

Bureau of Land Management

Abandoned Mine Lands Program

Feasibility Study for AML Inventory
Validation and Physical Safety Closures

July 2013



U.S. Department of the Interior Mission

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.



Bureau of Land Management Mission

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.



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Executive Summary

The Abandoned Mine Lands (AML) Program of the U.S. Department of the Interior (DOI), Bureau of Land Management (BLM), operates under multiple authorities. Assumptions in this study are based on a continuation of the \$15.9 million appropriated in Fiscal Year 2010. Appropriations are used to identify and remediate both physical safety and environmental hazards associated with abandoned hardrock mines on or affecting public lands. The BLM uses appropriations from general revenues for a range of activities, including:

- AML site validation (for example, site inventory, validation characterization, and maintenance of an inventory database)
- cultural, historical, and wildlife studies required under the National Environmental Policy Act (NEPA) or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- remedy design and construction
- remediation of physical safety and environmental hazards
- monitoring and maintenance

In 2009 the U.S. Senate Committee on Appropriations directed the DOI Secretary to provide a report on the status of the inventory and to submit a completed inventory for review.¹ In addition, the Government Accountability Office (GAO) reported and testified about the wide variation in estimates of abandoned hardrock mines owing to the lack of a generally accepted definition for a hardrock mine site among state and federal agencies in the West.² Also, the DOI's Office of Inspector General (OIG) has issued several reports concerning AML programs and sites. These reports made findings and recommended that the BLM:

- assess its lands to identify hazardous sites in close proximity to populated places
- inspect these sites and take appropriate action to mitigate safety hazards
- validate existing inventory data and develop procedures for ongoing data collection to ensure that data in the inventory is complete, accurate, and consistent³

¹Senate Report 111-038 – Department of the Interior, Environment, and Related Agencies, Appropriations Bill, 2010.

²“Hardrock Mining: Information on Abandoned Mines and Value and Coverage of Financial Assurances on BLM Land,” GAO-08-574T, March 12, 2008.

³OIG Flash Report C-IN-BLM-0013-2005, “Public Safety Issues at the Saginaw Hill Property, Bureau of Land Management,” U.S. Department of the Interior, Office of Inspector General, March 2005; and Audit Report C-IN-MOA-0004-2007, “Abandoned Mine Lands in the Department of the Interior,” U.S. Department of the Interior, Office of Inspector General, July 2008.

The BLM is committed to taking the necessary steps to define the full extent of the problem associated with known abandoned mine hazards. In response to the above critiques, the BLM has prepared this “Feasibility Study for AML Inventory Validation and Physical Safety Closures” to estimate the costs to validate and address the unremediated AML sites posing physical safety hazards.

This study determined that the total cost to complete field validation and physical safety hazard remediation at the 22,104 known AML physical safety sites is approximately \$402.6 million (Table 8). The BLM estimates that it will:

- cost \$39.7 million to field-validate all of the AML sites with physical safety hazards that are a part of the working inventory
- cost \$362.9 million to remediate all of the AML sites with physical safety hazards that are a part of the working inventory

To address the working inventory of sites with physical safety hazards most effectively, the BLM must set priorities. Consistent with existing priority criteria, the BLM has identified the following high-, medium-, and low-priority sites based on proximity to populated places:

- 594 high-priority sites (sites within a quarter mile of a populated place or school currently in use)
- 647 medium-priority sites (sites that are within a quarter mile of a historic populated place [for example, a mining “ghost town”], historic school, or area of high visitation)
- 20,863 low-priority sites (sites located more than a quarter mile away from a populated place)

The BLM estimates that \$11.4 million is needed to field-validate and remediate all high-priority sites impacting public safety and that \$12.6 million is required to field-validate and remediate the medium-priority sites; approximately \$377.7 million is needed to field-validate and remediate those sites characterized as low priority (Table 7).



1. Background and Purpose

The Abandoned Mine Lands (AML) Program of the U.S. Department of the Interior (DOI), Bureau of Land Management (BLM), is responsible for addressing two broad categories of hazards associated with abandoned hardrock mines⁴: physical safety hazards, such as open adits (horizontal openings), open shafts (vertical openings), highwalls, and pits; and environmental hazards, such as heavy metals in mine wastes and mill tailings and acid mine drainage that, when exposed to air and water, can impact water quality and human health. BLM tracks and addresses:

- sites that pose solely physical safety hazards
- sites that pose solely environmental hazards
- sites that pose both physical safety **and** environmental hazards

1.1 The BLM's Progress in Inventorying and Remediating AML Physical Safety Hazards

Since the BLM's AML Program was established in the late 1990s, the BLM has made great strides in identifying and addressing abandoned mine sites and associated physical safety hazards. The BLM developed the Abandoned Mine Site Cleanup Module (AMSCM) to track information about abandoned mine sites. The BLM prioritizes and remediates hazards at abandoned mine sites using a risk-based approach. It is an enormous task that will take the continued, dedicated commitment of resources over an extended period of time and cooperation with federal, state, local, and tribal governments as well as nongovernmental partners. Meanwhile, the risks associated with abandoned mines remain and continue to increase because more and more remote areas are being developed or accessed for recreation. Even dangerous mines that have been properly sealed off are sometimes entered, vandalized, and left open, potentially subjecting anyone nearby to unexpected and serious dangers.

The BLM remains focused on identifying AML sites with physical safety hazards, in particular, and on ensuring that immediate temporary or permanent mitigation measures are implemented as appropriate to address those sites posing the greatest threat to public safety. In fiscal years

⁴The BLM's Abandoned Mine Land Program Policy, MS-3720, defines an abandoned mine as follows: "An abandoned hard rock mine on, or affecting public lands administered by BLM, at which exploration, development, mining, reclamation, maintenance, and inspection of facilities and equipment, and other operations ceased as of January 1, 1981 (the effective date of BLM's Surface Management regulations codified at 43 CFR 3809) with no evidence demonstrating that the miner intends to resume mining. For many abandoned mines, no current claimant of record or viable potentially responsible party exists. Abandoned mines generally include a range of mining impacts or features that may pose a threat to water quality, public safety, and/or the environment."

(FY) 2006–2009 the BLM completed inventory activities at 5,481 AML sites, and remediated physical safety hazards at 1,733 sites.⁵ Where possible, the BLM conducted mitigation actions during the initial site visit. BLM state offices have increased inventory efforts in recent years to ensure that tangible and accurate information is gathered to address the full scope and scale of the problem as the AML Program moves forward. Although the BLM’s inventory is far from complete and AML sites continue to be identified, it is important to emphasize that many of the sites with the highest potential for harm to public health and safety have already been identified by federal, state, local, and tribal partners and are being addressed.

1.2 Government Interest in the BLM’s AML Program

In recent years there has been considerable government interest at the national level in the BLM’s AML Program and in sites posing physical safety hazards. For example:

- The Government Accountability Office (GAO) reported and testified about the wide variation in estimates of abandoned hardrock mines owing to the lack of a generally accepted definition for a hardrock mine site among state and federal agencies in the West. See, “Hardrock Mining: Information on Abandoned Mines and Value and Coverage of Financial Assurances on BLM Land,” GAO-08-574T, March 12, 2008.
- The Department of the Interior’s Office of Inspector General (OIG) has issued several reports concerning AML programs and sites. In 2008 the Inspector General (IG) stated that the “BLM’s inventory was incomplete, inaccurate and inconsistent.” The IG found that much of the data in the inventory was derived from the U.S. Bureau of Mines before its

closure in 1996 and was never validated by field surveys. These reports recommended that the BLM assess its lands to identify hazardous sites in close proximity to populated places; inspect these sites and take appropriate action to mitigate safety hazards; and validate existing inventory data and develop procedures for ongoing data collection to ensure that data in the inventory are complete, accurate, and consistent. See, OIG Flash Report C-IN-BLM-0013-2005, “Public Safety Issues at the Saginaw Hill Property, Bureau of Land Management,” March 2005; and Audit Report C-IN-MOA-0004-2007, “Abandoned Mine Lands in the Department of the Interior,” July 2008.

1.3 Purpose of This Feasibility Study

Given the increasing urgency of remediating AML physical safety hazards, in particular, this feasibility study focuses on the total cost of field-validating and remediating all such sites (as described in the AMSCM inventory). It does not, therefore, include estimated costs posed by environmental hazards, either in whole or in part.

1.4 Activities Covered by This Feasibility Study

Two primary categories of activities are required to address AML physical safety sites: site **field validation** and **remediation of physical safety hazards**. Throughout this study, unless otherwise specified, the term “remediation” means taking one or more permanent measures to eliminate a hazard.

Field Validation of AML Sites

Once a site is identified as a potential AML site, it must be field-validated to determine whether the site is eligible for funding under the AML Program.⁶ BLM state offices and field offices make this determination by:

⁵Management Information System (MIS), Bureau of Land Management.

⁶In general, an abandoned mine site is eligible for funding under the BLM’s AML program if the site: is on or affecting land administered by the BLM; was last mined before promulgation of the 43 CFR 3809 regulations (that is, before January 1, 1981), which implement the unnecessary or undue degradation provision of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701, et seq.); and has no mining claimants or responsible parties able or willing to clean up the site.

-
- conducting research to determine land status and ownership and the extent of field activity needed, which includes preparing and conducting site visits to collect on-the-ground data and information related to the AML site
 - reporting and filing information in the BLM's AMSCM database, which stores information about the sites and their associated features

In addition to conducting these basic information-gathering activities during field validation, field personnel also collect information to determine the best approach for addressing the physical safety hazards at the site. In some cases, a temporary action, such as posting of warning signs and construction of fencing to control access, may be implemented to reduce physical safety hazards until a permanent remedy can be put in place.

Remediation of Physical Safety Hazards

Permanent remediation of a physical safety hazard site may include such measures as:

- closing adits and shafts to keep people out while protecting bat habitat
- filling or blocking other potentially hazardous openings
- backfilling
- draining impoundments
- removing leftover equipment, dangerous structures, and debris

As described earlier, any temporary measures to address a physical safety hazard site are considered part of field validation activities, not remediation.



2. Methodology and Results

The four activities described below explain the methodology and data assumptions underlying this feasibility study:

- developing a working inventory of physical safety sites
- prioritizing the sites based on location with respect to population/recreation areas
- estimating BLM state office–specific average remediation costs
- estimating the total national remediation cost

2.1 Developing a Working Inventory of Physical Safety Hazard Sites

AMSCM is the AML Program’s database system of record for tracking the inventory of AML sites. It stores and reports information related to abandoned mine sites. The data contained in AMSCM assist AML Program managers in controlling:

- overall remaining workload estimates of sites, features, and feature types
- the status of sites under the National Environmental Policy Act (NEPA) or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) processes
- future monitoring and maintenance requirements and schedules for visiting remediated sites
- data and statistics useful for strategic and operational planning

As of November 2, 2010, AMSCM had tracked a total 29,090 AML sites with environmental and/or physical safety hazards. Each record comprises a site located on or potentially affecting surfaces managed by the BLM. Each site may have one or more features associated with it that require remediation.

To refine further the universe of sites for purposes of this feasibility study, AMSCM was queried to identify AML sites with **only** physical safety hazards. In other words, sites that pose solely environmental hazards and sites that pose both environmental hazards **and** physical safety hazards were removed from consideration. Also excluded from the analysis were sites at which remediation actions had been completed or were ongoing. Thus, a total of 2,825 sites were excluded from the analysis in this feasibility study. As reflected in Table 1, **there are 22,104 AML sites with solely physical safety hazards in 11 BLM state offices.** These sites represent the working inventory of AML sites with physical safety hazards that must be addressed.

2.2 Prioritizing Sites Based on Location with Respect to Population/Recreation Areas

This feasibility study determined which sites posed the highest risk in terms of physical safety hazards based on the AML Program's risk-based approach to addressing AML sites and the AML Program's National Evaluation Criteria (see Abandoned Mine Land Program Policy Handbook, H-3720-1). In addition, as a result of the OIG's Saginaw Hill Flash Report, the BLM AML Program identified priority AML sites to be addressed that are within a quarter mile of populated places. This study uses the quarter-mile criteria to identify high-, medium-, and low-priority sites based on their relative proximity to population centers and schools.

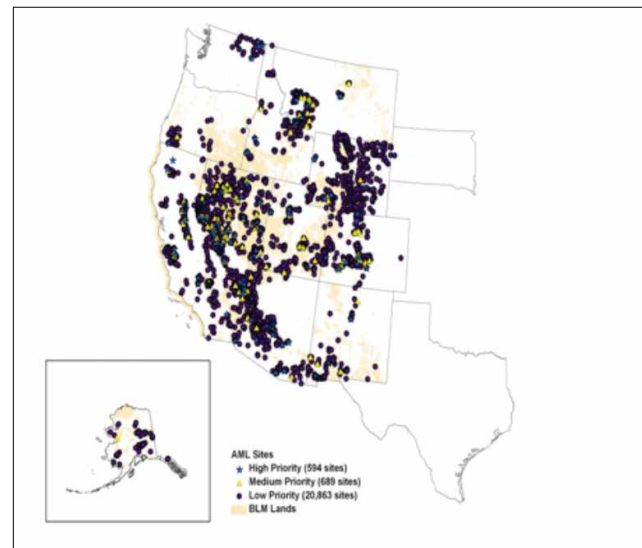
BLM policy directs state offices and field offices to conduct site validation on and mitigate AML-related safety hazards at those sites in proximity to populated places (PPL). The term PPL is a U.S. Geological Survey designation for a city, town, or village, and the primary point of a PPL is the center of original place, such as the city or town hall, main post office, or town square, regardless of changes over time. Sites located near PPLs or recreation areas have a higher likelihood of being easily accessed by the public.

As a first step in identifying the proximity of AML physical safety hazard sites to PPLs, latitude and longitude coordinates for each site were obtained from the AMSCM working inventory data and plotted in a Geographic Information System (GIS). A buffer was created around each site using AMSCM assigned acreage, if available, to approximate the site's size. If AMSCM did not contain an acreage value for a site, a minimum buffer size of 1 acre was applied.

Data were compiled from several sources to identify PPLs and other areas where people are likely to live, gather, and/or recreate, including:

- U.S. Geological Survey — Geographic Names Information System (GNIS)⁷:
 - ≈ populated places
 - ≈ parks
 - ≈ schools
- Federal Emergency Management Agency — HAZUS MH database:
 - ≈ schools
- BLM spatial data for:
 - ≈ recreation sites
 - ≈ buildings
 - ≈ campgrounds
 - ≈ trailheads

A more detailed description of these data sets is provided in Appendix A.



The AML physical safety hazard sites were plotted in a GIS mapping system, and the distance of each site to potential population sources was calculated. The buffered site locations were then analyzed for proximity to populated places, using the following criteria to prioritize the sites:

- **High priority:** PPL or schools within a quarter mile of one or more AML sites
- **Medium priority:** historic mining towns, historic

⁷U.S. Geological Survey, 19810501, "U.S. Geographic Names Information System (GNIS)," All States_20101001.zip, Reston, Virginia, October 2010. <http://geonames.usgs.gov/domestic/index.html>.

- schools, recreation areas, parks, camps, or trails within a quarter mile of one or more AML sites
- **Low priority:** sites located more than a quarter mile away from a populated place

The BLM will continue to focus on addressing high- and medium-priority sites to ensure protection of public safety; however, it is important to note that injuries have occurred at low-priority sites and that these sites must also be remediated. Low-priority sites are becoming more accessible to the public as population increases, causing urbanization to encroach

on once remote areas. As this occurs, low-priority sites may shift to a higher priority for the BLM. The BLM will track low-priority sites and remediate hazards as appropriate.

Table 1 shows the number of high-, medium-, and low-priority sites on or affecting lands managed by each BLM state office. There are 594 high-priority sites, or 2.6 percent of the physical safety hazard sites tracked in AMSCM. There are 647 medium-priority sites, or 2.9 percent of the physical safety hazard sites tracked in AMSCM.⁸

Table 1. AML Physical Safety Hazard Sites (by BLM State Office and by Level of Priority)

BLM State Office	High Priority	Medium Priority	Low Priority	Working Inventory (Total AMSCM Physical Safety Sites)
Alaska	0	1	158	159
Arizona	70	27	2,776	2,873
California	66	66	977	1,109
Colorado	16	41	957	1,014
Idaho	2	4	152	158
Montana/South Dakota	18	32	727	777
Nevada	293	393	9,962	10,648
New Mexico/Texas	107	9	1,378	1,494
Oregon/Washington	6	1	288	295
Utah	13	69	2,800	2,882
Wyoming	3	4	688	695
Total	594	647	20,863	22,104

2.3 Estimating BLM State Office–specific Average Remediation Costs

To estimate the total cost to field-validate and remediate the BLM’s physical safety hazard sites, this study analyzed expenditure and

performance data for FYs 2006–2010 from the BLM Management Information System (MIS) and Performance Management System (PMS) to develop an estimate of BLM state office–specific average remediation costs, as described in the remainder of this section.

⁸Some sites are located proximate to more than one populated place, and the GIS analysis identified 59 sites that qualified for multiple priorities. For each of these sites, the highest level of priority for which the site qualified was assigned to that site.

Data Sources for Estimating Cost of AML Activities

The AML Program’s business processes are managed by the BLM’s MIS and its several modules (Budget Planning System, Performance Module, and Activity-Based Costing Reports). MIS monitors direct costs for tracked activities, in addition to the Bureau Full Cost (BFC), which includes direct costs plus administrative costs distributed across all program elements.⁹ The BLM uses the MIS to establish annual performance targets and track actual accomplishments throughout

the year. MIS represents the best available data source for tracking historical costs associated with field validation and remediation of physical safety hazards at the national level.

Workload measures established by the BLM (for example, number of AML sites, number of acres treated) are used to track program accomplishments. The BLM uses six program elements in the MIS and PMS to measure field performance in the AML Program, as described in Table 2.

Table 2. AML Program Elements, Codes, and Workload Measures

AML Program Element	PE Code	Workload Measure
Inventory AML sites	BH	Number of AML sites
Remediate AML physical safety hazards	HP	Number of AML sites
Implement AML projects to restore water quality	JK	Number of acres treated
Monitor and maintain AML, hazmat, and Natural Resources Damage Assessment and Restoration (NRDAR) sites (sites where cleanup actions are completed)	MG	Number of AML sites
Evaluate potentially responsible parties (PRPs) for cost avoidance/recovery	NP	Number of PRP searches completed
Process hazmat cost avoidance/recovery cases	NQ	Number of cases referred to DOI Solicitor

The first two program elements listed are of concern in this feasibility study, as they directly correlate to the cost of field validation and remediation of physical

safety hazards. Table 3 describes the nature of the work included within these two performance elements and the costs involved.

⁹A “program element” is a specific activity or product for which the BLM captures cost data.

Table 3. AML Program Elements: Site Inventory and Remediation

Program Element BH — Inventory AML Sites:

Description: Inventory work at specific AML sites or at areas where AMLs may exist. Estimate the number of sites planned for inventory and use that estimate for the planning target.

Workload Measure: Number of sites inventoried or physical safety hazards mitigated (for example, through temporary measures, such as fencing or signs).

Costs Included:

- labor and operations for inventory (including field equipment, travel, and training)
- mitigation (temporary remediation measures, such as the placing of warning signs, protective fencing, or other temporary measures restricting access)
- other costs: cadastral surveys, GIS and data management support, consultations with Indian tribes/Alaska Native corporations, outreach and environmental education

Program Element HP — Remediate Physical Safety Hazards:

Description: Remediate physical safety hazards at AML sites, including:

- closures of adits and shafts
- backfilling of highwalls
- drainage of impoundments
- removal of leftover equipment and debris
- revegetation to help offset erosion and improve land stability

Workload Measure: Number of sites remediated. Mitigation (temporary remediation measures) is not a unit of accomplishment for HP and should be reported under BH.

Costs Included:

- labor and operations (including travel, materials, and contracts)
- other costs: cadastral surveys, GIS and data management support, consultations with Indian tribes/Alaska Native corporations, outreach and environmental education

Cost estimation for this feasibility study uses MIS data for the BH and HP program elements for each BLM state office for FY 2006–2010. MIS data related to cost and workload measures (the number of sites addressed by site inventory and remediation activities) during this period were reviewed for consistency, patterns and trends, and potential outlier data.

This study compared trends in the MIS data during FY 2006–2010 with AMSCM data over the same period to analyze the relationship between cost and performance for field validation and physical safety hazard remediation activities. This analysis assessed the accuracy and viability of historical MIS data as a basis for forecasting the future cost and timeframes for completing the inventory and remediation of AML sites. This comparison found that the distribution of the number and type of sites addressed at the state office level was generally consistent with the number and type of physical safety sites in the working inventory. Thus, it was determined that the MIS data could reasonably be used as a method of projecting future costs for addressing physical safety hazards.

While detailed information on AML site features and hazard remediation activities is tracked in AMSCM, MIS captures costs only at the site level, making it possible to conduct only a site-wide assessment of cost and activities. Although measuring performance at the site level is not as granular as measuring costs per feature type or costs per type of remediation activities at a single feature, the business process of inventory/field validation and remediation activities is normally done either for the entire site or for a group of sites.

BLM Total Historical Remediation Costs, FY 2006–2010

The total Bureau Full Cost (BFC) for the BLM’s inventory and remediation of physical safety hazard sites during FY 2006–2010 was \$75.8 million.

Distinguishing between the two program elements, site inventory activities (BH) accounted for approximately \$24.0 million, with a national average cost per site of approximately \$2,300 across the 5-year period, and remediation of physical safety hazards (HP) accounted for approximately \$51.8 million, with a national average cost per site of approximately \$17,400 across the 5-year period, as shown in Table 4.

Table 4. Total AML Physical Safety Hazard Sites Inventoried and Remediated (Nationwide), FY 2006–2010

Year	BH: Inventory AML Sites			HP: Remediate Physical Safety Hazards		
	Sites	Cost	Average Cost per Site (= Sites/Cost)	Sites	Cost	Average Cost per Site (=Sites/Cost)
2006	1,077	\$ 2,077,300		305	\$ 3,691,700	
2007	1,378	2,385,900		509	2,834,200	
2008	1,032	1,932,000		474	8,315,200	
2009	2,005	5,073,100		474	16,397,400	
2010	5,037	12,484,800		1,217	20,570,500	
2006–2010	10,529	\$23,953,100	\$2,300	2,979	\$51,809,000	\$17,400

BLM State Office–specific Historical Remediation Costs, FY 2006–2010

There is significant variability in the number, type, accessibility, and approach to field validation and remediation across BLM state offices. In addition, the number of high-, medium-, and low-priority sites is distributed unevenly across BLM state offices. Therefore, this feasibility study found it appropriate to apply the average cost for each BLM state office (rather

than the national average) to future field validation and remediation activities.

Table 5 shows the average cost of inventory and remediation for each BLM state office for FY 2006–2010, based on MIS data. The variability in the average cost per site in different states reflects the variability of how the state office programs function, and the number and type of sites that each state office addresses.

Table 5. Number and Average Cost of Inventorying and Remediating AML Physical Safety Hazards (by BLM State Office), FY 2006–2010

State	BH: Inventory AML Sites			HP: Remediate Physical Safety Hazards		
	Sites	Cost	Average Cost per Site (=Sites/Cost)	Sites	Cost	Average Cost per Site (=Sites/Cost)
Alaska	5	\$ 2,027,500	\$ 405,500	1	\$ 38,000	\$ 38,000
Arizona	1,337	2,087,100	1,600	468	3,064,900	6,500
California	1,598	8,305,800	5,200	745	14,456,300	19,400
Colorado	229	469,300	2,000	246	2,495,400	10,100
Idaho	126	1,942,200	15,400	157	2,090,500	13,300
Montana/ South Dakota	465	1,625,100	3,500	176	5,223,000	29,700
Nevada	4,000	4,204,500	1,100	777	16,070,400	20,700
New Mexico/ Texas	1,419	598,200	400	110	1,153,400	10,500
Oregon/ Washington	581	687,300	1,200	51	2,517,300	49,400
Utah	756	1,351,700	1,800	235	1,685,100	7,200
Wyoming	13	654,300	50,300	13	3,014,700	231,900
Bureau-wide	10,529	\$23,953,000	\$ 2,300	2,979	\$51,809,000	\$ 17,400

The BLM Washington Office and state office program leads (SOPLs) analyzed the data presented in Table 5 to authenticate the average cost per site across the BLM and to understand better the variability in average cost per site across BLM state offices. In general, for BLM state offices that had average per site BH and/or HP costs that were **lower** than the national average, SOPLs cited the following reasons:

- economies of scale by addressing multiple sites and safety hazards simultaneously
- larger corps of AML Program employees and volunteers
- partnership with universities and nonprofit organizations
- initial remediation of easily accessible sites

In general, for BLM state offices that had average per site BH and/or HP costs that were **higher** than the national average, SOPLs cited the following reasons:

- sites that are remote or spread out across the state, requiring additional resources for mobilization/demobilization
- state- or region-specific requirements impacting design of hazard remediation (for example, closing a safety hazard in remote Alaska requires transporting construction material by air or barge, while a safety

closure in remote California could very likely be reached by land)

- a small number of costly sites

Further, the BLM's Alaska State Office reported BH and HP data on a limited number of sites during FY 2006–2010, skewing average costs. Owing to limited data and the fact that remote locations and regional requirements result in significantly higher mobilization/demobilization, this feasibility study uses the national average with a 5x mobilization/demobilization factor (see Table 6).

Estimated Future BLM State Office–specific Remediation Costs

At the BLM state office level, the historical average cost per site for inventory and hazard remediation in the MIS is a starting point for estimating the future cost of addressing the remaining high- and medium-priority sites. The BLM Washington Office and SOPLs reviewed the MIS data to confirm that it was appropriate to apply the historical average state office–specific remediation cost to future remediation activities. For most state offices, the historical average BH and HP cost per site was determined to be the best estimate of future costs. However, for other state offices (for example, those with very little data recorded in MIS, or with unusual geographic considerations), an alternative average BH and HP cost per site was determined to be more appropriate, as described in Table 6.

Table 6. Estimated Future Average Cost per Site for Field Validation and Remediation of AML Physical Safety Hazards (by BLM State Office)

BLM State Office	Estimated Future Average Cost per Site		Data Source and Rationale
	Field Validation (BH)	Remediation of Physical Safety Hazards (HP)	
Alaska	\$ 11,400	\$ 87,000	MIS national average for BH and HP (FY 2006–2010) was used, owing to the low number of sites that were reported in MIS during that period. As supported by BLM state office data, a 5x mobilization/demobilization factor was applied to the MIS national average cost per site to account for the remote location of most sites.
Arizona	1,600	6,500	MIS state office average for BH and HP (FY 2006–2010).
California	5,200	19,400	MIS state office average for BH and HP (FY 2006–2010).
Colorado	2,000	10,100	MIS state office average for BH and HP (FY 2006–2010).
Idaho	15,400	13,300	MIS state office average for BH and HP (FY 2006–2010). Field validation cost is higher than remediation cost because some activities that are typically categorized in MIS as remediation are categorized as field validation in Idaho.
Montana/ South Dakota	3,500	15,600	MIS state office average for BH (FY 2006–2010) was used for field validation. The MIS state office HP data included a \$2.5 million project funded by the American Recovery and Reinvestment Act of 2009. This was a unique occurrence in FY 2010, which artificially increased the average cost per site for remediation to well above the national average. Consequently, this project was removed from the MIS data, and the average HP cost per site was calculated to be \$15,600 (FY 2006–2010).
Nevada	1,100	20,700	MIS state office average for BH and HP (FY 2006–2010).

Table 6. Estimated Future Average Cost per Site for Field Validation and Remediation of AML Physical Safety Hazards (by BLM State Office)

BLM State Office	Estimated Future Average Cost per Site		Data Source and Rationale
	Field Validation (BH)	Remediation of Physical Safety Hazards (HP)	
New Mexico/ Texas	800	17,400	The BLM's New Mexico State Office recently launched and has been conducting field validation and remediation in high-volume locations, depressing the average costs per site. The MIS state office data were deemed insufficient to determine an average cost per site for the purpose of estimating field validation (BH) costs, and the MIS national average cost per site was found to be too high. The BLM's Washington Office and New Mexico State Office determined that \$800 was an appropriate estimate for future field validation activities based on state office data. The MIS national average (FY 2006–2010) was found to be appropriate for estimating future HP costs.
Oregon/ Washington	2,300	17,400	<p>The MIS state average for BH (FY 2006–2010) was not used, because the historical state average cost per site was determined to be too low relative to future expected costs in Oregon. For the last several years, state office staff have been working on sites with good access; future inventory work is anticipated to be in more remote locations, with a higher cost that is similar to the national average. The bureau-wide national average was used instead of the state average cost.</p> <p>The MIS state average for HP was not used because the historical state average cost per site was determined to be too high relative to projected costs for remediation of physical safety hazards. Future physical safety remediation programs will address multiple projects at the same time, and this will result in lower costs per site than previously incurred on a statewide average. The bureau-wide national average was used instead of the state average cost.</p>
Utah	1,800	7,200	MIS state office average for BH and HP (FY 2006–2010).
Wyoming	2,300	17,400	The MIS state average for BH and HP (FY 2006–2010) was not used, because historical data captured in MIS do not fully reflect state office activities. The BLM national averages were used.

3. Estimated Total National Field Validation and Remediation Costs



In FY 2010 the BLM was appropriated \$15.9 million for the AML Program; however, only a portion of the annual appropriation is normally available for AML site inventory and remediation of physical safety hazards (that is, BH and HP activities), with the rest mostly targeted to fund priority environmental AML projects. Based on an annual appropriation of \$15.9 million, the BLM assumes, for purposes of this study, that 20 percent of the annual appropriation will be available to fund field validation (BH) each fiscal year, and that 30 percent of the annual appropriation will be available to fund remediation of physical safety hazards (HP) each fiscal year. Assuming that the program will continue to receive an annual appropriation of \$15.9 million, 20 percent or \$3.2 million will be available for BH activities, and 30 percent or \$4.8 million will be available for HP activities.

An estimated future cost of completing field validation and remediation of the sites in the AMSCM database, as ranked by state and priority, is approximately \$402 million (see Table 7). Cost estimates are based on the number of sites in the working inventory for each state office (see Table 1), as prioritized in the proximity analysis, and multiplied by the estimated per-site cost of field validation (BH) and physical safety hazard remediation (HP) in Table 6. Minor cost estimate differences between Table 7 and Table 8 are attributable to averaging; Table 7 differentiates costs by priority, whereas Table 8 averages costs with no consideration given to priority.

Table 7. Estimated Future Cost To Field-Validate and Remediate AML Physical Safety Hazard Sites (by BLM State Office and by Level of Priority)

BLM State Office	Number of AML Physical Safety Sites in Working Inventory				Estimated Future Cost by Priority			
	High	Medium	Low	Total	High	Medium	Low	Total
Field Validation (BH)								
Alaska	0	1	158	159	\$0	\$11,400	\$1,797,200	\$1,808,600
Arizona	70	27	2,776	2,873	\$109,300	\$42,100	\$4,333,500	\$4,484,900
California	66	66	977	1,109	\$343,000	\$343,000	\$5,078,100	\$5,764,100
Colorado	16	41	957	1,014	\$32,800	\$84,000	\$1,961,300	\$2,078,100
Idaho	2	4	152	158	\$30,800	\$61,700	\$2,343,000	\$2,435,500
Montana/ South Dakota	18	32	727	777	\$62,900	\$111,800	\$2,540,700	\$2,715,400
Nevada	293	393	9,962	10,648	\$308,000	\$413,100	\$10,471,400	\$11,192,500
New Mexico/ Texas	107	9	1,378	1,494	\$80,300	\$6,800	\$1,033,500	\$1,120,600
Oregon/ Washington	6	1	288	295	\$13,600	\$2,300	\$655,200	\$671,100
Utah	13	69	2,800	2,882	\$23,200	\$123,400	\$5,006,400	\$5,153,000
Wyoming	3	4	688	695	\$6,800	\$9,100	\$1,565,200	\$1,581,100
Bureau-wide	594	647	20,863	22,104	\$1,010,700	\$1,208,700	\$36,785,500	\$39,004,900
Remediation of Physical Safety Hazards (HP)								
Alaska	0	1	158	159	\$0	\$87,000	\$13,739,200	\$13,826,200
Arizona	70	27	2,776	2,873	\$458,400	\$176,800	\$18,179,700	\$18,814,900
California	66	66	977	1,109	\$1,280,700	\$1,280,700	\$18,958,100	\$21,519,500
Colorado	16	41	957	1,014	\$162,300	\$415,900	\$9,707,600	\$10,285,800
Idaho	2	4	152	158	\$26,600	\$53,300	\$2,024,100	\$2,104,000
Montana/ South Dakota	18	32	727	777	\$280,100	\$497,900	\$11,312,100	\$12,090,100
Nevada	293	393	9,962	10,648	\$6,060,000	\$8,128,300	\$206,040,300	\$220,228,600
New Mexico/ Texas	107	9	1,378	1,494	\$1,860,800	\$156,500	\$23,964,800	\$25,982,100
Oregon/ Washington	6	1	288	295	\$104,300	\$17,400	\$5,008,700	\$5,130,400
Utah	13	69	2,800	2,882	\$93,200	\$494,800	\$20,078,800	\$20,666,800
Wyoming	3	4	688	695	\$52,200	\$69,600	\$11,965,300	\$12,087,100
Bureau-wide	594	647	20,863	22,104	\$10,378,600	\$11,378,200	\$340,978,700	\$362,735,500
GRAND TOTAL	594	647	20,863	22,104	\$11,389,300	\$12,586,900	\$377,764,200	\$401,740,400

For the 22,104 sites in the working inventory, this feasibility study estimates that it will cost approximately \$402.6 million to field-validate and remediate the known AML sites with physical safety hazards in AMSCM for all priorities. This total cost is divided by BH and HP activities as follows:

- \$39.7 million to field-validate the AML sites (BH)
- \$362.9 million to remediate physical safety hazards at these sites (HP)

Table 8. Estimated Future Cost To Field-Validate and Remediate AML Physical Safety Hazard Sites (by BLM State Office)

State	Working Inventory (Total AMSCM Physical Safety Hazard Sites)	Field Validation (BH)		Remediation of Physical Safety Hazards (HP)		Total
		Estimated Future Average Cost per Site	Subtotal	Estimated Future Average Cost per Site	Subtotal	
Alaska	159	\$ 11,400	\$ 1,812,600	\$ 87,000	\$13,833,000	\$15,645,600
Arizona	2,873	1,600	4,596,800	6,500	18,674,500	23,271,300
California	1,109	5,200	5,766,800	19,400	21,514,600	27,281,400
Colorado	1,014	2,000	2,028,000	10,100	10,241,400	12,269,400
Idaho	158	15,400	2,433,200	13,300	2,101,400	4,534,600
Montana/ South Dakota	777	3,500	2,719,500	15,600	12,121,200	14,840,700
Nevada	10,648	1,100	11,712,800	20,700	220,413,600	232,126,400
New Mexico/ Texas	1,494	800	1,195,200	17,400	25,995,600	27,190,800
Oregon/ Washington	295	2,300	678,500	17,400	5,133,000	5,811,500
Utah	2,882	1,800	5,187,600	7,200	20,750,400	25,938,000
Wyoming	695	2,300	1,598,500	17,400	12,093,000	13,691,500
TOTAL	22,104	N/A	\$39,729,500	N/A	\$362,871,700	\$402,601,200

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4. Conclusions

Since the AML Program's inception the BLM has been committed to addressing high-risk and high-priority abandoned mine sites to protect public health and safety. This commitment endures and is demonstrated through continued on-the-ground success in addressing hazards associated with abandoned mines. It is strengthened by the BLM's commitment to collaborate with federal, state, local, and tribal governments and nongovernmental partners to ensure that the highest-priority sites are addressed first. Continued program success can be achieved only through thoughtful strategic planning, targeted work, transparency, accountability, and innovation that occur through the exchange of ideas and ongoing dialogue with partners.

The BLM currently estimates the total cost of inventory and remediation activities at 22,104 AML sites to be \$402.6 million. Of this, an estimated \$11.4 million is needed to address all high-priority sites, and an estimated \$12.6 million is needed to address medium-priority sites impacting public safety. The BLM currently estimates that \$377.7 million is needed to address those sites characterized as low priority. Injuries and accidents do still occur at these sites. Because changing circumstances may warrant changes in priority status, the BLM will closely track and monitor low-priority sites and shift priorities as needed. With the methodology of this feasibility study now in place, the BLM anticipates updating this study in conjunction with future strategic planning activities. AML Program managers will be able to measure progress, report results, and refine future costs and timeframes to complete remaining remediation for low-priority physical safety AML sites.

As the number of completed sites increases, additional dollars will be absorbed into monitoring and maintenance activities. Monitoring and maintenance efforts are necessary to avoid problems of adits and shaft closures failing over time; fences and signs being vandalized or otherwise damaged; and remedial activities adversely impacting wildlife. The BLM coordinates and integrates monitoring and maintenance efforts with other BLM resource and safety programs to ensure that corrective actions remain compliant with safety and environmental standards and that any lessons learned benefit subsequent risk-reducing efforts.

In addition, the BLM continues to emphasize the following activities to ensure that the highest priority sites are addressed in a timely and cost-effective manner.

- **Strategic Planning.** The best and most effective work is accomplished through thoughtful and careful planning. Accordingly, the BLM is currently revising its strategic plan for the AML Program. The BLM Strategic Plan will provide details on anticipated workload targets to meet program goals.

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- **AMSCM:** The need for current, complete, and accurate data in AMSCM is critical to measuring progress and reporting results for AML Program activities. The BLM is improving the AMSCM training, several state offices and field offices have robust inventory efforts underway, and available technologies are being considered for use by on-the-ground field personnel and contractors to capture and upload data to AMSCM.
 - **Best Practices.** Review of activity-based costing shows areas for improvement in how field validation activities and site remediation activities are conducted throughout

the BLM. The BLM is following up to identify the most efficient and effective practices in the field and will assist state offices in adopting such practices.

- **Partnerships.** The BLM continues to pursue additional partnerships with federal land management agencies, such as the U.S. Forest Service and the National Park Service, to find ways to share resources and to collaborate with state AML agencies. There may be ways, for example, to use joint or multi-agency teams to conduct field validation activities in locations with mixed land ownership or adjacent sites.

Appendix A, Proximity Analysis Data Source Definitions



USGS Geographic Names Information System (GNIS): The GNIS is the federal standard for geographic nomenclature. The U.S. Geological Survey developed the GNIS to maintain uniform feature name usage throughout the government and to promulgate standard names to the public. It is the official repository of domestic names and includes parks, populated places, schools, and other features of note.

USGS GNIS Definitions of Note:

- **Populated Place:** Defined as “representing a named community with a permanent human population, usually not incorporated and with no legal boundaries, ranging from rural clustered buildings to large cities and every size in between; includes metropolitan areas, housing subdivisions, developments, modular home communities, and named neighborhoods (village, town, settlement, hamlet, trailer park, etc.). The boundaries of most communities classified as Populated Place are subjective and cannot be determined.”
- **Historical:** Some features are listed in GNIS as “historical,” defined as “specifically and only that the feature no longer exists on the landscape,” with no reference to age, size, condition, extent of habitation, type of use, or any other factor. For example, a ghost town is not “historical,” only abandoned, as might be noted in the historical notes field. Most “historical” features are (or were) manmade, but they can also be natural features, such as shoals that are washed away by a storm or a hill leveled by mining activity.
- Any feature with the “historical” designation was shifted from a high to medium priority, considering that the feature was no longer present in the landscape but could still potentially attract visitors.

BLM Facility Asset Management System (FAMS): Tracks BLM-owned facilities, including recreation, campgrounds, administrative sites, buildings, and others.¹⁰

FEMA HAZUS MH (Multihazard Loss Information Software): The HAZUS dataset contains information on the Public Elementary/Secondary School Universe Survey Data from 2005–06, and the Private School Universe Survey Data from 2004–05, as maintained by National Center for Education Statistics, U.S. Department of Education.¹¹

¹⁰Downloaded from ArcIMS map services Site Mapper, June 2010.

¹¹HAZUS MH MR4 (v1.4) (FEMA) data disks, published August 2009.

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