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Hardrock Mining: Issues Relating To Abandoned Mine Lands and Uranium Mining

Energy and Natural Resources Committee
United States Senate

Statement of the Northwest Mining Association
Debra Struhsacker
March 12, 2008

Introduction

My name is Debra Struhsacker. I am an Environmental Permitting and Government Relations Consultant from Reno, Nevada. I am testifying today on behalf of the Northwest Mining Association (NWMA) as policy expert on abandoned mines and as a member of the Association's Board of Trustees. NWMA would like to thank you for the opportunity to testify today to describe the progress being made in reclaiming abandoned hardrock mines and to offer our suggestions for policies that will accelerate the pace of this progress.

NWMA is a 113 year old non-profit mining industry trade association headquartered in Spokane, Washington. Our 1,800 members reside in 35 states and 6 Canadian provinces and are actively involved in exploration, mining and reclamation operations on BLM- and USFS-administered public lands in every western state. Our broad-based membership includes many small miners and exploration geologists, as well as junior and large mining companies and suppliers of equipment and services to the domestic and global mining industry. . More than 90 percent of our members are small businesses or work for small businesses. Many of our members have extensive knowledge of the scope of the hardrock abandoned mine lands (AML) problem and first-hand experience in remediating AML environmental impacts and abating AML safety hazards.

NWMA asked me to testify because I have extensive experience with AML policy issues. This experience includes working with the Western Governors' Association and the National Mining Association on the Abandoned Mine Land Initiative and co-authoring the 1998 National Mining Association document "*Reclaiming Inactive and Abandoned Mine Lands – What Really is Happening.*" NWMA is submitting that document as part of this hearing record. During the course of my career – working first as an exploration geologist and now as a mine permitting and regulatory expert – I have worked on numerous exploration and mining projects on public lands throughout the West and have seen first-hand the effects of historic mining and abandoned mines.

All stakeholders in the dialogue about mining and its impact on the environment agree that cleaning up historic Abandoned Mine Lands (AMLs) to eliminate safety hazards and to

minimize environmental impacts is an important public policy goal. The NWMA, along with the rest of the hardrock mining industry, has long supported the development of policies to encourage AML cleanup. NWMA presented testimony to the House Subcommittee on Energy and Mineral Resources in 2006 and 2007; we are placing copies of these testimonies in the record for this Senate hearing. As we have stressed in previous testimony and as we will emphasize today, the key to expediting cleanup of AMLs is to provide more funding and to enact Good Samaritan liability relief for voluntary AML cleanup efforts.

120 Years of Mining Precede the Enactment of Environmental Laws

Table 1 juxtaposes a partial history of mining in the western U.S. on the left side of the table against the evolution of the environmental laws and regulations that affect mining on the right side of the table. (All of the tables are included behind the text.) As you can see in the yellow top part of Table 1, mining in the western U.S. started almost 170 years ago in about 1840. The enactment of federal and state environmental laws, shown in green, did not start until the 1960s – roughly 120 years later. As is readily apparent from Table 1, there were no environmental regulations applicable to hardrock mines before the 1960s. It is this unregulated era of mining that created the abandoned mines that are the subject of this hearing.

The pre-regulation mining districts shown in the yellow part of Table 1 like the California Mother Lode Gold Rush, the Comstock Lode in Nevada, Central City, Colorado, Butte, Montana, the Black Hills of South Dakota, Socorro, NM, the Klondike in Alaska tell the story of the development of the West . These and countless other mining districts helped build America. Although we cherish the history and heritage they represent, we are now left to deal with a difficult legacy of the safety hazards and environmental problems this history has left behind.

The wastes produced by mining and ore processing - waste rock, mill tailings, and smelter slags - were usually deposited adjacent to the operating facilities or directly down-gradient in the nearest valley or low spot, much as domestic wastes of the time were sent to the nearest moving water body. Gravity was considered the great equalizer - the best friend of miners and other industrial waste generators of the time. Once the commercial ore was exhausted or market prices fell below the cost of extraction and processing, operators commonly abandoned sites with little, if any, thought to reclamation or reuse of the land.

While this lack of environmental protection and reclamation measures seems unacceptable when viewed through the prism of our modern-day commitment to protect the environment, it is important to understand that mines of this bygone era were no different than other industries of the time. Environmental protection simply was not on anyone’s radar screen and no one considered the long-term consequences of these mining practices.

These mines provided the metals needed to build this country and to help win two world wars. In fact, the federal government operated a number of sites that are now some of the more challenging AML sites. The focus was on maximizing production and winning the wars – not on using mining methods designed to protect the environment. Because the American public benefited in the past from mining of these sites, we now have a public responsibility to develop policies and funding mechanisms to reclaim these sites.

Please note that the 1872 Mining Law is not shown on Table 1. The reason for this is simple – the Mining Law is not an environmental law. Rather, the Mining Law governs land tenure. It

gives U.S. citizens the right to enter upon public lands to explore for hardrock minerals, and to use and occupy public lands for mineral development and mining purposes.

Although mining critics are fond of saying that the Mining Law needs to be amended because it does not include any environmental provisions, this is a red herring. Today, the environmental laws shown in Table 1 produce highly regulated and environmentally responsible mines that use modern environmental protection technologies to safeguard the environment.

The environmental protection and bonding requirements for modern mines guarantee that today's mines will not become tomorrow's AMLs for two reasons. First, modern mines are designed, built, operated, and closed using state-of-the-art environmental safeguards that minimize the potential for environmental problems to develop after mining is completed. Second, federal and state regulators have adequate reclamation bond monies in the event a mine operator goes bankrupt or fails to perform the necessary reclamation. The amount of required financial assurance is based on what it would cost BLM, U.S. Forest Service, or a state agency to reclaim the site using third-party contractors to do the work. By law, the sufficiency of these reclamation bonds is reviewed and adjusted on a regular basis to make sure they keep pace with inflation and on-the-ground conditions.

BLM Director Henri Bisson's statement at the January 2008 hearing that BLM has roughly $1 billion in reclamation bond monies for hardrock mineral projects is compelling evidence of a robust bonding program for modern mining operations. Similarly, federal and state agencies in Nevada recently announced that they jointly hold $1.031 billion in reclamation bonds to guarantee reclamation of Nevada mines. Nevada's reclamation bond coffers have grown rapidly since 1990 when Nevada State law NRS 519A became effective and required all mining operations and exploration projects that disturb more than five acres to provide a reclamation bond. Nationwide, this combination of reclamation bonds and environmental laws and regulations ensures that the AML problem is a finite and historical problem and not one that will grow in the future.

Modern Bankrupt Mines Should Not be Confused with Historic AMLs

There is no question that the reclamation bonds at some mines permitted and developed in the 1970s and 1980s were insufficient to reclaim these sites, resulting in a public liability. However, if permit applications for these mines were submitted today and evaluated and bonded under current federal and state environmental and bonding requirements, we are confident that a different outcome would result because today's requirements are much different than they were 20 to 30 years ago.

As Table 1 shows, mining regulatory programs were in their infancy in the 1970s and 1980s. The Forest Services' 36 C.F.R. Subpart 228A hardrock mining regulations became effective in 1974. BLM's surface management regulations governing hardrock mining (43 C.F.R. Subpart 3809) went into effect in 1981. In 2001, BLM updated the 3809 regulations (see Table 1) and added detailed requirements at 43 C.F.R. 3809.420(11) governing mine waste testing and management and new bonding requirements at 43 C.F.R.3809.500. Among other things, the updated 3809 rules require detailed waste characterization studies to identify materials that have the potential to generate acid or to leach metals, and specific mine waste management mandates that require operators to "…handle, place, or treat potentially acid-forming, toxic, or other deleterious materials in a manner that minimizes the likelihood of acid formation and toxic and other

deleterious leachate generation." Had these requirements been in place many of the water quality problems that have developed at some 1970s- and 1980s-vintage mines would not have occurred because BLM and the Forest Service would have required dramatically different mine waste testing and management programs than were the norm 20 or 30 years ago.

Secondly, as discussed above, there has been a significant expansion in bonding requirements compared to the early years of state and federal mining regulatory programs. Examples of some of the new bonding requirements include the following:

- Bonds are now based on detailed reclamation cost calculations that use third-party contractor costs based on Davis-Bacon wage rates;

- Bonds now include up to a 40 percent surcharge for agency costs to manage the reclamation effort;

- Bonds for some mines now include long-term financial assurance if site-specific conditions suggest that long-term maintenance or monitoring may be needed;

- Bonds now include costs to manage the process fluid inventory (i.e., fluids in ponds and tailings impoundments) that must be dealt with before a site can be closed and reclaimed; and

- Bond amounts are reviewed on a regular basis and adjusted as necessary to reflect inflation and site conditions.

Additionally, the experience gained in reclaiming bankrupt sites has led to some recent refinements in how bonds are calculated and the scope of reclamation bonds. The U.S. Forest Service updated its bonding requirements in 2004. The BLM revised its bonding requirements in 2001. In Nevada, the Nevada Division of Environmental Protection worked with BLM, the Forest Service, and the Nevada mining industry to update Nevada's bonding requirements in response to lessons learned using bond monies to reclaim several bankrupt sites. Other states, such as Colorado and Montana have done likewise. NWMA recently developed a white paper that documents the evolution and refinement of Nevada's bonding requirements that we are submitting as part of the record for this hearing. This white paper demonstrates that existing federal and state laws and regulations already give regulators the necessary tools to protect the environment, to ensure proper reclamation, and to deal effectively with problems, gaps, or unforeseen situations should they develop in the future.

How Do We Accelerate the Progress of Current AML Reclamation Efforts?

Although the scope of the AML problem is large, state and federal agencies – in cooperation with communities, mining companies, and other private-sector interests – are making steady progress in reclaiming AMLs. Thus, as we consider the best ways to tackle the AML problem, it is important to start from the perspective that *the glass is not empty*. Progress is being made. The focus of the AML legislative dialogue should be to create policies that accelerate the pace of AML reclamation so that more sites can be reclaimed sooner rather than later.

Last year, BLM and the Forest Service released a report entitled *Abandoned Mined Lands – A Decade of Progress* that showcases a number of successful AML reclamation efforts. In the time available to prepare this testimony, NWMA compiled the preliminary list of state-led AML reclamation projects shown in Table 2 to augment the information presented in the BLM/Forest Service report. Although far from a complete inventory, this snapshot suggests several interesting trends.

It is readily apparent from our research that some western states have undertaken a number of successful AML reclamation efforts. States with active mining typically have the largest and most productive AML reclamation programs. The correlation is simple – states like Nevada use mining fees to fund some of the AML reclamation program. Conversely, states with little or no mining have very poorly funded programs and in some cases no program at all. South Dakota is an interesting example. Back in the 1990s, South Dakota had a very progressive and effective AML advisory program. However, now that there is virtually no hardrock mining in the state, this program no longer exists despite the fact that the State has identified at least 900 AML sites that need to be reclaimed.

The Nevada Division of Minerals' AML program is representative of an effective, well-funded state AML program. This program receives funding from a $1.50 fee on county mining claim filings and a one-time fee of $20 per acre of new permitted mining disturbance. The program is supplemented by small grants from BLM's abandoned mines program and the US Army Corps of Engineers (USACE) Restoration of Abandoned Mine Sites (RAMS) program[1]. In 2006, Nevada's AML program secured 540 hazards with approximately $350,000 in funding. The bulk of the work includes fencing or closing mine openings on federal public land. Since the inception of the program in 1987, the Nevada Division of Minerals has secured over 9,000 dangerous abandoned mine openings.

Table 2 also demonstrates that collaborative partnerships involving state and federal agencies, communities, mining companies, other private-sector interests, and conservation groups have a proven track record of achieving spectacular on-the-ground success in remediating environmental problems and abating safety hazards at AML sites throughout the West. This suggests that future AML policies should recognize that private-public sector partnerships which capitalize upon the talent, financial resources, and expertise in both sectors will result in the most cost effective AML program.

What Do AML Inventories Tell Us About the Scope of the AML Problem?

As discussed in the BLM/Forest Service report, there are a number of AML inventories, each with different estimates of the number of AML sites. Some of the divergence is due to different methodologies in how sites are catalogued. Some AML inventory efforts have considered a "site" to be any single opening, mining or exploration disturbance or mining related feature. Other state AML programs and the mining industry define "site" to include multiple features that

[1] The RAMS program was created in the 1999 WRDA and has partnering agreements in place with several federal and state agencies, tribes and non-profits, including the BLM, USFS, NPS, EPA, Navajo Nation, Nevada Division of Minerals, Montana DEQ, Colorado Division of Minerals & Geology and the South Yuba River Citizens League. Through this process 64 planning, database, technical studies and design projects have been initiated with 23 different partners in 11 western states. This program was the primary source of additional funding needed to reclaim a number of the Nevada bankrupt mines with inadequate bonds in the early part of this decade.

can be addressed with coordinated and consolidated reclamation and remediation measures. Consequently, there is no complete count, but we know for certain that there are many AML sites that require our attention.

While the desire to have a complete inventory of hardrock AML sites in the western US was perhaps an appropriate focus ten or fifteen years ago, we believe that enough is now known about the scope of the problem. The current AML cleanup progress clearly demonstrates that a complete inventory is not necessary because on-the-ground AML cleanup can occur concurrently with ongoing AML inventory efforts. Therefore, a complete AML inventory is not a first or even a critical step. The inventory can be built at the same time that AML cleanup efforts are underway.

We have a good idea where most of the high-priority environmental sites are (although we may not understand the complexities of each site.) But in some settings, there probably are unmapped safety hazards that are obscured by vegetation or are in remote locations.

Although the AML inventory numbers vary, there is good consensus about the broad characteristics of the AML problem. As shown in Table 3, most AML sites create unsightly landscapes and public safety hazards, with roughly 10 percent causing environmental problems. Some sites may have a combination of landscape disturbance, safety hazards, and environmental problems

Table 3 also lists some typical challenges at AML landscape, safety, and environmental sites. The problems shown at safety hazard sites pose the most imminent threat to people. According to the BLM/Forest Service report, approximately 25 people per year die in accidents involving unsecured historic mine shafts, tunnels, buildings, etc. AML environmental problems typically arise from the interaction of streams and precipitation with old mine wastes. The resulting water quality impairment is especially harmful to fish and other aquatic species. Dust due to wind erosion of tailings piles can also create significant problems at some sites – especially sites in arid environments.

AML policy discussions often focus on the worst and most complex environmental problems at AML sites, which are a subset of the total AML problem. This mischaracterization of the global AML problem has probably contributed to the lack of progress in developing federal policies and programs to solve the AML problem. Although remediating AMLs with environmental problems is important, in many settings, safety hazards deserve our immediate attention. Therefore, we should focus first-priority AML funds on eliminating safety hazards at abandoned mine sites located near population centers and frequently used recreation areas.

As shown in Table 3, there are a number of AML safety hazard abatement and cleanup and restoration techniques using modern engineering designs and environmental protection methods that can reduce and even eliminate safety hazards and environmental problems at AML sites. These techniques have a proven track record of successfully reclaiming many AML sites.

Although many of the response measures shown in Table 3 are expensive – especially those used to remediate environmental problems – they are technically straightforward, well understood, and are generally quite effective in improving environmental conditions at AML sites. It is important to understand, however, that each AML site is different. The response measures shown in Table 3 must be custom-tailored to fit the site-specific conditions of a particular site. A

cookie-cutter, one-size-fits all approach will not achieve optimal results and may even fail to address the problem. At many of the AML reclamation examples shown in Table 2, federal and state agencies, working in concert with community and private-sector partners, have successfully customized and fine-tuned these techniques to achieve optimal reclamation results at specific AML sites.

Federal Funding is Needed to Accelerate AML Cleanups

NWMA and other industry interests have long supported creating a federal hardrock AML fund using revenue generated from a net royalty on new claims to support, augment and expand existing AML programs. In order to build the fund more rapidly, the fund should solicit donations from persons, corporations, associations, and foundations. Congress may also wish to infuse the fund with some initial seed money in recognition that America benefited greatly from the metals produced from historic mines which justifies contributing some taxpayer monies to the fund.

NWMA recommends that the states that generate royalty revenues should be the first in line to receive at least a portion of the federal AML funds. We also believe that states should to take the lead in administering the AML program. As our research shows, many states already have effective AML programs. We see no need to re-invent the wheel by creating a new federal AML bureaucracy. This would be an inefficient use of the monies collected and would reduce the amount of money available for on-the-ground remediation and reclamation. Because each hardrock AML site has unique geology, geography, terrain and climate; a uniform, one-size-fits-all program will not achieve optimal results. The state AML programs are in the best position to prioritize where federal AML funds should be spent within the state and to perform hardrock AML hazard abatement, remediation and reclamation, in cooperation with federal land management agencies, industry, communities, conservation groups, and NGOs.

We also caution against creating a fund distribution formula or method that invites competition between states for AML funds. This occurred during the initial years of the SMCRA AML program and led to inaccurate, inconsistent, and even aggrandized AML inventories with inflated reclamation costs according to a 1988 GAO study.

Good Samaritan Legislation is Critical to Facilitating Voluntary AML Reclamation

Although more funding is a key component of solving the AML problem, funding alone is not the best way to accelerate the pace of AML reclamation activities. Enacting Good Samaritan liability relief is also essential. Concerns about liability exposure stemming from the Clean Water Act (CWA), CERCLA, and other laws are significantly chilling Good Samaritan AML clean ups.

Under these laws, a mining company, state or federal agency, NGOs, individuals or other entities that begin to voluntarily remediate an abandoned mine site could potentially incur “cradle-to-grave” liability under the CWA, CERCLA, and other environmental laws, even though they did not cause or contribute to the AML environmental problem. Furthermore, the CWA may require entities that undertake voluntary AML projects to prevent discharges to surface waters from the AML in perpetuity, unless those discharges meet strict effluent limitations and comply with stringent water quality standards, which may not be possible; and in any event, may be so

expensive that no state, company, individual, or other entity would undertake a voluntary cleanup.

Virtually everyone who has looked at the AML issue in the west has recognized and documented the legal impediments to voluntary cleanup of AMLs. Policymakers and independent researchers including the National Research Council, the Western Governors' Association, and the Center for the American West have urged Congress to eliminate these impediments. For example, the National Academy of Science 1999 report to Congress entitled "*Hardrock Mining on Federal Lands*" makes the following specific Good Samaritan recommendation:

> "Existing environmental laws and regulations should be modified to allow and promote the cleanup of abandoned mine sites in or adjacent to new mine areas without causing mine operators to incur additional environmental liabilities….
>
> To promote voluntary cleanup programs at abandoned sites, Congress needs to approve changes to the Clean Water Act and the CERCLA legislation to minimize company liabilities." (NRC report, pages 104 and 106.)

The state agencies listed in Table 2 emphasized the importance of Good Samaritan liability relief in enabling them to expand the scope of their AML reclamation programs. In the absence of such relief, most of the state agencies said they are avoiding sites with mine drainage due to concerns about CWA liability exposure.

Several Good Samaritan bills have been introduced in the past, but only the bill that Senators Salazar and Allard introduced in 2006 (S. 1848), passed out of committee. We strongly support the Salazar/Allard approach to Good Samaritan legislation which would accomplish many of the key Good Samaritan objectives shown in Table 4.

The combined effect of a federal AML reclamation fund and Good Samaritan liability relief is the best way to accelerate the pace of AML reclamation. It is also the best way to get the most bang for the buck because financial and in-kind contributions from the private sector, communities, foundations, and other sources will reduce the amount of funding that needs to come from royalty payments. Finally, Good Samaritan liability relief will facilitate public – private sector partnerships which we know to be the best solution to the AML problem. As Congress deliberates changing the Mining Law to include an AML funding mechanism, we urge you to address the equally important issue of providing Good Samaritan liability relief for voluntary AML cleanups.

Conclusion

The NWMA very much appreciates this opportunity to testify today to put AMLs into the proper historical perspective, to explain why AMLs are a finite problem and how today's environmental regulations and bonding requirements prevent the creation of new AMLs, to describe some of the excellent progress that is being made in reclaiming AMLs, and to present our recommendations for moving forward. We believe the AML problem is manageable and solvable because we know where AML sites are located, we understand the problems they are creating, and we have the engineering, environmental protection, and reclamation techniques needed to solve these problems. But our AML tool kit is missing two essential tools – adequate funding and Good Samaritan liability relief for voluntary AML cleanup projects.

So we conclude by asking for your help. Please add a federal AML fund and Good Samaritan liability relief to the AML tool kit. These two policies offer the best opportunity to accelerate the progress that is being made in abating AML safety hazards and remediating AML environmental problems. The NWMA stands ready to work with you and to help in any way we can to achieve what we all agree is an important goal – expediting AML reclamation.

I thank you for this opportunity to testify on this important issue and will be happy to answer any questions.

TABLE 1 Partial Chronology of U.S. Mining versus Enactment Dates for Environmental Laws and Regulations Affecting Hardrock Mining		
Decade	**Commencement of Selected Western Mining Activities**	**Enactment Dates for State & Federal Environmental Laws and Regulations**
1840s	CA: Mother Lode–gold WY: Atlantic City – gold	
1850s	CO: Cherry Creek, Clear Creek, – gold NV: Comstock Lode - silver & gold WA: Okanogan District – gold	
1860s	CO: Front Range – gold & silver ID: Boise Basin – gold	
1870s	SD: Black Hills - gold CO: Leadville, San Juan Mountains – silver, gold & base metals AZ: - Superior, Morenci - copper NM: Silver City – silver UT: Park City – gold, silver, lead	
1880s	CO: Aspen – silver, lead, zinc MT: Butte – copper ID: Coeur d'Alene District – silver NM: Socorro– silver, copper	
1890s	CO: Cripple Creek – gold WA: Republic District – gold AK: Klondike, Nome - gold WY: Kirwin – copper, silver	
1900s	UT: Bingham Canyon – copper NV: Round Mtn., Tonopah, Goldfields, Ely: – gold, silver copper	
1910s	CO: Climax - molybdenum CO, UT - AZ vanadium, radium	
1930s	NM: Pecos – silver, zinc, lead ID: Stibnite – antimony, tungsten	
1940s	CO, UT, AZ, NM: CO Plateau - uranium	
1950s	NM: Grants – uranium WY Sandstones - uranium NV: Yerington – copper OR: Riddle - nickel	
1960s	NV: Carlin – gold	•National Historic Preservation Act •Air Quality Act •National Environmental Policy Act
1970s	CO: Henderson - molybdenum NV: Round Mountain – gold	•Occupational Safety and Health Act •Clean Air Act •CA Environmental Quality Act •MT Metal Mine Reclamation Act •MT Environmental Policy Act •Federal Water Pollution Control Act/Clean Water Act •Endangered Species Act •U.S. Forest Service 36 CFR 228A regs •CA Surface Mined Land Reclamation Act •Federal Land Policy and Management Act •Resource Conservation and Recovery Act •Clean

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1970s (cont.)		Water Act Amendments •CO Mined Land Reclamation Act •Mine Safety and Health Act •Surface Mining Control and Reclamation Act •WI Metallic Mining Reclamation Act •ID Surface Mining Act •Archaeological Resources Protection Act
1980s	NV: Jerritt Canyon, Sleeper, Gold Quarry, Goldstrike, Chimney Creek – gold ID: Thompson Creek – molybdenum CA: McLaughlin - gold MT: Stillwater – platinum/palladium	•Comprehensive Environmental Response, •Compensation, and Liability Act/Superfund •BLM 43 CFR 3809 Regulations •SD Mined Land Reclamation Act •Hazardous and Solid Waste Amendments •Superfund Amendments Reauthorization Act •UT Mined Land Reclamation Act •NV Water Pollution Control Law •NV Mined Land Reclamation Act
1990s	AK: Ft. Knox – gold NV: Pipeline, Lone Tree - gold	•Clean Air Act Amendments •NM Mining Act
2000s	NV: Marigold expansion, NV – gold NV: Phoenix Project – gold NM: Copper Mtn. South expansion – copper AZ: Carlota, Safford – copper	•BLM updates 43 C.F.R. 3809 regulations to include mandatory bonding requirements for all surface-disturbing activities •USFS updates bonding requirements •NV expands and updates bonding requirements •MT updates bonding requirements

Table 2. Examples of Progress Made by State Agencies in Addressing the AML Closure and Reclamation Issue.

State	Project Name	Project Description	Techniques Used or Considered	Principal Participating State Agencies	Partnership/Stakeholder Group
Alaska	Treadwell Mine	Safety closures of 17 shafts and adits, 5 hazardous facilities, and 70 dangerous highwalls.	Backfilling; Slope reduction; Portal gates; Panel covers; Fencing; Signing; Revegetation.	Alaska Department of Natural Resources. Alaska Division of Mining, land and Water.	No information.
	Gold Standard Mine	Safety closure of 10 adits and 2 shafts.	Backfilling; Slope reduction; Portal gates; Panel covers; Fencing; Signing; Revegetation.	Alaska Department of Natural Resources. Alaska Division of Mining, land and Water.	No information.
Colorado	Bonanza Mining District	Polymetallic mine waste and tailing removal, remediation and reclamation. Water control within Rawley Mine.	Adit bulkhead; In-situ grade, neutralize, revegetation; Covered repository; Erosion BMPs.	Colorado Hazardous Materials and Waste Management Division. Colorado Water Quality Control Division. Colorado Division of Reclamation, Mining and Safety; AML.	The Bonanza Group (5 PRPs). Federal Partnership: USFS, BLM, USACoE, EPA.
	Hensen Creek Watershed	Feasibility study and reclamation/remediation options for 25 mines in Hensen Creek Watershed.	In-situ grade, neutralize, revegetation; Covered repository; Erosion BMPs; Diversion ditches; stream diversion; Passive water treatment systems (anoxic limestone drains, settling ponds, wetland construction, aeration, lime injection, etc.); Grout curtains; In-mine diversion.	Colorado Division of Reclamation, Mining and Safety; AML.	Lakefork Watershed Stakeholders. BLM.
	Tenmile Mining District Closures	Safety closures using multiple techniques of 21 abandoned mine sites in the Tenmile Mining District; Restoration of historic headframe.	Precast panel; PUF (Polyurethane foam) and cover; Backfill; Bat-friendly door/gate; Headframe restoration and stabilization.	Colorado Division of Reclamation, Mining and Safety; AML.	Climax Molybddenum Company partnership.
	St. Elmo Mining District - Mary Murphy Mine	Mine waste and tailing remediation and reclamation of the historic Mary Murphy Mine.	In-situ grade, neutralize, revegetation; Covered repository; Wetland restoration; Erosion BMPs.	Colorado Division of Reclamation, Mining and Safety; AML. Colorado Water Quality Control Division.	Other participants: EPA, USACoE.
	Virginia Canyon Reclamation	Feasibility study and reclamation/remediation options for 37 mine sites in Virginia Canyon, a tributary to Clear Creek.	Diversion ditches; Stream diversion; In-situ grade, neutralize, revegetation; Erosion BMPs.	Colorado Division of Reclamation, Mining and Safety; AML.	Upper Clear Creek Watershed Association.
	Animas River Watershed	Polymetallic mine waste and tailing removal, remediation and reclamation of 50 sites. Water control measures, historic building resotration, and fishery and wildlife habitat restoration.	Bulkhead seals; shaft closures; In-situ grade, neutralize, revegetation; Covered repository; Erosion BMPs; Diversion ditches; Settling ponds; Wetland restoration; Stream restoration; Historic structure restoration. Project is cutting edge for new technologies.	Colorado Hazardous Materials and Waste Management Division. Colorado Water Quality Control Division. Colorado Division of Reclamation, Mining and Safety; AML. Colorado Division of Wildlife. Colorado River Watch.	Animas River Stakeholders Group, City of Durango, San Juan County, town of Silverton, Southwestern Water Conservation District, Five citizens groups, 10 private entities.

Table 2. Examples of Progress Made by State Agencies in Addressing the AML Closure and Reclamation Issue.

State	Project Name	Project Description	Techniques Used or Considered	Principal Participating State Agencies	Partnership/Stakeholder Group
Idaho	Copper Queen Mine	Safety closures and reclamation of 8 underground openings.	Backfilling, installation of steel grate bat openings; Revegetation.	Idaho Department of Lands.	Cooperation with: Idaho Geological Survey, Idaho Department of Environmental Quality, Idaho Department of Fish and Game, USFS, BLM.
	Hailey Area	Safety closures and reclamation of 9 underground openings.	Backfilling, installation of steel grate bat openings; Revegetation.	Idaho Department of Lands.	Cooperation with: Idaho Geological Survey, Idaho Department of Environmental Quality, Idaho Department of Fish and Game, USFS, BLM.
	Panhandle National Forest	Safety closures and reclamation of 18 underground openings.	Backfilling, installation of steel grate bat openings; Revegetation.	Idaho Department of Lands.	Cooperation with: Idaho Geological Survey, Idaho Department of Environmental Quality, Idaho Department of Fish and Game, USFS, BLM.
	Silver Butte/Iron Mask Mines	Safety closures and reclamation of 5 underground openings.	Backfilling, installation of steel grate bat openings; Revegetation.	Idaho Department of Lands.	Cooperation with: Idaho Geological Survey, Idaho Department of Environmental Quality, Idaho Department of Fish and Game, USFS, BLM.
Montana	Boulder River Watershed - High Ore Creek; Comet Mine	Polymetallic mine waste and tailing removal, remediation and reclamation. Water control measures, and fishery and wildlife habitat restoration.	In-situ grade, neutralize, revegetation; Covered repository; Erosion BMPs; First multi-site shared covered repository; wetland and riparian restoration; Stream restoration.	Montana Department of Environmental Quality. Montana Department of Fish, Wildlife, and Parks. Montana Bureau of Mines and Geology.	Federal partnership: BLM, USFS, USACoE, USBR, EPA, USGS.
	Brooklyn Mine	Mine waste rock and tailings removal, in-place waste rock reclamation, and stream restoration.	Removal of waste rock and tailings to repository; In-situ grade, neutralize, revegetation; Erosion BMPs; Diversion ditches; Stream restoration; Fishery habitat restoration.	Montana Department of Environmental Quality. Montana Abandoned Mine Reclamation Bureau (now Mine Waste Cleanup Bureau.	Cooperative agreement: USFS.
	Londonderry/Maxville Tailings Site	Mine waste rock and tailings removal, consolidation and reclamation.	Construction of stream protection structure; Waste rock removal from stream; Consolidation with tailings in covered repository; In-situ grade, neutralize, revegetation; Erosion BMPs; Stream and riparian restoration.	Montana Department of Environmental Quality. Montana Mine Waste Cleanup Bureau.	Cooperative agreement: BLM, Granite County, Private landowners.

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State	Project Name	Project Description	Techniques Used or Considered	Principal Participating State Agencies	Partnership/Stakeholder Group
Nevada	Valley of Fire State Park	Safety closure of hazardous open trenches	Fencing and signs.	Nevada Division of Minerals, AML Program. Nevada Division of State Parks. Nevada Division of Environmental Protection	Nevada Abandoned Mines Permaner Closure Program; partnerships with BLM, NDOM, Nevada Department of Wildlife, Nevada Mining Association, Eagle Scouts, Girl Scouts, prospector clubs and others.
	Ray Camp	Safety closures of 53 adits and shafts.	Backfilling with mine waste; PUF; Fencing; Signage. Bat gates where needed.	Nevada Division of Minerals, AML Program.	Nevada Abandoned Mines Permaner Closure Program; partnerships with BLM, NDOM, Nevada Department of Wildlife, Nevada Mining Association, Round Mountain Gold Co., others.
	Beaty/Rhyolite	Safety closures of 37 shafts and adits.	Backfilling with mine waste; PUF; Fencing; Signage. Bat gates where needed.	Nevada Division of Minerals, AML Program.	Nevada Abandoned Mines Permaner Closure Program; partnerships with BLM, NDOM, Nevada Department of Wildlife, Nevada Mining Association, others.
	Perry Canyon	Safety closures of 18 shafts and adits.	Backfilling with mine waste; PUF; Fencing; Signage. Bat gates where needed.	Nevada Division of Minerals, AML Program.	Nevada Abandoned Mines Permaner Closure Program; partnerships with BLM, NDOM, Nevada Department of Wildlife, Nevada Mining Association, others.
	2005 Eagle Scout Project	Eagle Scouts secured 46 shafts and adits.	Fencing and signs.	Nevada Division of Minerals, AML Program.	Partnership with the Eagle Scouts for volunteer public service closings.
	2005 Girl Scout Project	Girl Scouts secured 4 AML hazards.	Fencing and signs.	Nevada Division of Minerals, AML Program.	Partnership with the Girl Scouts for volunteer public service closings.

Table 2. Examples of Progress Made by State Agencies in Addressing the AML Closure and Reclamation Issue.

State	Project Name	Project Description	Techniques Used or Considered	Principal Participating State Agencies	Partnership/Stakeholder Group
New Mexico	Pecos/Tererro Mine and El Molino Mill Site	Remediation and reclamation of mine site associated, butgeographically, removed mill site.	Removal and consolidation of waste rock and tailingsto separate locations and repositories; In-situ grade, neutralize, revegetation; realignment and stabilization of stream channel; New channel construction; Underdrain construction; Discharge structures; Diversion ditches; wetland and riparian restoration; Stream restoration.	New Mexico Environmental Department. New Mexico Energy, Minerals and Natural Resources Dept. New Mexico Mining and Minerals Division.	Cooperative agreement: EPA, USFS, New Mexico Transportation Department, New Mexico Department of Game and Fish.
	Cerrillos South Mine Safeguard Project	Safety closures for 67 underground mine shafts and adits, 19 pits and trenches, and 2 dangerous highwalls. Protection of bat habitat. **Creation of Cerrillos Hills Historic Park**.	Safety closures included backfilling with mine waste, PUF, welded wire fencing, mesh and picket fencing, berms, steel netting, steer grates allowing bat ingress and egress; erosion BMPs; Revegetation; Construction of viewing platforms over and around shafts.	New Mexico Energy, Minerals and Natural Resources Dept. New Mexico Mining and Minerals Division. New Mexico Abandoned Mined land Bureau.	Partnerships with: Cerrillos Hills Park Coalition; Santa Fe County, New Mexico State Hisotric Preservation Office, BLM, National Park Service, others.
	Socorro West Project	Safety closures for 24 underground mine adits, shafts, and open stopes while protecting use of various sites by bats and owls.	Backfilling with nearby waste; concrete panels; Heavy steel cable netting; Reinforced grated closures; Reinforced steel fencing; Earthen berms; Thick cactus barriers to reduce vandalism; Revegetation.	New Mexico Energy, Minerals and Natural Resources Dept. New Mexico Mining and Minerals Division.	Partnerships with: University of New Mexico, Department of Biology, private owners.
	Gage Mine Safeguard Project	Safety closures for 164 underground mine adits, shafts, and open stopes including use of existing mine waste as backfill and protecting use of various sites by bats and owls.	Use of existing mine waste for backfill; Safety closures using backfill, PUF, locked doors, steel gates, steel netting, concrete slabs and panels, adit grates and bat/owl grates to allow bird access.	New Mexico Energy, Minerals and Natural Resources Dept. New Mexico Mining and Minerals Division. New Mexico Abandoned Mined land Bureau. New Mexico Office of Archaeological Studies.	Partnerships with: University of New Mexico, Department of Biology, Museum of New Mexico, private owners.
North Dakota	**No State AML Program**	N/A	N/A	North Dakota Department of Minerals.	N/A
Oregon	**No State AML Program**	N/A	N/A	Oregon Department of Environmental Quality. Oregon Department of Geology and Mineral Industries.	N/A
South Dakota	**No State AML Program.**	South Dakota has identified 900 AML sites in the state. 65 have been reclaimed voluntarily by the USFS or private parties.	Unknown	South Dakota Department of Environment and Natural Resources. **The state has no organized AML program.**	South Dakota DENR serves in an advisory capacity to USFS and private parties, but has no funding internally.

Table 2. Examples of Progress Made by State Agencies in Addressing the AML Closure and Reclamation Issue.

State	Project Name	Project Description	Techniques Used or Considered	Principal Participating State Agencies	Partnership/Stakeholder Group
Washington	Cleveland Mine and Mill	Tailings removal, stabilization and reclamation.	Removal of tailings from creek; Consolidation of tailings in repositories; Stream restoration and stabilization; Water diversion; Revegetation.	Washington Department of Ecology, Abandoned Mine Land Initiative. Washington Department of Natural Resources.	Partnership with: BLM
Wyoming	Carissa Gold Mine	Remediation and restoration of AML mine and mill site for future tourism.	Removal and consolidation of waste rock and tailings; In-situ grade, neutralize, revegetation; Erosion BMPs; Shaft and adit safety closures (grated doors, PUF, panels, etc.); Historic sturcture restoration for future tourist use.	State of Wyoming (purchased the site in 2003). Wyoming Department of Environmental Quality. Wyoming Abandoned Mine Land Division.	Cooperative agreement: Multiple Wyoming state agencies; BLM.
	Copper Mountain Reclamation Project	Safety closures and reclamation of 13 underground mines and features in the Birdseye Pass Mining Area.	In-situ grade, neutralize, revegetation; Waste consolidation; Covered repository; Erosion BMPs; Backfilling; Safety closures (PUF, portal doors); Bat grates.	Wyoming Department of Environmental Quality. Wyoming Abandoned Mine Land Division.	Cooperative project: BLM, Fremont County, private landowners.
	Sun/Snoball/Heald Uranium Site Reclamation	Safety closures and reclamation of AML uranium sites.	Highwall reduction and partial backfill; Adit closure using PUF, bulkheads, and backfilled concrete walls; Diversion ditches; Erosion BMPs; Revegetation.	Wyoming Department of Environmental Quality. Wyoming Abandoned Mine Land Division.	No information.

Glossary of Terms Used in Table 2

Abandoned - A site with no private owner of record typically on land managed (and often owned) by a federal, state, or local government agency. These sites also have been referred to as "orphaned".

Adit – Horizontal opening from the surface to an underground mine. Also known as a tunnel.

AML Improvement Project - A collective and inclusive term meaning any combination of abatement, reclamation, or remediation measures that address one or more safety or environmental problems at an AML site.

Backfilling – Process of placing fill material (including mine waste) into a mine opening.

Bulkhead (Bulkhead seals) – Plugs in horizontal mine openings (adits or internal tunnels) used to obstruct entrance and to curtail or divert water flows. May be made of various materials and may have man-gates or doors included.

Covered Repository/Repository – Site, usually lined, in which mine waste is consolidated. Usually covered with topsoil or a combination of impermeable covers and topsoil. Domestic waste sites are examples of covered repositories.

Diversion Ditches – Constructed ditches placed around mine waste and repositories to divert clean water around the sites.

Erosion BMPs – "Best Management Practices" using various techniques to minimize and control wind and water erosion of soils and waste at reclaimed mine and mill sites.

Grade – Construction process that reduces high-angle slopes and produces engineered angles to reclaimed sites prior to topsoil placement and revegetation.

Grates – Covers over mine openings to prevent human access but allow air-flow and ingress and egress of various wildlife species such as bats and owls. May be called "bat grates" or "owl grates", and may be made of various materials.

Inactive - A site on patented/private land that, in contrast to an abandoned site, has an owner or owners of record. However, inactive mine owners are not typically the entity involved in the past mining activities that created the safety hazards or environmental problems. Moreover, some owners of inactive mines do not have the financial resources necessary to correct the safety and environmental problems.

In Situ - The process of regrading, covering, capping, or other measures to stabilize previously mined materials in place.

Neutralize – The process of adding amendments such as lime, limestone, or other alkaline agent to reduce acidity in acid-generating mine wastes.

Open Stope – A portion of an underground ore area that is mined out, or removed, to the surface producing an opening at the surface that is neither a shaft nor an adit. Open stopes are particularly dangerous.

Panels – Pre-constructed or constructed on-site, panels are slabs used to cover shafts or open stopes. They may be constructed of concrete, wood, polyurethane foam, or other materials.

Portal – The surface mouth of a tunnel or an adit allowing horizontal access to an underground mine.

PUF – "Polyurethane Foam". An inexpensive, expanding foam material widely utilized to close shafts and adits. Once the PUF plug hardens or "sets", it usually is covered with backfill and/or topsoil material.

Reclamation - The process of returning a site to a beneficial post-mining land use.

Remediation - The process of improving environmental conditions and reducing environmental risks. The terms "remediation" and "cleanup" are used synonymously.

Removal Actions - The process of removing and relocating previously mined materials to a mine waste disposal facility.

Revegetation – The process of seeding a reclaimed area. This definition includes the application of fertilizers and mulches as each site may, or may not, require.

Riparian Restoration – The process of returning the banks of a water-body (streams, rivers, ponds, lakes) to its previous undisturbed configurations.

Settling Ponds – Engineered and constructed small ponds used in some reclamation projects to hold waters for treatment or until suspended sediments drop out, allowing clean water to exit the ponds.

Steel Netting – Constructed steel cable nets used to close larger diameter shafts and open stopes while allowing ingress and egress of wildlife species.

Site - A specific "project". A project can be a district, area, property, or ownership block and can have multiple "features" such as adits, shafts, tailings facilities, and smelters, singly or collectively. However, a project also can entail, for example, closure of a single feature. The important point is that a "one-size-fits-all" definition for an AML site is not appropriate.

Shaft – Vertical entrance to an underground mine or ventilation or safety access to an underground mine.

Stream Diversion – Engineered process of re-routing a stream, creek, or flowing water body away from or around contact with mining wastes.

Stream Restoration – The process of returning a stream, creek, or flowing water body to its pre-disturbance configurations.

Wetland Restoration – The process of re-establishing a wetland where it once existed or returning a wetland system to its pre-disturbance configurations.

Table 3 The Scope and Nature of the AML Problem		
Types of AML Problems	**Examples of Typical Response Measures**	**Approximate Percentage of AML Sites[1]**
Landscape Disturbances • Surface Disturbance that detracts from the aesthetic or natural appearance of the site • Discarded equipment, abandoned buildings in disrepair	• Regrading and recontouring disturbed areas to blend in with the surrounding topography • Revegetating regraded areas with native species • Removing and properly disposing of discarded materials • Dismantling and disposal of buildings	70%
Safety Hazards • Unrestricted and hazardous openings (shafts, adits, portals, stopes) • subsidence features and exploration excavations • Dangerous highwalls and open pits • Unsafe structures and dilapidated buildings	• Partial or complete backfilling of mine openings • Installation of gates, grates, and doors to impede access into mine openings, • Fencing around mine openings and hazardous highwalls and open pits • Signage to warn the public to avoid dangerous mine openings and highwalls • Removal of unsafe buildings.	20%
Environmental Problems • Erodible waste rock dumps, tailings deposits, and smelter wastes • Acid rock drainage form mine openings, waste rock dumps, and tailings deposits • Blowing dust from tailings piles • Contaminated soils • Chemical contamination from processing reagents	• Removing mine wastes and contaminated soils and placing in an authorized engineered structure • Stabilizing the wastes in-situ with engineered covers to prevent wind erosion and to minimize infiltration of precipitation • Treating (reprocessing) mine wastes to remove contaminants • Treating contaminated mine drainage with active and passive water treatment technologies • Rerouting drainages to avoid contact with mine wastes • Installing plugs in portals with drainage	10%

[1] Modified after: *Burden of Guilt*, 1993, Mineral Policy Center, *Cleanup of Abandoned Hardrock Mines in the West*, 2005, Center for the American West/ University of Colorado, *Abandoned Mined Lands – A Decade of Progress*, 2007, U.S. Department of the Interior Bureau of Land Management and U.S. Forest Service

Table 4
Key Components of Good Samaritan Legislation

- Provide both Clean Water Act and CERCLA liability protection.
- Create Good Samaritan permits that provide unambiguous and complete legal liability protection against specified federal, state, and local environmental laws for AML cleanup activities that are performed according to the work plan authorized in the permit.
- Stimulate greater private-sector involvement in direct cleanup efforts and in making financial and in-kind contributions towards agency-led cleanup projects.
- Allow Good Samaritans to maximize the amount of money spent on the ground by streamlining the permitting process and eliminating the requirement to conduct a Potentially Responsible Party (PRP) search at sites that will be reclaimed using private funding. It should not matter whether there might be a PRP. The goal should be environmental improvement, not finding someone to blame.
- Allow entities – including mining companies – that have no previous connection to a site and that did not create environmental problems at an AML to qualify as Good Samaritans.
- Eliminate liability exposure associated with performing the site work necessary to determine the scope of the AML environmental problems and to develop appropriate remediation plans.
- Make federal land management agencies and State AML Programs the lead agency(s) in reviewing and approving Good Samaritan permit applications, with assistance from State environmental permitting authorities for those states where EPA has delegated Clean Water Act authority.
- Encourage meaningful public input and collaboration in the permitting process and discourage the misuse of the public involvement process as a vehicle for delaying project cleanups.
- The environmental requirements for a Good Samaritan project should be wrapped into a single permit. The permit should be approved only if the project is technically sound and promises overall improvement to the environment and/or securing of safety hazards.
- Allow incremental cleanups using technically sound remediation measures that will result in an improvement to the environment – even if they will not result in the complete cleanup of all contaminants at an abandoned mine land site or the attainment of all otherwise applicable environmental standards, such as stringent water quality standards.
- Give the permitting authority(ies) discretion to make site-specific adjustments to environmental requirements and standards under state and federal environmental laws that could otherwise thwart Good Samaritan remedial actions.
- Recognize that reprocessing is a viable site environmental remediation technique that removes metal contaminants from historic mine wastes and produces a more chemically stable and benign waste product that can then be stored in a properly engineered facility.

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