosion degrades water quality and causes sedimentation problems on adjacent unmined land. The spoil can contain acidic and saline materials that prevent vegetation establishment. Metals such as molybdenum, arsenic, and selenium may be found in concentrations that are toxic to plants and animals.

Program description:

Railroad Commission of Texas
Surface Mining and Reclamation Division
Texas Abandoned Mine Land Program

The Commission's Abandoned Mine Land Program (AMLP) was established in 1979 and implements Title IV of the federal Surface Mining Control and Reclamation Act of 1977. It is the intent of AMLP to reclaim and restore land and water resources and to protect the public from the adverse effects of pre-law mining practices. AMLP either conducts and/or directly oversees the development, design, and reclamation work necessary to achieve program goals.

The objectives of AMLP are to abate conditions hazardous to the health, safety, and welfare of the people of the State of Texas, where such conditions may exist; to abate pollution of the land, water, and air of Texas which is caused by past mining; and to restore the utility of the land for commercial, industrial, residential, recreational, agricultural, and forestry purposes.

A survey conducted in 1991 with the UT Bureau of Economic Geology inventoried 12,000 abandoned mine sites within the state. Approximately 2,000 of those sites are related to heavy metal mining such as copper, cinnabar, silver, and uranium. To date, Texas AMLP has reclaimed 38 abandoned hardrock sites. The latest was a gypsum mine in Gillespie County that posed severely hazardous mine openings. The mine was reclaimed through a combination of bat gates and collapse of exposed tunnels.

UTAH

State Agency Responsible for AML:
Utah Division of Oil, Gas and Mining, Abandoned Mine Reclamation Program (AMRP). (https://ogm.utah.gov/amr-home/)

Full Time State Employees devoted to AML:
11 AMRP employees that share coal and hardrock AML work, 100% federally funded.

Funding available to agency for hardrock AML:

- Surface Mining Control and Reclamation Act (SMCRA) AML fee-based grant.
  - » Approximately $800k of the annual minimum program distribution of $2.83 million.
- Bureau of Land Management (BLM) grants for hardrock mine closure and environmental projects on BLM-managed land.
  - » Agreement from 2017-2023 provided $4.2 million.
  - » Current Agreement 2023-2028 provides $500k.
- Department of Energy (DOE) grants from the Defense Related Uranium Mine (DRUM) Program for inventory and mine closure work at DRUM sites on public, private, and state land.
  - » Agreement from 2017 – 2025 provides $3.4 million.
  - » Current annual distribution of $500k.

Minerals commonly associated with hardrock AML:
Copper, gold, silver, lead, zinc, uranium, vanadium, gilsonite, and phosphate.

Most common types of hardrock AML hazards:
Physical safety hazards include open shafts, adits, inclines, trenches, unstable structures, and old explosives. Environmental safety hazards include mine dumps and mill tailings containing heavy metals, residual chemicals used in mining processes, radiation exposure at uranium mines, and heavy metal seepage into ground and surface water.

Program description:
The Utah Abandoned Mine Reclamation Program (AMRP) was created within the Division of Oil, Gas and Mining (OGM), a division of the Department of Natural Resources (DNR). Utah received primacy from the Office of Surface Mining Reclamation and Enforcement (OSMRE) in 1983. The AMRP protects the public's health and safety from hazards at abandoned mines and restores lands damaged by past unregulated mining. Coal reclamation is prioritized by SMCRA funding, but the funding also allows for safeguarding of physical safety hazards at hardrock abandoned mines. More recent funding sources from the BLM and DOE have supplemented the SMCRA funds for hardrock abandoned mine reclamation. This narrative focuses on the AMRP hardrock abandoned mine work.

At the time that the Utah AMRP received primacy, it was estimated that there were as many as 20,000 abandoned mines in Utah, located in every county in the state, but with especially heavy concentrations of precious metals mining in the Wasatch Mountains and portions of the West Desert, and uranium and vanadium mining in the Colorado Plateau. Hazards associated with these mines are predominantly physical safety hazards from open adits and shafts. AMRP generally considers a mine opening greater than 10 feet in depth to be hazardous. Environmental hazards associated with abandoned hardrock mines in Utah are infrequent, presumably due to a lack of water and geologic conditions that are not conducive to acid mine drainage. Environmental hazards have not been a focus of AMRP's work because, historically, funding has not allowed for environmental remediation at hardrock AML sites.

There is no comprehensive inventory of the abandoned hardrock mines in Utah, so the AMRP has prioritized mining districts for inventory and safeguarding generally based on proximity to population centers and more recently, transient recreation. In the 42 years it has been operating, AMRP has closed over 7,000 hazardous abandoned mine openings. It is now estimated that there are around 10,000 open abandoned mines remaining. The AMRP's work continues to be important to public safety because many of Utah's most beautiful and popular outdoor recreation areas are located in former mining districts, and abandoned mine openings near skiing, hiking, or OHV trails continue to be discovered or to require maintenance on existing closures.

Approximate Distribution of Abandoned Mines by Landowner:

Private land - 45%
BLM-managed land - 40%
USFS-managed land - 8%
State land - 5%
Other - 2%

Program Hardrock AML Awards:

- **2020: NAAMLP Hardrock AML Award**
  Remediation of Physical Safety Hazards
  - » Red and Fry Canyon Project – closure of 62 abandoned uranium mines in San Juan County. Phase 1 of a 400-square-mile project, this phase included twelve National Register-eligible sites.
- **2018: NAAMLP Hardrock AML Award** Remediation of Physical Safety Hazards
  - » Wolf Den Fire Project – successful abatement of a gilsonite fire burning in an open stope in Uintah County.
- **2016: NAAMLP Hardrock AML Award**
  Remediation of Physical Safety Hazards
  - » San Rafael Swell Project- closure of 172 abandoned uranium mines over 800 square miles of steep, rocky desert territory in the San Rafael Swell of Emery County.
- **2010: Office of Surface Mining Western Region Award**
  - » Temple Mountain Project – uranium mine closure project in the San Rafael Swell of Emery County.
- **1997: Office of Surface Mining Western Region Award**
  - » Silver Reef Project – silver mine closure project in the unique, and historic mining Silver Reef mining district in Washington County.

VIRGINIA

State Agency Responsible for AML:
Virginia Department of Energy, Division of Mineral Mining

Full Time State Employees devoted to AML: 2

Funding available to agency for hardrock AML:
As a result of a proposal by the mining industry, legislation was enacted in 1978, which established a non-coal orphaned land reclamation program. Funds for the reclamation of orphaned mines are obtained from interest monies earned from a state managed industry self-bonding program. Mine operators participating in the program make payments into the Mineral Reclamation Fund based on the acreage disturbed by their operations. The fund assures that active mines will be reclaimed and participation is mandatory under Virginia's Mineral Mining law. Additional funding is obtained by actively soliciting environmental grants to leverage the interest monies to the maximum extent possible. No state general funds are available to operate the Virginia Orphaned Land Program.

Minerals commonly associated with hardrock AML:
Barite, clay, copper, dolostone, feldspar, gneiss, gold, granite, iron, manganese, lead, limestone, marble, mica, pyrite, quartz, sandstone, shale, soapstone, titanium, and zinc.

Most common types of hardrock AML hazards:
Environmental pollution is defined as any condition which poses existing or potential hazards to the environment. The major environmental problems associated with inactive/abandoned mine sites are stream sedimentation from unvegetated soils, acid draining tailings and waste piles, ground water degradation, and trash dumps.

Hazards to the public health and safety are defined as any conditions which have the potential, now or in the future, of posing a danger to the public. The major public health and safety problems associated with inactive/abandoned mine sites in Virginia are fall hazards from highwalls, shafts and other mine openings, and the unauthorized and unsupervised use of mine sites as recreational areas.

Program description:
"Orphaned", or abandoned, mineral mined lands are those areas disturbed by the mining of all minerals, except coal, which were not required by law to be reclaimed or have not been reclaimed. Virginia's General Assembly enacted reclamation laws in 1968 to minimize the adverse effects of mining on the environment. Recognizing that past mining practices had left many orphaned or unreclaimed mine sites, a proposal was made to study the extent of orphaned mines in Virginia.

Early mining in Virginia began with the retrieval of flint and stone by American Indians for use as tools, and with the mining of bog iron ore near Jamestown in 1609. The first ironworks were set up in 1619 about 66 miles above Jamestown on the James River. The Austinville Lead/Zinc Mine in Wythe County, Virginia operated in the 1700's and was important in the Revolutionary War. The Crimora Mine, the largest producer of manganese in the United States, operated until 1958.

The materials mined in the 1900's included the only arsenic mined east of the Mississippi River, the Brinton Mine, which operated from 1912-1917. Manganese and iron mining continued throughout the state until production ceased for the most part in the 1950's. Barite production began in Fauquier County in 1845 and continued also until the mid-1950's. Titanium ore mining and processing continued from the 1940's to the early 1970's. The mining of construction materials, which was first documented in the late 1800's, continues today and includes sand and gravel, granite, limestone, gneiss, and sandstone used for crushed stone, and dimension stone, gypsum, clay, and others. At one time or another, over 50 minerals have been mined in Virginia, contributing greatly to the state's economy but also sometimes causing adverse impacts on the public's health and safety and the environment.

Gold, pyrite, zinc, and copper mines in the eastern, south-central, and southwest portion of the state pose public safety hazards due to hazardous open mine shafts at many of the mines, and environmental hazards from acidic drainage, mine waste, and stream sedimentation.

In this same region of the state, abandoned sand and gravel mines provide potential sources of non-point and point source pollution of the Chesapeake Bay and its tributaries. The entire state is host to hundreds of acres of denuded landscape resulting from manganese and iron mining prior to 1950. These mines continue to pose threats to state waters through increased stream sedimentation.

In the western region of the state, shafts from the mining of zinc, and stream sedimentation from manganese and iron are prevalent.

Across the state, abandoned quarries pose numerous dangers to public health and safety. These old mine sites were often used as trash dumps and/or for recreational activities. As a result, people have fallen from highwalls at old quarry sites, drowned in bodies of water left by mining operations, and suffered serious injuries while riding ATV's and other off-road vehicles.

There are an estimated 9,900 abandoned mine features in the Commonwealth, 30% of which have been inventoried. Once identified, an abandoned mineral mine site is evaluated for its potential hazards to the environment and the public's health and safety. This evaluation includes soil and water investigations, studies on the feasibility of reclaiming the site, cost analysis, and seeking the landowner's consent to allow reclamation to proceed. Once inventoried, sites are prioritized by the Orphaned Land Advisory Committee, which meets annually. This committee is comprised of 8 members from the public, industry, Virginia Geologic Survey, Virginia Department of Environmental Quality, USDA, Virginia Transportation Construction Alliance (VTCA), Virginia Department of Energy, Abandoned Mine Land Program and Virginia Tech Crop & Soil Environmental Sciences Department.

The first orphaned land site was reclaimed in 1981. Since then, 138 orphaned land projects have been completed.

WYOMING

State Agencies with responsibility for AML:
Abandoned Mine Land Division, Department of Environmental Quality

Full-time state employees devoted to hardrock AML:
Wyoming has 8 FTEs that work some portion of their time on hardrock reclamation. Seven project managers and one program manager devote at least 50% of their time to hardrock AML reclamation.

Funding available to agencies for hardrock AML:
Wyoming became a Certified State in 1984 allowing the use of the annual SMCRA AML fee-based funding for hardrock reclamation in addition to coal reclamation. Physical safety hazards rank as the most common problem associated with hardrock mines. These mines range from single portals to large-scale uranium mining districts. Uranium open pit mines continue to be addressed in multi-phase, multi-year projects ranging in size from 300 – 3,500 acres. Due to the short construction season in Wyoming, these large projects can take over 15 years to complete and costs can exceed $25 million.

Minerals most commonly associated with hardrock AML:
Gold, silver, copper, limestone, bentonite, and uranium.

Most common types of AML hazards:
Adits, shafts, highwalls, and open pits are the most common hardrock mining issues in Wyoming. Sediment loading to perennial streams from erosional features continues to have negative impacts to water quality. Potential radiometric impacts from eroding uranium piles also are a concern. Wyoming is fortunate to have very limited mine drainage impacted water.

Program description:
Wyoming has developed a hardrock inventory over the last 40 years. The inventory continues to be updated as new features are discovered. Our last large inventory effort was over 20 years ago. Due to the age of our inventory, a new hardrock inventory contract will be awarded to a consulting engineering firm in 2025 to address areas of the state that were not well covered during previous efforts. While our hardrock inventory is statewide, it should not be viewed as comprehensive or complete. The nature of Wyoming hardrock mines, frequently being in remote areas at high altitudes, makes them difficult to locate, inventory, and reclaim. Some of these mines require horse packing to access wildness areas and/or helicopters to safely deliver materials for reclamation.

Wyoming AML works closely through MOUs with the federal land managers since 48% of the state is federally owned. WY AML uses annual grant funding of around $500K from the BLM to reclaim 10-20 mines annually. The USFS and Wyoming AML have an excellent working relationship and work closely together on common high-priority closures within the 8 national forests in the state. While many of these are small mines, the remoteness and difficulty in closures increases the costs significantly.

Wyoming AML works with federal land managers, other state agencies, and NGOs to address Greater Sage-Grouse and sagebrush restoration efforts statewide through our AML Native Plants Project. These cutting-edge efforts have resulted in more successful revegetation on our hardrock reclamation sites.

Total 5-year average funding: Estimate: $20,000,000

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