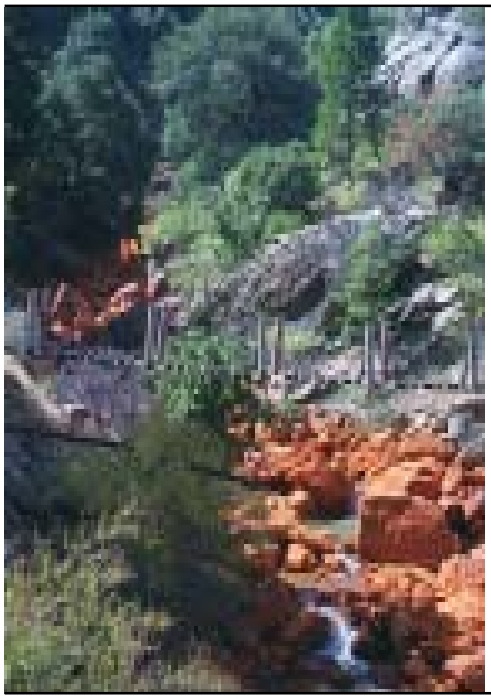
U.S. Environmental Protection Agency

Abandoned Mine Lands Team



Reference Notebook

September 2004

Front Cover Photos, top to bottom: Lower retention pond at Libby Asbestos Mine, Libby, Montana; Rocks stained by acid mine drainage in Squaw Creek, Mammoth Mine, California; Mine tailings piles in residential areas of Eureka, Utah.

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Chapter 1

Introduction

This reference document is intended to illustrate the extent of the abandoned mine lands (AML) contamination problems across the U.S. and the range of actions that EPA's AML Team intends to take in addressing this problem. Its aim is to provide assistance to EPA staff in better coordinating their AML functions. *The policies and procedures set forth herein are intended as guidance for employees of the U.S. Environmental Protection Agency. They do not constitute rulemakings by the Agency and may not be relied on to create a substantive or procedural right enforceable by any person. The Government may take action that is at variance with the policies and procedures in this reference document. This is a living document and may be revised periodically without public notice. Nothing in this document constitutes a regulatory determination nor does the use of definitions reflect official Agency policy.*

Waste rock pile and warning sign at Mammoth Mine, California.

This document is divided into six parts:

- Chapter 1, an introduction to EPA's AML Team;
- Chapter 2, an overview of the cause and extent of the AML problem;
- Chapter 3, an overview of EPA's AML Programs;
- Chapter 4, a summary of federal AML Programs;
- Chapter 5, a review of state AML Programs; and
- Chapter 6, a look at AML site reuse and redevelopment.

As this document provides an overview of many topics, numerous appendices and tables supplement the text by offering a deeper examination of individual chapter components.

1.1 The Scope of Abandoned Mine Lands

As a first step in understanding the AML problem, the AML Team created the following scope:

> *"Abandoned mine lands" are those lands, waters, and surrounding watersheds contaminated or scarred*

by the extraction, beneficiation or processing of ores and minerals (excluding coal). Abandoned mine lands include areas where mining or processing activity is determined to be temporarily inactive.

For purposes of this reference document, "abandoned mine lands" are those lands, waters, and surrounding watersheds contaminated or scarred by the extraction, beneficiation or processing of ores and minerals (excluding coal). Abandoned mine lands include areas where mining or processing activity is determined to be temporarily inactive.

This scope is intended to focus the AML Team on the chemical and physical contamination problems at hardrock mines. Although this scope does not specifically state it, mining operations associated with coal, oil, natural gas, gravel, sand, and stone are not included as abandoned mine lands. However, mining sites associated with phosphate extraction are included as abandoned mine lands, even though they are categorized as "leasable minerals" in the glossary.

1.2 Role of EPA's Abandoned Mine Lands Team

EPA's AML Team has been created to provide EPA Headquarters and regions access to expertise on issues at abandoned mine sites. The team is a subgroup to the already existing EPA National Mining Team (NMT) and will address issues related to abandoned mine sites. The AML Team will also serve as a focal point for coordinating and facilitating EPA policy, funding, process, and technical issues with stakeholders such as, but not limited to, National Mining Association, Mineral Policy Center, Bureau of Land Management (BLM), U.S. Department of Agriculture (USDA) Forest Service, Western Governors Association (WGA), states, tribes, and others on abandoned/inactive mine research, characterization, cleanup, and redevelopment activities.

A goal of the AML Team is to set priorities for the evaluation, cleanup, and redevelopment of abandoned mine sites to reduce federal government financial liabilities in addressing these sites. This group has also been established to identify and resolve key EPA technical and policy issues at abandoned mine sites to promote a nationally consistent and fiscally sound decision-making process for AML sites across the country. In addition, the AML Team will work to identify opportunities to prevent future AML problems in active mining operations. This team will work with and support existing Office of Superfund Remediation and Technology Innovation (OSRTI) teams and national teams (e.g., remedy selection, sediments, National Mining team). The AML Team is composed of regional and Headquarters technical and policy staff from EPA's Office of Enforcement, OSRTI, Office of Solid Waste (OSW), and Office of Radiation and Indoor Air (ORIA).

For more information on EPA's Abandoned Mine Lands Program, visit: http://www.epa.gov/superfund/programs/aml.

Chapter 2

Background

To set the stage for discussing the problems associated with abandoned mines, this document will first present how ore and mineral extraction and beneficiation of specific minerals and metals occurs. The nature and extent of the abandoned mine lands problem is discussed, followed by a general overview of the estimated costs of addressing the problem.

2.1 The Processes of Hard Rock Mining

Metals are mined from two basic types of deposits, lode and placer deposits. Lode deposits are concentrated mineral deposits in solid rock. Iron, copper, lead, gold, silver, and zinc are mined mainly from lode deposits. Placer deposits are alluvial deposits of sand, gravel, and rock, containing valuable metals. They usually contain metals that were once part of a lode deposit. Only a small percentage of domestic gold and silver is derived from placer deposits.

Metal mining processes include extraction and beneficiation. Extraction removes the ore from the ground; beneficiation concentrates the metal in the ore by removing unwanted constituents.

2.1.1 Mining and Ore Extraction

Most ore-bearing rock lies beneath unwanted "overburden." Accessing the ore may be as environmentally destructive as the beneficiation and processing of the ore.

Historical mine portal at Elizabeth Mine, Strafford, Vermont.

The following describes three basic approaches to mining/ extracting ore:

- Surface or open-pit mining, which requires blasting rock, soil movement, and vegetation removal to reach lode deposits. Open pit mining is the primary domestic source of iron, copper, gold, and silver. Open pit mining was also once the principal means of uranium mineral extraction.
- Underground mining entails sinking a shaft to reach the main body of ore. Underground mines do not create the volume of overburden waste associated with surface mining. Lead, antimony, and zinc mining are solely underground operations in the U.S.
- Solution or fluid mining entails drilling into intact rock and using chemical solutions to dissolve lode deposits. During solution mining, the leaching solution, usually a dilute acid, penetrates the ore and dissolves soluble metals. This pregnant leach solution is then retrieved for recovery at a solvent extraction and electrowinning plant. This method of mining is used to recover copper, gold, and uranium.

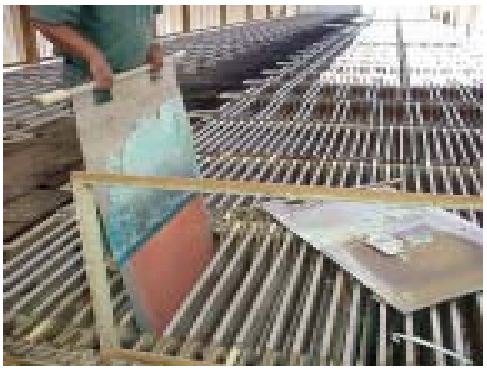
2.1.2 Beneficiation

Beneficiation is the process of concentrating or enriching ores. Under regulations promulgated pursuant to the Resource Conservation and Recovery Act (RCRA) , (40 CFR §261.4) beneficiation of ores and minerals is defined as including the following activities: crushing, grinding, washing, dissolution, crystallization, filtration, sorting, sizing, drying, sintering, smelting, pelletizing, briquetting, calcining to remove water and/or carbon dioxide, roasting, autoclaving, and/or chlorination in preparation for leaching, gravity concentration, magnetic separation, electrostatic separation, flotation, ion exchange, solvent extraction, electrowinning, precipitation, amalgamation, and heap, dump, vat, tank and in situ leaching.

Some of the more commonly used practices of beneficiation include the following:

- **Milling** extracts ore to produce uniform-sized particles using crushing and grinding processes.
- **Magnetic separation** is used to sort magnetically susceptible minerals from gangue minerals by applying a magnetic field. Iron ores are commonly separated this way.
- **Flotation** uses a chemical reagent to make minerals adhere to air bubbles for collection.
- **Gravity concentration** separates minerals based on differences in their gravity.

- **Thickening/filtering** removes most of the liquid from slurried concentrates and mill tailings.
- **Leaching** is the process of extracting a soluble metallic compound from an ore by selectively dissolving it in a solvent such as water, sulfuric or hydrochloric acid, or cyanide solution. The desired metal is then removed from the "pregnant" leach solution by chemical precipitation or another chemical or electrochemical process. Leaching methods include dump, heap, and tank operations.
- **Smelting** requires melting down the metallic ore concentrate, and the metal is separated from other substances in the concentrate.
- **Electrowinning** mixes a metal-bearing solution with chemicals that transfer the metal to a more concentrated solution called an electrolyte. The electrolyte is pumped to steel tanks. Starter sheets hang in the solution and, using an electric current, the metal is plated from the electrolyte onto the sheet, forming purer metal on the plates.



Former copper leachate collection, concentration, and electrowinning operations at Anaconda Mine, Yerington, Nevada.

2.1.3 Mineral Specific Operations

The following summaries describe the extraction and beneficiation processes used for mineral-specific mining operations and the associated wastes generated during these processes:

- **Iron** ore is almost exclusively surface mined. Typical beneficiation steps applied to iron ore include: milling, washing, sorting, sizing, magnetic separation, flotation, and agglomerations. Milling followed by magnetic separation is the most common beneficiation sequence used, according to the American Iron Ore Association. Agglomeration generates byproducts such as carbon dioxide, sulfur compounds, chlorides, and fluorides. Primary wastes are overburden/waste rock and tailings.
- **Copper** is generally extracted from surface, underground, and increasingly, from in situ operations (the practice of percolating dilute sulfuric acid through ore to extract copper). Beneficiation of copper consists of crushing and grinding; washing; filtration; sorting and sizing; gravity concentration; flotation; chlorination; dump and in situ leaching; ion exchange; solvent extraction; electrowinning; and precipitation. The methods vary according to the particular copper ore characteristics and economic factors. Approximately half of copper beneficiation occurs through dump leaching, while the other half uses flotation. Typical leaching agents include hydrochloric and sulfuric acids.

Mining operations are performed throughout the U.S., but the concentration of metal mining is in the western region of the country.

Solvent extraction requires impure leach solutions containing copper, iron, and other base-metal ions to be mixed with an active organic extractant, usually kerosene, forming a copper-organic complex. Primary wastes include overburden/waste rock, tailings, spent ore and spent or escaped leach solutions.

- **Lead** and **zinc**, which are typically found together in common ores, are extracted from underground operations. Beneficiation of lead and zinc includes crushing and grinding; filtration; sizing; flotation; and sintering of concentrates. Flotation is the most common method for concentrating lead-zinc minerals. Lead-zinc ores are conditioned to prepare for flotation; common conditioners include lime, soda ash, caustic soda, or sulfuric acid. Reagents used in the flotation processes typically include sulfur dioxide, zinc sulfate, coal tar, copper sulfate, and sodium or calcium cyanide. Primary wastes consist of overburden/waste rock and tailings.
- **Gold** and **silver**, also typically found together in common ores, are extracted from surface, underground, and in situ (experimental) operations. Beneficiation consists of three principal techniques: cyanide leaching, flotation of base metal ores followed by smelting, and gravity concentration. Cyanide leaching generated 88 percent of all domestic lode gold in 1991. Over half of the silver produced in 1991 was from smelting concentrates produced by flotation. Gravity concentration is used primarily for gold and silver placer deposits. Primary wastes include overburden/waste rock, spent process solutions, tailings, slag, and spent ore.
- **Uranium** has been extracted from surface, underground, and in situ operations, and quite commonly produced along with either precious metals, copper, vanadium, or phosphate from the same geologic deposit. The mining of uranium ores by both underground and surface methods produces large amounts of bulk waste material, including bore hole drill cuttings, excavated top soil, barren overburden rock, weakly uranium-enriched waste rock, and subgrade ores (or protore). At some abandoned mine sites, ore enriched with uranium was left on site when prices fell, while transfer stations at some distance from remote mines may contain residual radioactive soil and rock without any visible facilities to mark their location. Beneficiation enrichment of ores and chemical processing to yield "yellowcake" takes place at mills, which place their finely ground waste rock byproducts in tailings impoundments. In situ operations have moved the chemical processing steps from the mill to plants at the solution well field site and directed spent leachate solutions and produced

water to evaporation ponds; the evaporite and any disturbed soil and drill cuttings are either buried on site or trucked to other disposal locations.

2.1.4 Diversity of the Mining Industry

Mining operations are performed throughout the U.S., but the concentration of metal mining operations is in the western region of the country. Copper deposits are found primarily in Utah, Michigan, New Mexico, and Arizona. The majority of gold and silver production in the U.S. is concentrated in Nevada, Montana, Idaho, and Colorado. The Viburnum area of Missouri is the center of U.S. lead production. Alaska is the largest producer of zinc; central Tennessee and northern New York are also major zinc sources. Phosphate is mined primarily in Florida. Additional large-scale phosphate operations are also located in North Carolina, and smaller operations are located in Idaho, Montana, and Utah. More than 90 percent of the U.S. uranium production has come from sandstone deposits located in western states. Most of those deposits occur in Wyoming, Colorado, Utah, New Mexico, Arizona, and Texas.

Ore extraction pit at Anaconda Mine, Yerington, Nevada.

2.1.5 The End Result of Mining Activities

Due to fluctuating market value and depleted concentrations of ore, mines are often abandoned after they are no longer profitable. As a result, inactive and abandoned mines often contain significant environmental and public safety hazards. If market prices increase and ore processing technologies allow for greater metal recovery, mines may become active again as low-grade ores become profitable to reprocess. In other instances, abandoned mine lands and their environs may be reused and redeveloped for other purposes beyond mining (e.g., golf courses and wind farms).

2.2 Nature of the Problem

The extraction and beneficiation of ores to produce metals result in significant waste generation and unwanted byproducts. Initial site preparation creates erosion due to the removal of vegetation. Blasting and excavation of the overburden to allow access to the ore or mineral body may produce acid mine drainage (AMD), erosion of sediments, and waste rock. Blasting and exploration drill holes may alter natural patterns of ground water flow providing new and unsuspected migration paths for mine contaminants into surface and ground water bodies. Crushing and ore concentration generates waste rock, additional tailings, and possible AMD from drainage of waste rock or tailings piles. Beneficiation and mineral processing may produce spent process and leach solutions, spent ore, slag, sludge from neutralization of contaminated water, and

particulate and gas emissions including compounds such as carbon dioxide, sulfur compounds, chlorides, and fluorides.

The extraction and beneficiation of ores to produce metals result in significant waste generation and unwanted byproducts.

2.2.1 Contaminant Origins

Mine contamination can originate from any number of source areas at an abandoned or inactive mine. The following describes typical sources:

- **Waste rock and overburden dumps** are generally constructed on unlined terrain or backfilled in previously excavated areas.
- **Tailings** are created by most beneficiation processes and usually leave the mill as a slurry. They contain a mixture of impurities, trace metals, and residue of chemicals used in the beneficiation process. Typically, tailings consist of 40 to 70 percent liquid mill effluent and 30 to 60 percent solids. (Liquids are commonly used in the milling processes.) Most mine tailings are disposed of in on-site impoundments. However, slurried tailings are sometimes disposed of as backfill into underground mines to provide ground or wall support.
- **PCB-containing electrical equipment** may be found in mines throughout the world because electrical systems in mines follow the same general patterns as any other industry. This threat is particularly prevalent in the mining industry because mines generally penetrate the water table. When polychlorinated biphenyls (PCBs) are spilled or PCB equipment is abandoned underground, the PCBs can be expected to be released into the ground water with no possibility of source retrieval. This can result in water pollution for which there may be no solution.
- **Surface impoundments** are created to de-water tailings and as a holding area for the tailings. They are also used as evaporation ponds for process waters or waste water cleanup of in situ leach operations.
- **AMD**, or highly acidic water rich in metals, forms as a result of a chemical reaction of surface water and/or shallow subsurface water with rocks that contain sulfur-bearing minerals (e.g., pyrite). This reaction causes oxidation to produce ferrous ions and sulfuric acid, which can cause metals to be leached from rocks that come in contact with the acid. When mixed with ground water, surface water, and soil, AMD may have harmful effects on humans, animals, and plants as it poisons ground and drinking water and destroys aquatic life and habitat. AMD is accentuated and accelerated by mining activities such as extraction and beneficiation.

Wind and water erosion of tailings piles at Anaconda Mine, Yerington, Nevada.

1960s photo of mine effluent in Davis Mill Creek and the Ocoee River and, at center, the acid production facility: Copper Basin Mining area, Ducktown, Tennessee.

These mining activities increase the rate of these chemical reactions by exposing increased surface area of sulfide rock material, which would have otherwise been protected in the host rock where oxidation occurs very slowly. Increased erosion of the surrounding areas is an additional AMD impact that feeds into its destructive cycle. Acid drainage can and does occur naturally when sulfide minerals are exposed to weathering and react with water and oxygen to produce sulfuric acid. This natural process is acid rock drainage.

- **Heap leaching** produces spent ores, spent leach and process solutions, sludge, and slag.

Unlined leachate and contaminated ground water evaporation ponds at Anaconda Mine, Yerington, Nevada.

2.2.2 Environmental Hazards

Sedimentation and Sediment Contamination

Surface runoff can carry AML-originated silt and debris downstream, eventually leading to stream clogging. Sedimentation results in the blockage of the stream and can cause flooding of roads and/or residences and pose a danger to the public. Sedimentation may also cause adverse impacts on fish.

Another sediment concern is the large area of land that is disturbed during mining operations. As a result, erosion can be a major concern at mining sites. This type of erosion can cause significant loading of sediments and pollutants into nearby water bodies. The sediments are then deposited in naturally low-lying lands, impacting surface water, ground water, and terrestrial systems. Minerals associated with deposited sediments may lower the pH of surface runoff, mobilizing metals that can infiltrate into the surrounding subsoil or can migrate to nearby waters. Contaminated sediments may lower the pH of soils enough to destroy suitable habitat for vegetation and wildlife.

Acid mine drainage leaking from the Stowell portal at Mammoth Mine, California.

Water Pollution

AMD is a serious problem at many abandoned mines. Abandoned mines can produce AMD for more than 100 years and, consequently, pose significant risks to surface water and ground water. AMD can lower the pH of surrounding surface water, making it corrosive and unable to support many forms of aquatic life and vegetation. Humans may also be affected by consuming water and fish tissue with a metal content.

Inactive copper leachate collection pond adjacent to heap leach pile (left) at the Anaconda Mine, Yerington, Nevada.

Acid leaching operations are a potential source of water pollution. The leaching process itself resembles AMD, but is conducted using high concentrations of acids to extract metals from the ore. The leaching process produces large volumes of metal-bearing acid solutions. Most of the environmental

damage associated with leaching is caused by leakage, spillage, or seepage of the leaching solution. Therefore, the leach dumps and associated extraction areas need to be designed to prevent releases.

Mercury contaminated waters at the Sulfur Bank Mercury Mine at Clear Lake, Califorina.

Surface water can be contaminated by runoff containing AMD, metals, acid solutions from leaching, and sediment loading due to erosion. In the past, overburden and tailings were sometimes placed in the stream beds because they were natural depressions. This loaded the stream with metals and AMD. The lowered pH and increased metal content may damage aquatic animals and vegetation, as well as humans and other organisms that drink from the streams or eat plant and animals that have bioaccumulated hazardous substances from the stream.

Ground water can be contaminated when there is a hydraulic connection between surface and ground water, when there is mining below the water table, and when waters infiltrate through surface materials (including overlying wastes or other material) into the ground water. Blasting, underground mine excavations and collapse, and exploration drilling all can create pathways for water seepage through mines into ground water. Ground water is also affected by the pumping of mine water that creates a cone of depression in the ground water table increasing infiltration. It can take decades or centuries for ground water to return to its pre-mining level after pumping stops.

Air Pollution

Air pollution occurs at mining sites during excavation and transportation. Blowing dust from AML sites is a common concern, as many mines are in arid western states. Some sources of dust may be from road traffic in the mine pit and surrounding areas, rock crushers located in pits and in mills, and tailings ponds. The toxicity of the dust depends on the proximity of environmental receptors and the type of ore being mined. High levels of arsenic, lead, and radionuclides tend to pose the greatest risk, according to EPA's 1997 "National Hardrock Mining Framework" and radiation guidance from EPA's Office of Radiation and Indoor Air.

Exhaust fumes from diesel engines and blasting agents may also be a serious hazard in underground mines. These exhausts produce carbon monoxide and nitrogen oxide gas, which collect in underground areas. Radon gas from the decay of naturally occurring radioactive materials is present in all rocks and mines and may accumulate to hazardous levels in underground mines, or be vented from unclosed air shafts resulting in high concentrations in surface air in some mine districts.

2.2.3 Public Safety Hazards

In addition to numerous environmental hazards, abandoned mine sites present many threats to public safety. In response to the dozens of injuries resulting from individuals exploring or playing on mine property, the U.S. Department of Labor's Mine Safety and Health Administration (MSHA) created "Stay Out - Stay Alive," a public safety campaign to educate children and adults about the existing hazards at active and abandoned mine sites. The following describes some of the public safety hazards that can exist at abandoned mine sites:

- Vertical mine shafts - Usually hundreds of feet deep, they may be completely unprotected at the surface, hidden by vegetation or covered by rotting boards;
- Horizontal openings - Rotting timbers and unstable rock formations can make cave-ins a real danger;
- Deadly gases - Lethal concentrations of gases can accumulate in underground passages;
- Unused or misfired explosives - Vibrations from a touch or footfall can trigger an explosion;
- Highwalls, or excavated vertical cliffs - Highwalls in open pit mines and quarries can become unstable and prone to collapse;
- Stockpiles - Hills of loose material or refuse heaps can unsuspectingly collapse;
- Hidden rock ledges and mining debris - Water-filled quarries and pits can hide rock ledges, old machinery, and other hazards.

Irrigation and mine runoff drainage ditch near Anaconda Mine, Yerington, Nevada.

Erosion on mine tailings ponds at Kennecott Copper Mine, Magna, Utah.

2.2.4 Who is Affected?

The historic impact of mining on the environment is significant. Contaminants from mining affect the biological, recreational, industrial, and municipal use of watersheds for many miles. AMD and metals affect waterbodies and water supplies and the aquatic organisms, vegetation, and humans that rely on them for survival purposes. Modern mines are required to more fully address environmental concerns through the permit process.

In addition to numerous environmental hazards, abandoned mine sites present many threats to public safety.

The following overview provides examples of the environmental impacts that mining activities have caused:

- Environmental problems and liabilities have resulted from cyanide heap-leach gold mining operations at the Zortman-Landusky Gold Mine in Montana. Now bankrupt and abandoned, the mining operations impacted surrounding communities, water and cultural resources. Numerous cyanide spills from the mine have contami-

Warning sign near Anaconda Mine, Yerington, Nevada

Contaminants from mining affect the biological, recreational, industrial, and municipal use of watersheds for many miles.

nated local tap water with cyanide concentrations above drinking water standards and contaminated nearby streams.

- Surface water and ground water contamination resulted from numerous sources of the Summitville Mine in Colorado. Cyanide-bearing processing solutions mixed with acidic ground water as they began leaking into an underdrain system beneath the heap leach pad. Several times over the course of mining operations, cyanide solutions also leaked from transfer pipes directly into the Wightman Fork of the Alamosa River. Due to extensive downstream use of the Alamosa River water for livestock, agricultural irrigation, and wildlife habitat, the environmental problems at Summitville have been of particular concern. A 1990 disappearance of stocked fish from Terrace Reservoir and farm holding ponds along the Alamosa River was suspected to have been caused by increased acid and metal loadings from Summitville.
- In 1990, nearly 11,000 fish were killed over an 80-kilometer stretch of the Lynches River in South Carolina when rains caused an earthen dam to collapse and release more than 10 million gallons of a cyanide solution.
- In 1969, an uncontrolled release of contaminated water from Iron Mountain Mine (mined for copper, gold, silver, and zinc) in California killed approximately 200,000 salmon. Due to discharges with rates as high as 1,500,000 gallons per day from Iron Mountain Mine, AMD and metal contamination caused a decline in King Salmon as well.
- At the East Helena Smelter in Montana (smelted lead and zinc), blood tests in children residing in the adjacent community had shown blood-lead levels twice the national average. The sources of contamination were primary and fugitive emissions and seepage from process ponds and process fluids.
- The Plant City Chemical Complex (produced phosphoric acid) in Florida had contaminated aquifers beneath the plant. Elevated levels of fluoride, sodium, gross alpha radiation, metals, sulfate, and total dissolved solids were detected in wells in excess of applicable guidance concentrations and/or state and federal drinking water standards.
- A 1972 aerial radiation survey of selected western state communities found over 500 habitable buildings had been constructed with uranium mine waste rock. In 2001, EPA removed a Utah house constructed with uranium waste, due to radiation levels in the living area 500 times greater than the maximum permissible level.

2.3 Extent of the Problem

There is little agreement on the number of abandoned mine lands and what constitutes or defines an AML. For example, individual mine "features" are sometimes used to delineate individual AML sites, whereas in other instances, collections of mine features for an individual mining operation are defined as an AML site. This has resulted in varying methods for conducting AML inventories among agencies, states, and mining-related associations. For instance, the 1997 EPA "National Hardrock Mining Framework" estimates over 200,000 inactive and abandoned mines nationwide, although a 1993 estimate by the Mineral Policy Center puts the number of hardrock abandoned mines at 557,650 nationwide.

Multiple inventories exist for various agencies, states, and mining-related associations across the country. Each entity possesses their own methods of designation, identification, and prioritization for AML sites within their universes making comparisons and coordination difficult for AML response, reclamation, and policy development managers. However, with the emergence of multi-agency, state, and association collaborations in developing AML inventories, hope exists of producing standardized, complete, and comparable AML universes to help in AML response and reclamation efforts as well as the development of useful, worthwhile and consistent AML policy. A compilation of other programs and organizations involved in the AML reclamation process can be found in Appendix D of this document. A more detailed look into the various inventory studies conducted by the agencies and programs involved in addressing AML can be found in Table 2-1.

Large tailings pile at the Elizabeth Mine, Strafford, Vermont.

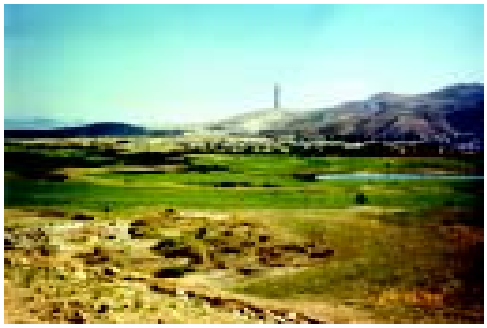
Highwall at Golden Sunlight Mines near Whitehall, Montana.

2.4 Magnitude of Cleanup Costs

Information on the actual cost of AML site cleanup is not readily available to the public. However, several major studies have been conducted in the past regarding the possible cost associated with addressing AML sites.

Information developed by the Department of Energy for inclusion in an international report on remediation of uranium production facilities found that for 22 U.S. mines, the cost for cleanup per metric ton of ore produced ranged from a low of $0.24 to a high of $33.33. A median was approximately $3.00 and the average costs for all mines was $5.07. The cleanup costs did not include long term maintenance and water treatment.

As of April 2002, EPA's estimated and actual cleanup costs at 88 NPL mining sites were over $2.8 billion.



Anaconda smelter (smokestack in background) and reclaimed wetlands in foreground, Anaconda, Montana.

A 2001 study conducted by Resources for the Future (RFF), *Superfund's Future: What Will It Cost?*, determined that the average cost of addressing a mining site under the Superfund program is approximately $22 million per site. The study also found that the problem of cost is further compounded by increasingly insufficient financial assurance amounts being provided by mining companies. As a result, western states could face unfunded reclamation bonding liabilities exceeding $1 billion.

According to the General Accounting Office (GAO) 1996 report, *Federal Land Management: Information on Efforts to Inventory Abandoned Hard Rock Mines*, the Forest Service estimates about $4.7 billion and the National Park Service (NPS) about $165 million in costs to reclaim AML sites on the public lands that they manage.

In 1993, the Mineral Policy Center estimated that the worst 363,000 (out of 557,650) AML sites would require between $32 and $72 billion for reclamation.

In the 1991 scoping study, *Inactive and Abandoned Noncoal Mines*, by the Western Interstate Energy Board, estimates for the cost of reclamation were presented for 31 states. The estimated costs ranged from $1.3 billion in Missouri to $2.5 million in Nevada. Table 2-2 provides a summary of the estimated reclamation costs per state as presented in the 1991 Western Interstate Energy Board report.

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Chapter 3

EPA's Abandoned Mine Lands Programs

As environmental policies became increasingly focused on the integration of multi-media, multi-statute approaches in dealing with environmental concerns posed by hardrock mining, EPA recognized the need to develop a framework to improve the understanding of the use of existing authorities and the role of other stakeholders. In 1997, EPA developed the *Hardrock Mining Framework*. The primary purpose of the framework was to promote a coordinated approach at mining sites, which would lead to the protection of human health and the environment over the long-term. The Framework presents recommendations and action items to assist the Agency in meeting these goals at mining sites. One of the recommendations from the Framework included that "the Agency should promote use of a geographic/risk-based approach to determining priorities for Inactive and Abandoned Mine (IAM) reclamation. Setting priorities and selecting appropriate cleanup strategies (including tools for implementation) should be conducted in cooperation with appropriate stakeholders."

Setting priorities and selecting appropriate cleanup strategies (including tools for implementation) should be conducted in cooperation with appropriate stakeholders.

In response to the Hard Rock Mining Framework and its recommendations, the National Mining Team was formed in 1998. The NMT is composed of Regional and Headquarters technical and policy staff from EPA's Office of Water, Office of Enforcement, Office of Air and Radiation, and OSRTI. This group has been established to identify and resolve key technical and policy issues at active, inactive, and abandoned mine sites to promote a nationally consistent decision making framework for mine sites across the country. In 2001, the AML Team, reporting to EPA's Office of Emergency and Remedial Response (OERR) (now OSRTI) Director, was created as a subgroup to the National Mining Team. The primary goal of the AML Team is to facilitate evaluation and cleanup of abandoned mine sites and to find ways to reduce federal government financial liabilities at these sites.

3.1 Current AML Team Initiatives

In an effort to provide a general scope of the AML problem, the AML Team has developed this document to act as an internal EPA reference document. It is intended to illustrate the extent

of AML contamination problems across the U.S., the regulatory complexity inherent with AML issues, and the course that EPA's AML Team intends to take in addressing this problem.

Since its inception, the AML Team has been active in forming collaborations with other agencies and programs, as well as private organizations involved in addressing AML. One goal of the AML Team in forging such collaborations is to develop an inventory of AML sites that are located on private lands and pose serious threats to human health and the environment. In an attempt to begin building the foundation for such a multi-agency AML inventory, the AML Team has started by assessing and compiling information from EPA data sources.

An initial AML inventory of 562 sites was compiled primarily from the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database and information gathered by EPA Regional staff. The result is the CERCLIS and EPA Regional AML Inventory, presented in Appendix A of this report. However, it should be noted that this is an initial step toward a more collaborative and complete inventory as envisioned by the AML Team. Next steps may include further research and assessment into other available EPA resources, as well as initialization of outreach efforts to other entities for future AML inventory collaborations.

Each abandoned mine site faces a somewhat unique set of regulatory requirements, depending on federal and state statutes or regulations; whether it is on federal, state, tribal, or private land; local regulations; and site-specific environmental considerations.

3.2 CERCLA Statute Discussion

Each abandoned mine site faces a somewhat unique set of regulatory requirements, depending on federal and state statutes or regulations; whether it is on federal, state, tribal, or private land; local regulations; and site-specific environmental considerations. When an AML is located on public or private lands, it may be addressed under EPA authorities. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, provides the primary tools available to EPA project managers in developing strategies for assessment, investigation, and cleanup of environmental risks from abandoned mine sites. The law authorizes two kinds of response actions: removal and remedial actions. CERCLA provides funding for cleanups, either through payment for or by direct implementation of cleanups by responsible parties or by the government; it also provides for site-specific approaches to environmental problems and is not limited to particular media.

However, the use of CERCLA authorities is not limited to EPA. Other federal agencies, under the authority of Executive Order 12580, have used CERCLA to implement cleanup activities on their lands. Executive Order 13016 expanded the ability of

other federal agencies to use CERCLA authority to achieve mine site cleanups. Other federal authorities used to address AML are discussed in Chapter 4 of this document.

3.3 Overview of the National Priorities List (NPL) Process

The National Priorities List (NPL) was established by CERCLA §105(a)(8)(B) to provide a guide to EPA in determining which sites warrant further investigation, to assess the nature and extent of the public health and environmental risks associated with the site, and to determine what CERCLA-financed or Responsible Party (RP) financed remedial action(s), if any, may be necessary. Inclusion of a site on the NPL does not establish that EPA will undertake response action. Moreover, listing does not require any action of any private party, nor does it determine the liability of any party for the cost of cleanup of the site. A site need not be on the NPL to be CERCLA-financed as a removal action, an action brought pursuant to CERCLA §106 or 107(a)(4)(9b), or a Remedial Investigation/Feasibility Study (RI/FS).

Section 300.425(c) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the federal regulation by which CERCLA is implemented (55 FR 8845, March 8, 1990), provides the following three mechanisms for placing sites on the NPL:

- Hazard Ranking System (HRS) - the scoring system EPA uses to assess the relative threat associated with the release or potential release of hazardous substances from a waste site. An HRS score of 28.50 or above is used to determine if a site is eligible for the NPL;
- "Each State can nominate one site to the NPL as a State top priority regardless of its HRS score; and
- Sites may also be added in response to a health advisory from the Agency for Toxic Substances and Disease Registry (ATSDR)" [51532 Federal Register, Vol. 55, No. 241].

The current policy approach to NPL listing has evolved as the federal Superfund program and state programs have matured. In recent years, requests from states or tribal governments or affected communities have played a more important role in listing decisions. EPA's current approach results in the following:

- Listing sites where there are no potentially responsible parties (PRPs);
- Listing sites where cleanup is beyond a state's ability to fund or oversee a remedial action and that lack a PRP;

and

- Listing sites where non-NPL response options have not proved viable, primarily due to recalcitrant PRPs.

Although formal governor's concurrence is no longer statutorily required for NPL listings, as a matter of policy, EPA requests states and, where appropriate, tribal concurrence before all NPL listing proposals.

In addition to the NPL process, there is another commonly used approach termed "Superfund Alternative (SA)." EPA regions and other stakeholders (e.g., PRPs) may initiate this SA approach when there is adequate documentation to demonstrate that the site scores 28.5 or higher, requires long-term action, and has a willing and viable PRP. An enforcement agreement must be in place (e.g., Consent Decree) by the time the site is in remedial action to be an SA site. Fro more information regarding SA sites policy, see OSWER 9208.0-18, "Revised Response Selection and Settlement Approach for Superfund Alternative Sites," dated December 17, 2003.

3.4 Components of the NPL

The success of the EPA AML program is connected to routine coordination with federal, state, and private groups due to the complexity of mining and cleanup of private, federal, and mixed land use sites.

Since the NPL was established in 1982, 1,499 sites have been listed on the NPL and 278 have been deleted, resulting in a current NPL of 1,305 sites. As of March 2004, 65 additional sites were proposed for listing, although many of the sites may not be finalized. Out of these sites the number of mining sites include the following (current as of March 8, 2004):

- NPL Final Mining Sites - 70
- NPL Proposed Mining Sites - 8
- NPL Deleted Mining Sites - 10

The following two categories are not components of the NPL but comprise a large segment of Superfund work and, therefore, need to be recognized:

- Removal Mining Sites - 74
- Superfund Alternative Mining Sites - 10 (The Superfund Alternative approach is another tool besides the NPL for cleaning up a site according to the NCP without going through the lengthy NPL proposal and listing process and avoids the possible stigma of the NPL.)

It is important to note that the number of sites in all of the previous categories is constantly changing.

3.5 EPA Coordination in Addressing AML Sites

The success of the EPA AML program is connected to routine

coordination with federal, state, and private groups due to the complexity of mining and cleanup of private, federal, and mixed land use sites. Coordination begins with EPA Headquarters staff. EPA Regions 8 and 10 have established mining teams that meet with federal, state, and industry representatives. Region 8's mining program resides in the Office of Ecosystem Protection and Remediation (EPR) and contact information is available at: http://www.epa.gov/region08/land_waste/mining/minewho.html.

3.6 Other Statutes that Potentially Impact AML Sites

Historically, EPA has relied on other regulatory tools to address AML sites. The following provides overviews of other statutes that have or can potentially impact AML sites.

3.6.1 Clean Water Act

After CERCLA, the Clean Water Act (CWA) of 1972 is probably the most widely used regulatory tool for addressing environmental problems at mining sites. Section 402 of the CWA authorizes EPA or delegated states to regulate "point source discharges" of "pollutants" to "waters of the United States." Each discharge must be permitted. Section 404 of the CWA provides authority for regulating the discharge of "dredged or fill material." Many mine sites suffer from the uncontrolled discharge of acidified water, which becomes contaminated as it flows through abandoned mine workings. Section 402, in particular, may be of use as EPA or states try to control this flow. If a mine site is discharging contaminated waters, and if a responsible party can be identified, EPA or a delegate of the state may be able to address the problem under Section 309.

In 1987, Congress amended the CWA by adding provisions concerning the control of point source discharges composed entirely of storm water by directing EPA to publish permit application regulations for "discharges of storm water associated with industrial activity." EPA defines "storm water" as storm water runoff, snow melt runoff, and surface runoff and drainage. It also defined "[s]torm water discharge associated with industrial activity" to include the discharge of pollutants from any conveyance that is used for collecting and conveying storm water, which is directly related to manufacturing, processing, or raw materials storage area at an industrial plant. This includes conveyances at mining facilities from active or inactive mining operations that discharge storm water contaminated by contact with, or that has come into contact with, overburden. EPA noted that "a permit application will be required when discharges of storm water runoff from mining operations come into contact with any overburden. . . ."
In 1987, Congress amended the Clean Water Act by adding

section 319, which established a national policy that states develop and implement programs for the control of non-point source pollution. Non-point source pollution causes or contributes to beach closures, destroyed habitat, unsafe drinking water, fish kills, and many other severe environmental and human health problems. States were to address non-point source pollution by conducting statewide assessments of their waters; developing non-point source management programs; and implementing their EPA-approved non-point source management programs. For example, a 319 project in 1991 consolidated five tailings piles to a location just below the Mary Murphy mill ruins in central Colorado. The consolidated tailings were stabilized and revegetated with grasses, forbs, and trees. The drainage from the mine works was diverted around the consolidation pile into a constructed wetland between the consolidated tailings and Chalk Creek. Sampling in subsequent years found that the recovery zone had moved upstream from 12 miles to just approximately 4 miles below the mining activity.

Per the CWA, the NCP was revised in 1973 to include a framework for responding to our Nation's hazardous substance spills and oil discharges. The NCP has been revised repeatedly, including broadening under CERCLA in 1982 to cover emergency removal actions at hazardous waste sites. It is by such broadening of existing statutes that a multitude of statutes and programmatic authorities exist and are applicable for use in responding to AML sites.

The Clean Water Act gives EPA authority to implement pollution control programs such as:

- Setting wastewater standards for industry;
- Setting water quality standards for all contaminants in surface waters;
- Making it illegal for any person to discharge any pollutant from a point source into navigable waters without a permit; and
- Addressing nonpoint sources.

3.6.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires that federal agencies consider the environmental consequences of their actions and decisions as they carry out their mandated functions. EPA has been actively involved in NEPA as a lead agency, a cooperating agency, and a reviewer of NEPA environmental impact statements. The NEPA process offers an opportunity to understand potential, indirect, direct, and cumulative impacts of mining projects and to identify permit conditions that may be appropriate to manage or mitigate environmental

concerns.

The purposes of NEPA are to declare a national policy that will encourage productive and enjoyable harmony between humans and their environment; promote efforts that will prevent or eliminate damage to the environment and biosphere and stimulate human health and welfare; enrich the understanding of the ecological systems and natural resources important to the Nation; and establish a Council on Environmental Quality. More information regarding the purpose of NEPA is available at: http://ceq.eh.doe.gov/nepa/regs/nepa/nepaeqia.htm.

Under NEPA, the federal government must consider environmental impacts when approving a federally funded project, and the NEPA document is used to meet that requirement. Depending on the potential for significant impacts one of three NEPA documents would be used: an Environmental Impact Statement (EIS), an Environmental Assessment (EA), or a Finding of No Significant Impact (FONSI). The document would describe the proposed project, characterize the existing environmental conditions at the site, describe how the project will affect environmental resources, and identify any unavoidable significant impacts. The significance of the proposed action determines which type of NEPA document would be utilized.

3.6.3 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) gives EPA the authority to control hazardous waste from "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also sets forth a framework for the management of non-hazardous wastes. In October 1980, Congress amended RCRA through the Solid Waste Disposal Act, which included the Bevill Amendment. The Bevill Amendment excluded "solid waste from the extraction, beneficiation, and processing of ores and minerals" and required EPA to study mining wastes to determine if regulation under RCRA Subtitle C was warranted. In 1986, EPA issued a regulatory determination that certain hardrock mining wastes (i.e., those wastes generated by the removal and treatment of the ore to concentrate its valuable constituents) should not be regulated as hazardous wastes under Subtitle C at that time. As a consequence of EPA's analysis and subsequent regulatory interpretations and rulemakings, relatively little mining waste is currently subject to RCRA regulation as hazardous waste.

3.6.4 Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) of 1974, is the main federal law that ensures the quality of Americans' drinking water. Under SDWA, EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers

who implement those standards. Implementing regulations for 40 CFR 141 includes the establishment of national primary drinking water standards, which currently include maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for radiation and radionuclides, metals, pesticides, total dissolved solids, and other contaminants.

Enacted under the SDWA, the Underground Injection Control (UIC) program works with state and local governments to oversee the use of underground injection wells in order to prevent contamination of drinking water resources. Because a number of minerals are mined by using injection wells, this program is of particular importance.

In general, this type of mining technology involves the injection of a fluid, usually called lixiviant, which contacts an ore that contains minerals that dissolve in the fluid. The pregnant fluid is pumped to the surface where the mineral is removed from the fluid.

The following practices are examples of mining operations that use mining wells:

- Salt solution mining - fifty percent of the salt used in the U.S. is obtained this way;
- In-situ leaching of uranium - eighty percent of the uranium extracted in the U.S. is produced this way; and
- Sulfur production using the Frasch process - super heated steam is injected in order to recover a sulfur solution.

Through the UIC program, EPA protects drinking water from contamination from mining wells by implementing regulations. Of the five classes of injection systems defined and regulated by the UIC program, mining wells are addressed under Class III. Among other things, the regulations under the UIC program require mining well operators to perform the following:

- Case and cement their wells to prevent the migration of fluids into an underground drinking water source;
- Never inject fluid between the outer-most casing and the well bore; and
- Test the well casing for leaks at least once every five years.

3.6.5 Atomic Energy Act

The Atomic Energy Act (AEA)(1954) provides for the control of source materials - uranium and thorium - used for the produc-

tion of atomic energy and weapons. With the exception of in situ uranium production facilities, the Nuclear Regulatory Commission (NRC), (and its predecessor, the Atomic Energy Commission) was not authorized to permit or regulate uranium, radium, or thorium mines. Oversight of these facilities falls to the land management agencies, EPA, and the states. Standard setting for radiation protection under the AEA was transferred to EPA in 1970 through government reorganizations. Recognition of this authority served as the precedent for EPA's establishment of radionuclide and radiation protection limits. The Office of Air and Radiation recently released a guidance titled "Potential for Radiation Contamination Associated With Mineral and Resource Extraction Industries." This guidance informs EPA personnel of the potential for radioactive contamination associated with a list of specific minerals and certain resource extraction, processing, or manufacturing industries. The identification of listed minerals and materials at an inspection or investigation site should serve as cause for EPA personnel to contact EPA regional radiation staff to help implement radiation safety measures, and conduct radiation surveys as appropriate.

3.6.6 Toxic Substances Control Act

Section 6(e) of the Toxic Substances Control Act (TSCA) regulates the use and disposal of polychlorinated biphenyls (PCBs) by manufacturers. PCB-containing electrical equipment may be found in mines throughout the world because electrical systems in mines follow the same general patterns as any other industry. This threat is particularly prevalent in the mining industry because mines generally penetrate the water table. When PCBs are spilled or PCB equipment is abandoned underground, the PCBs can be expected to be released into the ground water with no possibility of source retrieval. This can result in water pollution for which there may be no solution. It should be emphasized that surface mines and the attendant crushing and milling facilities of both surface and underground mines may use PCB-containing electrical equipment. Depending on the cost effectiveness of removal and salvage, mines may be abandoned without removing any of the underground mining, haulage, hoisting, or electrical equipment. Underground mines are emphasized here because abandoned PCB-containing equipment is likely to cause water pollution that can affect the environment and the health of downstream fish, wildlife, and human populations.

3.6.7 Clean Air Act

The Clean Air Act (CAA) regulates area, stationary, and mobile source air emissions and authorizes EPA to establish National Ambient Air Quality Standards (NAAQS) to protect human health and the environment by setting maximum pollutant standards.

The CAA was amended in 1990 primarily to address problems that were not sufficiently considered in previous versions of the CAA, such as air toxics, acid rain, and ground-level and stratospheric ozone depletion. Under the amended CAA, Title II of Section 234 *Provisions Related to Mobile Sources, Fugitive Dust*, requires EPA to review and revise "the accuracy of the Industrial Source Complex (ISC) Model and AP-42 emission factors for estimating fugitive emissions of PM-10 from surface coal mines." Mining sites can produce substantial amounts of air pollution during excavation and transportation, particularly through fugitive and windblown dust. The sources of these air pollution types at mine sites include tailings ponds, rock clusters and road traffic in the mine pit and surrounding areas. The fugitive emissions reviews on surface mines required by CAA Section 234 are conducted in order to demonstrate surface coal mine compliance with NAAQS or for purposes of new source review.

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Chapter 4

Coordinating with Federal AML Programs

AMLs exist under private, mixed, and federal land uses adding to the complexity of the issue. A number of federal statutes address environmental contamination issues associated with AML. Federal statutory authority is spread among several agencies with no one agency having overall statutory responsibility. Ensuring that appropriate authorities are used at AML sites will work to facilitate cleanup.

This chapter discusses possible federal regulatory and programmatic authorities that have been or could be used for cleaning up AML. However, the following descriptions only summarize the key aspects of their programs. For additional information about their statutes, programs, or activities, please contact your local Bureau of Land Management, National Park Service, or Forest Service office. A review of federal regulatory and programmatic authorities can be found in Table 4-1.

Federal statutory authority is spread among several agencies with no one agency having overall statutory responsibility. Ensuring that each of these regulations is enforced at AML sites will facilitate cleanup.

4.1 Department of the Interior

4.1.1 Bureau of Land Management

The Federal Land Policy and Management Act of 1976 (FLPMA) authorizes the Secretary of the Interior through the Bureau of Land Management (BLM) to control mining to the extent that the Secretary can, by regulation or otherwise, take actions necessary to prevent unnecessary or undue degradation of the land. In conjunction with other laws, FLPMA provides the authority to remediate abandoned mine lands created in 1981 or later to meet the principles of the Act including reasonable safety of the general public. BLM regulations also require financial assurances for all sites except for those sites having negligible land disturbances.

The BLM works in partnerships with EPA, state agencies, tribes, private parties, and other groups to accelerate the rate of cleanup of watersheds affected by abandoned hard rock mines. With special emphasis on ensuring that viable responsible parties contribute their share of cleanup costs, federal land managers will add three to five watersheds or major mine

cleanup actions to the program each year from 1999 through 2005. Because BLM manages roughly 264 million acres in eleven western states and Alaska, collaborations would be openly welcomed for mine sites located on these BLM-managed lands. BLM is attempting to identify, prioritize, and take appropriate actions on those historic mine sites that pose safety risks to the public or present serious threats to the environment.

Inventory

BLM has developed an inventory based on data collected during a 1993-1995 on-the-ground survey of BLM-managed public lands. The resulting data were compiled into a database system that bears the same name as the Office of Surface Mining (OSM) AML inventory system, Abandoned Mine Lands Inventory System (AMLIS). Through the BLM AMLIS, a user can locate a site entry, print reports, and create Geographic Information System (GIS) maps, all via the Internet. The original inventory efforts were directed toward physical safety hazards. Presently, the emphasis has shifted toward a watershed approach. As of 2002, 10,200 records were posted on the AMLIS database. Individual states included in the BLM inventory and the resulting state AML inventory estimates are discussed according to each individual state in Chapter 5 of this document. The BLM AMLIS system and further information on sites currently undergoing cleanup can be found at: http://www.blm.gov/aml/amlis.htm.

Cleanup

In 1997, BLM, the States of Colorado and Montana, the USDA Forest Service, and other watershed partners leveraged their combined resources to generate $7 million in funding and technical support for watershed-based cleanup pilot projects in Montana and Colorado. Removal of tailings and mine wastes from stream beds, stabilization of flood plains, and capture of acidic drainage in priority watersheds were all accomplished through the reclamation work of the collaborative partners.

Additional information regarding sites addressed by BLM in fiscal year 2001 is provided in Table 4-2.

Funding

For fiscal year 2003, $10 million in 1010 (soil, water, and air) funding has been allocated for AML activities, of which $8.9 million will be provided to the field and the remainder will support information technology activities, National Science and Technology Center (NSTC), and the Washington, D.C. BLM office. BLM sets its own priorities on how sites are selected for cleanup based on the following factors:

- If unreclaimed land presents a danger to public health or safety; or
- If unreclamied land causes the degradation of environmentally sensitive areas such as wilderness study areas.

4.1.2 National Park Service

Although mineral operations are generally prohibited on National Park Service (NPS) lands, as stated in the Mineral Leasing Act of 1920, it does have some statutory and regulatory authority for controlling allowed mineral development, including mineral development rights such as valid mining claims that had vested before designating the lands as protected areas.

In addition to eliminating the location of mining claims in NPS lands under the 1872 Mining Law, the Mining in the Park Act of 1976 directed the Secretary of the Interior to develop regulations to control all activities resulting from the exercise of valid existing mineral rights on patented and unpatented mining claims in any area of the National Park System to preserve the pristine beauty of these areas. The NPS also has extensive regulations governing exercise of valid existing mineral rights (36 CFR Part 9 Subpart A) including restrictions on water use, limitations on access, and requirements for complete reclamation. These reclamation requirements and restrictions are enforceable on all mining operations within NPS lands established after September 28, 1976.

As part of NPS's Disturbed Lands Restoration Program, the Abandoned Mineral Land Restoration Program encourages the full restoration of lands affected by mining activities, addresses environmental concerns (metals contamination, acid mine drainage), safety hazards (vertical mine openings, unstable slopes), and the sustainability of bat species, which may rely on mine shafts for habitat.

Inventory

The NPS maintains an inventory of AMLs for reclamation projects on NPS lands through its Disturbed Lands Restoration Program. As of February 2001, a total of 3,199 AML sites were listed in the NPS inventory of AML reclamation sites. A complete list of NPS's AML Reclamation Sites can be found at http://den2-s11.aqd.nps.gov/grd/distland/amlreports/AMLinventory02-23-01.pdf.

Cleanup

Summaries of AML reclamation conducted and ongoing on NPS administered lands is provided in Table 4-3.

Funding

In 1993, the estimated cost of reclamation of all remaining AML sites in the National Park System was $200 million.

4.2 U.S. Department of Agriculture – Forest Service

As early as 1897, the Organic Act gave the USDA Forest Service power to manage mining impacts by making rules to preserve America's forests from destruction. The National Forest Management Act of 1976 (NFMA), the primary statute governing the administration of the national forests, is the broader statutory authority for the Secretary of Agriculture's resource management of the national forests. NFMA reorganized, expanded, and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on national forest lands. It requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use and sustained-yield principles, and implement a resource management plan for each unit of the national forest system. It is the primary statute governing the administration of national forests and can be found at: http://ipl.unm.edu/cwl/fedbook/nfma.html. Forest Service regulations also require financial assurances for all mine sites.

Inventory

The Forest Service has based its own inventory off the lower limit on the number of abandoned and inactive mines on or near national forests (1,800 total) as listed in the Minerals Availability System/Mineral Industry Location System (MAS/MIL) developed by the U.S. Department of the Interior's U.S. Geological Survey. The Forest Service is no longer conducting inventories. A detailed estimate for total number of abandoned mines and features is not publicly available at this time; however, a CD of the MAS/MIL database can be purchased at: http://minerals.er.usgs.gov/sddp/html/mrdsorder.html.

Cleanup

Collaboration with state and federal agencies and other AML stakeholders aids the Forest Service in addressing AML on their administered lands. For example, the Forest Service, in partnership with BLM, the States of Colorado and Montana, and other watershed partners, combined their resources to generate $7 million in funding and technical support for the Interdepartmental Abandoned Mine Lands Watershed Cleanup Initiative, a series of watershed-based cleanup pilot projects in Montana and Colorado as previously described in section 4.1.1.

Additional summaries of AML reclamation conducted and ongoing on Forest Service administered lands are provided in Table 4-4.

Funding

For fiscal year 2004, the President's Budget request for the Forest Service totaled $4.8 billion. Of this total, approximately $1.3 billion would be appropriated to Minerals and Geology Management, under which the Forest Service addresses abandoned mine lands. The Forest Service sets its own priorities on how sites are selected for cleanup based on the following factors:

- If unreclaimed land presents a danger to public health or safety; or
- If unreclaimed land causes the degradation of environmentally sensitive areas such as wilderness study areas.

4.3 Other Federal Programs that Impact AMLs

4.3.1 Surface Mining Control and Reclamation Act

The Surface Mining Control and Reclamation Act (SMCRA) is aimed at mining operation controls and allows specifically for AML cleanups. SMCRA taxes coal mined today and distributes the money to states and Indian tribes for reclamation activities at coal mine sites abandoned before 1977 and their associated waters. After reclamation is completed at abandoned coal mine sites, a state or tribe can also use the funds to remediate environmental hazards at abandoned hardrock mine sites. The States of Montana, Louisiana, Wyoming, and Texas have been certified as having substantially addressed abandoned coal mines and are therefore released to do reclamation on other mineral mines and to fund public facilities projects in communities that are eligible under the regulations.

Established and funded by SMCRA's AML fund, the AML program is administered primarily by the DOI's Office of Surface Mining Reclamation and Enforcement (OSMRE) and funds the reclamation of eligible mine sites abandoned prior to the act's passage. Under its AML program, OSMRE has granted 23 states and two Indian tribes authority for reclaiming sites within their borders. Funding for reclamation within state or tribal authority is appropriated from 50 percent of the fees collected from mining operations in any state or Indian lands. The remaining 50 percent may be spent largely at the discretion of the Secretary of the Interior, typically for reclaiming

problem sites that pose an imminent hazard to public safety and well being and require a rapid response.

In addition, SMCRA's AML fund also provides resources to the Rural Abandoned Mine Program (RAMP), which is administered by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS). RAMP provides assistance to landowners and land users for reclamation, conservation, and development of rural abandoned mine lands. Differing from OSMRE directed projects, RAMP projects involve a contract or "partnership" directly with the landowner, who must apply to the Soil Conservation Service (SCS) for RAMP assistance.

A national coalition of states and tribes, in cooperation with OSMRE, has grown out of SMCRA and has been very effective in promoting good reclamation science and engineering and publicizing the many AML program successes. This coalition, the National Association of AML Programs, is led by state agencies and is a major player in the remediation of all types of abandoned mine sites throughout the country.

In Fiscal Year 1999, SMCRA grants totaling $145,252,000 were distributed to 26 states and tribes for traditional AML cleanup and the Appalachian Clean Streams program. Fee collections are currently authorized until the end of fiscal year 2004, and at this time there is about $1.4 billion in the fund carried over from previous years.

4.3.2 Uranium Mill Tailings Radiation Control Act

The Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 allows the U.S. Department of Energy (DOE) to regulate cleanup activities at inactive uranium tailings disposal sites. The statute provided for the Uranium Mill Tailings Remedial Action Project, which identified 24 inactive uranium sites (two of which have been delisted) at which the DOE monitored the contamination, ground water, and maintenance. These sites also will be part of the Long-Term Surveillance and Maintenance Program, which provides for surveillance, ground water monitoring, and maintenance of sites cleaned up under the UMTRCA Program. In addition, DOE cleaned up properties in the vicinity of the sites contaminated with residual radioactive materials. DOE's Office of Environmental Management now calls it "DOE's oldest and most successful environmental restoration project."

UMTRCA amended the Atomic Energy Act by directing EPA to set generally applicable health and environmental standards to govern the stabilization, restoration, disposal, and control of effluents and emissions at both active and inactive uranium and

thorium mill tailings sites. The standards limit air emissions and address soil and ground water contamination at both operating and closed facilities (42 USC 2022 et seq.).

Title I of the Act covers inactive uranium mill tailing sites, depository sites, and vicinity properties. Under this Act, EPA must set standards that provide protection as consistent with the requirements of RCRA as possible. The standards must include ground water protection limits. Title II of the Act covers operating uranium processing sites licensed by the NRC. EPA was directed to promulgate disposal standards in compliance with Subtitle C of the Solid Waste Disposal Act, as amended, to be implemented by NRC or the Agreement States. The 1993 Amendments to UMTRCA further directed EPA to promulgate general environmental standards for the processing, possession, transfer, and disposal of uranium mill tailings. The NRC was required to implement these standards at Title II sites.

In 1983, EPA developed standards to protect the public and the environment from potential radiological and nonradiological hazards at abandoned processing sites. These standards include exposure limits for surface contamination and concentration limits for ground water contamination. DOE is responsible for bringing surface and ground water contaminant levels at the 22 sites (two sites were delisted) into compliance with EPA standards. DOE is accomplishing this through the UMTRCA Surface and Ground Water Projects.

4.3.3 U.S. Army Corps of Engineers Reclamation of Abandoned Mine Sites (RAMS) Program

The U.S. Army Corps of Engineers (USACE) RAMS program was developed for the restoration of abandoned and inactive non-coal mines where water resources (ecosystems/habitat) have been degraded by past mining practices. The purpose of the USACE RAMS program is to "support activities and priorities of Federal, State, Tribe, and nonprofit entities and as such provide a support role rather than a lead in addressing this national environmental clean-up need." The USACE RAMS program was authorized for approximately $45 million on remediating mine sites. It is not clear how much money will be spent on mine sites by this program.

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Chapter 5

State AML Programs

Compared to EPA and other federal AML programs, state AML programs may have a farther reaching capacity to address AML due to their ability to be involved with issues on both private and public lands. Many states have their own statutes protecting the same CERCLA and other federal resources discussed earlier in this document. Although the degree of protection varies among states, many of these statutes are designed to mirror federal regulations and allow states to respond to environmental degradation independently, in conjunction with, or prior to federal actions. Although a detailed discussion of specific state statutes is beyond the scope of this document, the following provides a list of examples of some state statutes and regulations affecting mining activities:

Bi-phasic chemical treatment system of acid mine drainage at Leviathan Mine, California.

- State Voluntary Cleanup Programs;
- California Environmental Quality Act (CEQA);
- California Surface Mined Land Reclamation Act (SMLRA);
- California Chap. 15 Discharges of Waste to Land, Article 7, Mine Waste Management;
- Colorado Mined Land Reclamation Act;
- Montana Metal Mine Reclamation Act;
- Montana Environmental Protection Act (MEPA);
- Nevada Water Pollution Control Law;
- Nevada Mined Land Reclamation Act;
- South Dakota Mined Land Reclamation Act;
- Utah Mined Land Reclamation Act;
- Wisconsin Metallic Mining Reclamation Act; and
- Wisconsin Metallic Mineral Mining and Regulation of Metallic Mining Waste.

Table 5-1 provides a summary of 11 states and their requirements for hardrock mine sites.

The complexity and maturity of AML programs vary greatly among the states: some are just starting their inventory; others are doing site assessments; and others have very sophisticated programs to address abandoned mine cleanup. The States of Montana, Wyoming and Colorado possess the most successful AML programs due to their relatively high levels of funding and broad statutory authorities.

Further information on individual state and tribal AML programs and inventory resources is provided in Table 5-2 including Web addresses for AML programs.

5.1 State AML Inventories

Many agencies and programs involved in addressing AML have conducted AML inventories at the state level. The following sections provide a brief overview of individual state-level inventories. Internet Web searches were conducted to identify AML inventories developed by federal agency and state AML programs. Although information presented for the AML inventory summaries below reflects the sources found as of July 22, 2003, many sources are out of date and have not been updated.

In addition, state AML inventory information as listed in the Western Interstate Energy Board's 1991 "Inactive and Abandoned Noncoal Mines: A Scoping Study," is also provided in the following summaries.

More recently, the Mineral Policy Center (MPC) conducted its own research of state AML programs. In a report released in May 2002, the MPC provided general program, AML inventory, and funding information for 13 state AML programs, including Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, South Dakota, Utah, Washington, and Wyoming. EPA further assessed the state AML programs researched in the MPC study and reached their own conclusions. The results of both research efforts regarding state AML inventories and program funding are also summarized in the following sections.

When reviewing the overviews of state AML inventories provided in the following sections, it is important to keep in mind that a universally applied definition of an AML site does not exist at present. Therefore, the various agencies and state-developed AML inventories presented below may possess inconsistencies and are not intended for exact quantitative comparisons. They have been presented within this document for reference purposes only.

Alabama

According to the Alabama Department of Industrial Relations, approximately 15,000 acres of abandoned mine lands existed in the State as of 1991.

Alaska

According to a 1991 literature search conducted by the Alaska Department of Natural Resources (DNR)/Division of Mining, Land, and Water, 432 non-coal abandoned mine sites were identified in Alaska; however, the inventory was deemed incomplete for state, private and native lands. The State is currently working to computerize its database of non-coal AML. Further information can be found at: http://www.dnr.state.ak.us/mlw/mining/aml/. According to BLM efforts, 106 abandoned mine lands exist on BLM administered lands in Alaska and have been funded or await future funding for AML related activities.

The Alaska DNR/Division of Mining, Lands, and Water's AML program has an annual budget of approximately $200,000 for use in addressing non-coal abandoned mine sites, according to MPC and EPA studies.

It is important to keep in mind that a universally applied definition of an AML does not exist at present. Therefore, the various agencies and state-developed AML inventories presented below may possess inconsistencies and are not intended for exact quantitative comparisons.

Arizona

According to MPC and EPA research, state estimates of AML in Arizona are between 8,000 and 10,000 sites. The Arizona Abandoned Mines Program, under the direction of the Arizona Mine Inspector, is now conducting an inventory of abandoned mines on state lands known as the Arizona Abandoned and Inactive Mine (A.I.M.) survey. As of 2002, the survey had identified a total of 8,787 mines, of which 288 mines were found to present environmental hazards and 1,149 mines contained significant public health hazards. The A.I.M. survey is available in a database version, which includes digitized maps and photos. Further information regarding the Arizona Abandoned Mines Program can be found at: http://www.asmi.state.az.us/abandoned.html.

An additional Arizona AML inventory is maintained by the Arizona Department of Mines and Mineral Resources. Its site-specific database, AzMILS, includes 4,000 mines and is available, by request, on disk. Further information about AzMILS can be found at: http://www.admmr.state.az.us/mingen.htm.

According to BLM efforts, approximately 2,008 abandoned mine lands exist on BLM administered lands in Arizona.

As discovered during MPC and EPA research, the Abandoned Mine Safety Fund, created through State legislature in 1998, was approximately $15,000 at the end of fiscal year 2001.

Funding is uncertain for fiscal year 2003 due to budget shortfalls in the State. The fund can be used only to abate physical hazards, not for environmental projects. Because all active coal operations lie on the Hopi and Navajo Reservations in the northeast portion of the State, Arizona receives no funding from OSM and relies on State appropriations and contracts with BLM and NPS.

Arkansas

The Arkansas Department of Environmental Quality/Division of Surface Mining and Reclamation has developed an open-cut mining database of Arkansas mines, which is available via the Internet at: http://www.adeq.state.ar.us/home/pdssql/pds.asp. The database can be queried according to permit ID, county, mine name, mine operator, and mineral of interest. A detailed estimate of the total number of abandoned mines is not publicly available at this time.

According to the Arkansas Department of Pollution Control and Ecology, Arkansas contained 5,000 acres of disturbed land as a result of mining activities as of 1991.

California

According to MPC and EPA studies, the California State AML inventory contains between 40,000 and 47,000 sites. Fifty percent of the sites are on private lands, 48 percent on federal lands, and 1.5 percent on State lands.

In addition, a three-year effort conducted by the California Department of Conservation (DOC) to determine "the magnitude and scope of the abandoned mine problem in California" produced an inventory of abandoned mines, which is included and further described in the resulting report "California's Abandoned Mines: A Report on the Magnitude and Scope of the Issue in the State." Inventory information was collected through examination of existing literature and data and spatially analyzed through the implementation of a GIS. Field investigations were used to fill in any identified data gaps and acquire site-specific information. A detailed estimate of total number of abandoned mines is not publicly available at this time. A downloadable copy of the California DOC report and further information can be found at: http://www.consrv.ca.gov/OMR/abandoned_mine_lands/california_abandoned_mines/index.htm.

In 1991, California State Water Resources Control Board/Division of Clean Water Programs estimated a total of 2,400 inactive and abandoned mine sites.

According to BLM efforts, approximately 688 abandoned mine lands exist on BLM administered lands in California. However, BLM AML records for the state are far from complete and the detail and quality vary considerably. AML data for the desert area of Southern California are very much under-represented.

State legislature appropriated funding to the California DOC's AML program ranges from $125,000 to $450,000, according to MPC and EPA sources.

Colorado

According to MPC and EPA efforts, Colorado State estimates identify between 8,000 to 23,000 AML sites in the State. Additionally, the Colorado Department of Natural Resources/Division of Minerals and Geology has developed an on-line database of mining data that identifies 23,000 mine openings in the State. The database can be queried according to county, mine operator, permit number, permit status, mine name, and commodity. Further information about the Colorado Abandoned Mines Program and its database of mining data can be found at: http://mining.state.co.us/dmginactive.html.

In 1991, Colorado Inactive Mine Reclamation Program estimated 22,000 mine openings existed in the State.

According to BLM efforts, a total of 2,600 abandoned mine lands exists on BLM administered lands in Colorado. Because Colorado's BLM has made inventory and record keeping a high priority from the outset, their records are highly detailed and reliable with new AML sites added as they are reported.

Funding for Colorado DNR/Division of Minerals and Geology's Inactive Mine Reclamation Program is received from various avenues. SMCRA funds, of approximately $2 million per year, are the greatest contribution of funding to the program. Colorado has been certified as having substantially addressed abandoned coal mines in the State and is therefore released to do reclamation on other mineral mines and to fund public facilities projects in communities that are eligible under the regulations. Limited-stakes gambling to safeguard hazardous openings in the Central City, Blackhawk, and Cripple Creek areas provides an additional $111,655 per year. Clean Water Act Section 319 funds also provide approximately $750,000 per year for abandoned mine projects. Approximately $200,000 to $300,000 per year is acquired through State abandoned mine cleanup agreements with the BLM and Forest Service. Finally, the State is in the early stage of a cleanup project with the National Mining Association (NMA) in which the NMA has committed $100,000.

Florida

Florida's Department of Natural Resources/Bureau of Mine Reclamation estimated that 49,000 acres (clay settling ponds) and 13,000 acres (non-clay settling ponds) of phosphate mine dumps existed in the State as of 1991.

Idaho

The number of AML sites in Idaho ranges between 8,000 and 16,000 sites, according to State estimates provided in MPC and EPA research efforts. According to BLM efforts, Idaho possesses approximately 400 priority abandoned mine lands. However, BLM records for the State are far from complete because records reflect a mixture of data from U.S. Geological Survey (USGS) databases, a State database, and BLM records.

Idaho's Department of Health and Welfare/Division of Environmental Quality estimated 8,700 mineral exploration sites existed in the State in 1991.

As provided in MPC and EPA studies, funding for Idaho Department of Lands' AML program is received from a mine license tax, created by the State as a source of funds for abandoned mine reclamation. Due to legislature-enforced tax reductions and a drop in ore production, the mine license tax yields approximately $40,000 per year.

Illinois

According to the Illinois Department of Mines and Minerals in 1991, 35,000 acres of AML existed in the State.

Indiana

Indiana's Department of Natural Resources/Bureau of Mine Reclamation estimated, in 1991, that 1,200 AML sites existed in the State.

Louisiana

In 1991, Louisiana's Department of Natural Resources/Injection and Mining Divisions estimated 900 AML sites existed in the State.

Maine

According to the Maine Department of Environmental Protection, 700 mine openings existed in the State as of 1991.

Maryland

According to the Maryland Water Resources Administration, a total of 200 AML sites existed in the State as of 1991.

Minnesota

In 1991, Minnesota's Department of Natural Resources/Minerals Division estimated 650 AML sites existed in the State.

Missouri

According to the Missouri Department of Natural Resources and Department of Environmental Quality, a total of 48,000 affected acres, as measured from USGS, Soil Conservation Service, and Forest Service aerial photos, existed in the State as of 1991.

Montana

Within its Web site, the Montana Department of Environmental Quality's Mine Waste Cleanup Bureau (MWCB) presents five downloadable databases pertaining to Montana's inactive mine sites (http://www.deq.state.mt.us/rem/mwc/download.asp). The databases include: MWCB Priority Site Rank List, MWCB Priority Cleanup Sites, Montana Inactive Mine Sites, Water Sampling Sites for Montana Inactive Mines, and Sediment Sampling Sites for Montana Inactive Mines. Approximately 6,000 hardrock abandoned mines were identified through the MWCB survey. BLM AML inventory efforts also identified approximately 6,000 abandoned mine lands on BLM administered lands in Montana.

An additional inventory was developed by the Montana Bureau of Mines and Geology (MBMG). Its abandoned-inactive mines database contains more than 8,000 records and includes several data tables that include information on location (latitude/longitude and cadastral as determined from 1:24,000-scale maps, Global Positioning System (GPS), or other sources), ownership, office and field screening results, and water/soil sampling (sample-ID, location, and field parameters). Information contained in the inventory was collected first by obtaining an accurate location, followed by determining the ownership of the site, assessing the relationship of the site to Forest Service or BLM land, and finally assessing the potential impact of sites on or affecting federal land. Additional information about the MBMG inventory can be found at: http://www.mbmg.mtech.edu/env-abldbms.htm#database.

In 1991, Montana's Department of State Lands/Reclamation Division estimated 19,000 mine sites, 1,200 mill sites, and 1,000 smelters existed in the State.

According to MPC and EPA sources, SMCRA money is the primary funding mechanism used to address AML sites in Montana. Montana has been certified as having substantially addressed abandoned coal mines in the State and is therefore released to do reclamation on other mineral mines and to fund public facilities projects in communities that are eligible under the regulations. If a site is only partially eligible for SMCRA

funds, the State supplements with State funds, obtained by taxes on oil, gas, coal, metal mines, and other mineral extractions. The tax money is placed in a Resource Indemnity Trust Fund and disbursed via grants to up to three abandoned mine projects each grant cycle, at up to $300,000 per project.

Nevada

A 1999 Nevada Abandoned Mine Land Environmental Task Force report estimates 200,000 to 500,000 AML sites are present in the State. Presently, the task force has cataloged and verified 8,000 of these sites. Additional information can be found at: http://www.nbmg.unr.edu.

Nevada's Department of Minerals identified approximately 50,000 mines in the State as of 1991.

Through research of USGS, former Bureau of Mines, Nevada Division of Mines and Geology, and Nevada Division of Minerals inventory records, BLM AML efforts have identified a total of approximately 165,000 abandoned mine lands on BLM administered lands in Nevada. Of these, 1,550 have been visited and verified by BLM.

Approximately $2 million in State bonds is spent on AML reclamation each year, according to Alan Coyner, Abandoned Mine Program, Nevada Division of Minerals. Funding for the State's "Stay Out and Stay Alive" program is generated from industry fees of $1 per mining filing and $20 per acre of newly permitted mining disturbance on public lands for a total of approximately $200,000 per year, depending on the level of mining industry. Additionally, Nevada receives funding through Western Governors' Association and BLM grants.

New Mexico

According to MPC and EPA studies, State estimates place the number of AML sites in New Mexico between 10,000 to 20,000 sites; the BLM estimates that approximately 595 abandoned mine lands exist on public lands administered by the BLM in New Mexico. However, the BLM inventory reflects roughly 40 percent of the estimated hardrock AML sites on BLM land in New Mexico.

In 1991, New Mexico's Energy, Minerals, and Natural Resources/Mining and Minerals Division estimated 7,200 AML sites existed in the State.

Approximately $1.8 million per year of funding is allocated to the state under SMCRA, as provided in MPC and EPA sources. In addition, New Mexico has entered into various partnerships with BLM, Forest Service, State Land Offices, and other entities in an effort to coordinate reclamation activities on public lands.

New York

According to the New York Department of Environmental Conservation/Division of Mineral Resources, 30,000 mine-affected acres existed in the State as of 1991.

North Carolina

As of 2001, the North Carolina Geological Survey Minerals Resources Division had estimated the total number of inactive mines in North Carolina as 150. Further information about the North Carolina AML program and its annual mining inventory estimates can be found at: http://www.geology.enr.state.nc.us/Mineral%20resources/Mineral_Resources.html.

Ohio

According to the Ohio Department of Natural Resources/Division of Reclamation, 6,000 acres of AML existed in the State as of 1991.

Oklahoma

In 1991, the Oklahoma Conservation Commission estimated 26,000 acres of AML in the State.

Oregon

According to the Oregon Department of Environmental Quality (DEQ) and Department of Geology and Mineral Industries (DOGAMI), the number of AML sites in Oregon is estimated to be between 94 to 120 sites.

The Oregon Department of Geology and Mineral Industries/Mined Land Reclamation estimated 3,500 AML sites existed in the State as of 1991.

According to initial BLM efforts, 323 AML sites were identified on public lands managed by BLM in Oregon and Washington. Of these, 50 sites have been determined to be in need of some form of remediation. To date, this inventory information for Oregon and Washington has not been completely entered into BLM's AMLIS database. AMLIS data entry continues to be a priority task for fiscal year 2003 in these states.

Funding to address AML sites comes from the State's Orphan Site Account, which is used to address orphaned contamination at landfills and industrial sites. According to DEQ's Abandoned Mine Land Coordinator, the fund allocates $1 million to AML sites every two years. Additional funds are received through collaborations with the BLM and Forest Service. For instance, the Forest Service recently provided the State with a $50,000 grant.

Pennsylvania

According to the Pennsylvania Department of Environmental Resources/Bureau of Mining and Reclamation, 1,300 AML sites exist in the State.

South Carolina

The South Carolina Geological Survey maintains a database, which contains information on more than 1,000 sites in South Carolina, including metallic and nonmetallic deposits. The database is a collaboration of the USGS Mineral Resources Data System (MRDS) and the Mineral Availability System (MAS). Further information about the South Carolina AML inventory database can be found at: http://water.usgs.gov/pubs/FS/FS-040-96/.

According to the South Carolina Land Resources Conservation Commission/Mining and Reclamation Division, 19,000 acres of AML existed in the State as of 1991.

South Dakota

Through a study conducted by the South Dakota Department of Natural Resources in conjunction with the South Dakota School of Mines and Technology, approximately 900 non-coal mines were identified, of which 700 were on private lands and 200 on Forest Service administered lands. Additional information can be found at: http://www.state.sd.us/denr/DES/mining/acidmine.htm.

According to MPC and EPA research efforts, no funding for abandoned mine cleanup is allocated by the State, and South Dakota does not receive funds under SMCRA. Therefore, most of the sites remain unclaimed, except for voluntary efforts completed by industry, Forest Service, and the State. A mine reclamation fund exists under State mine reclamation laws and may receive monies to reclaim lands previously affected by mining as allocated by the South Dakota Board of Minerals and Environment. Contributions to the fund have been very limited, mainly consisting of bond forfeitures.

Texas

In 1991, the Railroad Commission of Texas/Surface Mining and Reclamation Division estimated 20,000 sites existed in the State. Funding for the Texas AML program is primarily obtained by AML grants through the OSM. Texas has been certified as having substantially addressed abandoned coal mines in the State and is therefore released to do reclamation on other mineral mines and to fund public facilities projects in communities that are eligible under the regulations. According to funding levels as of 1998 that totaled $1.5 million annually, the State estimated that its AML program could complete all of its remaining uranium and hardrock AML sites by 2007.

Utah

Through reviews of mining industry and State mineral occurrences databases, USGS maps, and mining district information, the State estimates that there are 20,000 mine openings in Utah, according to MPC and EPA research. Additional information on Utah's Abandoned Mine Reclamation Program can be found at: http://dogm.nr.state.ut.us/AMR/.

According to the BLM efforts in Utah, approximately 478 AML have been identified throughout the State. However, these records represent only a fraction of the State, but the information they contain is highly reliable and detailed.

As of 1991, Utah's DNR/Division of Oil, Gas, and Mining estimated that 25,000 acres had been affected by mining activities in the State.

As provided in MPC and EPA studies, the Utah DNR/Division of Oil, Gas, and Mining's Abandoned Mine Reclamation Program receives approximately $1.5 million per year of funding from SMCRA and approximately $30,000 per year of funding from the State legislature. State legislature funding is typically applied to the federal partnership projects. Utah also works cooperatively with NPS and BLM in addressing AML in the State.

Virginia

According to the Virginia Department of Mines/Minerals and Energy, approximately 2,000 AML sites existed in the State as of 1991.

Washington

Washington DNR/Division of Geology and Earth Resources and the Department of Ecology estimate that there are approximately 3,800 sites in Washington. According to MPC and EPA efforts, no dedicated funding source to address problems of abandoned mines exists in Washington. However, there is a State law that allows that "fines, interest, and other penalties collected by the department [DNR]...shall be used to reclaim surface mines abandoned prior to 1971." (Revised Code of Washington 78.44.045.) Pursuant to this statute, a few thousand dollars per year has been collected and spent on the inventory study. Washington DNR has also applied for EPA grant funding to reclaim three small abandoned operations that are on State lands.

Additional information about the Washington AML inventory effort can be found at: http://www.dnr.wa.gov/geology.

Wisconsin

Wisconsin's DNR estimated that 200 acres had been affected by mining activities in the State as of 1991.

Wyoming

Presently, the Wyoming Department of Environmental Quality's Abandoned Mine Reclamation Program AML inventory lists 3,371 records; however, some of these may be duplicates because the database has not been field-checked after being converted into an ARC/GIS system last year. Through the combined efforts of BLM and OSM, approximately 931 AML have been identified in Wyoming. More than 530 of the records are from the database maintained by the State AML Division, of which the quality of the data varies widely. Another 320 records are from the OSM AMLIS tracking system and represent multiple "problem areas" associated with 36 AML sites on BLM land. The remaining records are the result of BLM inventory efforts.

The Wyoming Abandoned Mine Reclamation Program is primarily federally funded based on SMCRA funds, as determined during MPC and EPA research efforts. Wyoming has been certified as having substantially addressed abandoned coal mines in the State and is therefore released to do reclamation on other mineral mines and to fund public facilities projects in communities that are eligible under the regulations. The State relies on bonding and reclamation fees collected from the coal industry by the State as additional funding sources and has worked cooperatively with BLM, Forest Service, and NPS in addressing AML in Wyoming.

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Chapter 6

Reuse and Redevelopment of AML

The reuse of hazardous waste sites, including AMLs, is an Agency-wide priority at EPA. Most recently, the Agency has implemented the Land Revitalization Agenda, which seeks to ensure that cleanups integrate the protection of public health, welfare, and the environment with consideration of future land use. While land use planning and regulation remain the responsibility of local governments, EPA recognizes that site cleanups directly impact the future use of these sites, and that thoughtful Agency decisions and activities can help to mitigate these impacts. In addition, the AML Team recognizes that reuse opportunities at AMLs may provide the critical impetus to expedite environmental cleanup. Examples of Agency actions that can support reuse include: deferring the listing of a site in order to avoid stigma and accelerate cleanup; choosing and designing remedies that do not prohibit the likely future use of a site; implementing policies that encourage site reuse; and providing communities with general information about potential site reuse opportunities, resources, and lessons learned.

EPA's AML Team is dedicated to providing tools and resources to support the reuse of AMLs. As part of this effort, the AML Team serves as a focal point for: 1) coordinating and facilitating collaborative efforts with other organizations; 2) developing technical and policy guidance for the reuse of AMLs; and 3) exploring options for the reuse of AMLs. In addition to its own undertakings, the AML Team seeks to leverage the activities of other programs that support reuse of contaminated properties. Through programs such as the Superfund Redevelopment Initiative and the Brownfields program, the AML Team has identified a number of projects that have supported AML Team goals and serve as examples for parties interested in seeking reuse options for AML sites. The following sections describe these efforts in greater detail, provide several anecdotes that illustrate the successful reuse of AMLs, and detail the ongoing work of the AML Team in support of reuse.

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6.1 Superfund Redevelopment and Brownfield Programs

Through the Superfund Redevelopment Initiative and the Brownfields program, the Agency has been working with communities since the late 1990s to actively reclaim AML sites through reuse projects.

6.1.1 Superfund Redevelopment Initiative

EPA's Superfund Redevelopment Initiative (SRI) is a coordinated national effort to facilitate the return of the country's most hazardous waste sites (NPL sites) to productive use by providing communities and key stakeholders with the tools they need as they seek to reuse these lands. SRI has undertaken a wide variety of projects to support NPL site reuse including a pilot program to provide funding for community based reuse planning efforts. Since 1999, SRI has contributed nearly $5 million in grants and in-kind services to support reuse planning efforts in approximately 70 communities across the country, including communities with AMLs.

The Initiative's grants and in-kind services have frequently been used to support community-based reuse planning processes, which bring together a wide range of stakeholders, including community residents, local government representatives, site owners, and potentially responsible parties. These community stakeholders work together to develop reuse recommendations for sites, which can then be taken into consideration by EPA site managers to make appropriate decisions about remedy selection and design. Integrating a site's reasonably anticipated future land use as a criteria in remedial decisions helps to ensure the effectiveness of EPA cleanups, while the reuse of sites provides communities with a wide range of economic, environmental and social benefits.

The following section summarizes several examples of successful reuse outcomes at NPL sites contaminated by mining waste that have been supported or documented by EPA's Superfund Redevelopment Initiative.

California Gulch - Leadville, CO

Through collaboration between EPA, the State of Colorado, local communities, and mining companies, the California Gulch Superfund site is being remediated and reused. Due to metal contamination in area soils and the Arkansas River from abandoned mine tailings, the site was added to EPA's NPL in 1983. In an effort to enhance the area's growing tourism industry, a unique bike path was developed. The 12-mile Mineral Belt Bike Path, inspired by the area's significant mining heritage, loops around the historic mine tailing piles and mining artifacts

within the site and the City of Leadville. A year-round attraction, the bike path is used in the winter as a trail for recreational skiers. Future public access to open space on the site has been finalized through two agreements signed by EPA and the State of Colorado, allowing the Colorado Division of Parks and Outdoor Recreation and the City of Aurora to purchase ranches along the Arkansas River. The ranches will be used as parks, wildlife habitat, and for recreational activities.

Anaconda Smelter - Anaconda, MT

Once a copper smelting facility, the Anaconda Smelter is now an award-winning golf course designed by Jack Nicklaus. Following the closure of the smelting facility, the Town of Anaconda experienced severe economic impacts from the loss of local jobs and revenue that the facility had provided. The landscape of the area was also left heavily contaminated. Successful cleanup and reuse of the site were achieved through collaboration between EPA, the community, and current owners of the smelter in the development of a cleanup design that allowed for redevelopment of the property. The resulting golf course has provided local jobs and a foundation for the community's plan to redefine itself as a recreational resort town.

Silver Bow Creek/Butte Area - Butte, MT

Multiple innovative reuse methods have been employed at the Silver Bow Creek/Butte Area site. Once a copper smelter, the site was added to the NPL in 1983 by the EPA to begin addressing its severely polluted ponds and soil. EPA and Atlantic Richfield Company (ARCO) formed a partnership and have cleaned up and redeveloped portions of the site into a sports complex including youth baseball fields, a driving range, and volleyball courts. Through restoration of many of the site's ponds and wetlands, fly-fishermen have been attracted from neighboring towns. Additional uses for the cleaned property are being developed by the local residents. Plans include walking trails and a playground.

Oronogo-Duenweg Mining Belt - Jasper County, MO

Contaminated ground water, surface water, and soil, including at least 2,700 residential yards, were the result of mining, milling, and smelting of lead and zinc ores that occurred at the Oronogo-Duenweg Mining Belt site. Through the collaborative efforts of EPA, the State of Missouri, and the local community, reuse is ongoing at the site. A scrap metal recycler bought and cleaned up 40 acres of the site in exchange for a release from liability for preexisting contamination. The recycler opened a scrap metal recycling center in 1995 and has provided permanent jobs to 20 local residents. Additionally, EPA in partnership with the Missouri Highway and Transportation Department is planning to build a highway bypass through part of the site as

well as use the mine wastes as fill in the construction of the highway. This will provide a dual purpose by providing the Highway Department with the fill it needs to construct the bypass as well as providing containment of the mine waste to prevent future exposures to the contaminants. Further negotiations are underway for other contaminated portions of the site to be cleaned up and redeveloped for commercial purposes, which would provide increased annual incomes and tax revenues for the local community.

Bunker Hill Mining & Metallurgical Complex - Silver Valley, ID

The area of Silver Valley is experiencing new commercial development through the reuse of the Bunker Hill lead smelter site. Redevelopment of the site includes Motel 8, McDonalds, and the Silver Mountain Resort, now a popular ski resort. The new businesses have created approximately 225 new jobs, and more than 800 acres have been recovered for reuse. Fifteen years ago, the Bunker Hill lead smelter and several other area mines closed, leaving the Silver Valley economy close to collapse and its landscape poisoned with metals. After adding the site to the NPL, EPA in partnership with the Panhandle Health District and the State of Idaho worked to restore the area's ecology and residential soils through cleanups of lawns and parks, containment of tons of mine tailings, and the planting of hundreds of trees. Institutional controls were also developed to ensure the protection of the area residents from remaining contaminated soil on site.

Additional information about redeveloped Superfund sites and ongoing efforts to support reuse is available at http://www.epa.gov/superfund/programs/recycle/.

6.1.2 Brownfields Program

On November 9, 1994, EPA initiated its Brownfields program. The purpose of the program is to help communities develop innovative ways to overcome the current obstacles to the cleanup and reuse of potentially contaminated urban properties in a sustainable, environmentally sound manner. Through the Brownfields program, communities identify and work with developers to restore abandoned sites, thereby supporting new jobs and economic growth, increasing property values, stimulating tax revenues, and rejuvenating neighborhoods.

Most recently, new brownfields legislation was signed by President Bush in January 2002. In Section 104(k) of the 2002 Small Business Liability and Brownfields Revitalization Act, the term "brownfield" includes, for the first time, "mine-scarred lands," thus making AMLs eligible for brownfields revitalization funding. The implications and applicability of this new legislation in addressing AML are currently under EPA review.

This section provides several examples of how AML sites have been and currently are being reused with support from the Brownfields program.

Murray City, UT

Murray Smelter exemplifies a successful collaborative effort between Superfund and Brownfields. The former Murray Smelter in Murray City is a 141-acre site surrounded by single-family and multiple-unit residential areas, schools, and office buildings. Concerns regarding residual contamination, as a result of operations at the smelter, coupled with potential environmental liability concerns have prevented the redevelopment of the site.

Today, the Murray Smelter site contains a Utah Transit Authority (UTA) light rail station with a 300-space parking lot, a designated connector road, and a major retail membership warehouse club. Groundbreaking for a one-million-square-foot hospital facility began in 2003. The site is being redeveloped as several multi-use properties that address Murray City's need for regional health care facilities, public transit access, and diversified economic development. Redevelopment is being supported in part through a $176,000 Brownfields program grant, which was used to pay for a seismic analysis and a real estate consultant to advise on potential reuse opportunities. Murray Smelter was eligible for brownfield funding because interested parties worked with EPA to keep the site off of the NPL. In addition, cooperative efforts between EPA and site stakeholders, including Murray City, interested developers, the PRP, and others allowed the site's remedial project manager (RPM) to integrate the site's remedy with identified reuse opportunities.

Summit County, CO

The hardrock mining industry left Summit County with a legacy of contaminated and abandoned mine sites that lay idle and continue to degrade the environment. Mining and its associated AMD have significantly impacted Peru Creek. The 15-square mile Peru Creek Basin is located 70 miles west of Denver and is a tributary of the Snake River. About 3,000 people live year-round in the Snake River watershed in Summit County, though seasonal resort use swells that number to over 20,000.

Through the Brownfields program, the community hopes to restore the natural ecosystem and thereby enhance recreational opportunities and create economic benefit to the county. Presently, the following preliminary steps have been planned for addressing the site:

- Gather existing data and conduct preliminary environmental site assessments;

- Prioritize sites on the basis of the preliminary assessments;
- Conduct Phase I and Phase II environmental site assessments for the highest priority sites;
- Develop a cleanup plan; and
- Engage the community in brownfields decisions through the county's web site, local newspapers, and public meetings.

For more information on the Brownfields program, visit EPA's brownfields web site: http://www.epa.gov/epahome/hi-brownfields.htm.

6.2 AML Team – Pursuing Innovative Reuse Opportunities

Over the last several years, significant progress in the innovative reuse of mining sites has been achieved. Examples of innovative reuses include wind farms, conservation areas, recreational parks, historical parks, resorts, hotels, retail stores and highway bypasses. In addition, the AML Team is exploring other creative reuse options for AMLs such as wetland banking, water quality trading credits, and carbon sequestration.

The AML Team has investigated and published reports on two of these innovative uses, and is currently working on the creation of additional reports. These reports can be found on the AML Team Web site at http://www.epa/gov/superfund/programs/aml/revital/index.htm. *Wind Energy at Former Mining Sites* describes the reuse of AMLs as wind farms, provides anecdotal examples of former mining sites used as wind farms, and discusses benefits and limitations associated with wind energy. *Recreational Opportunities at Abandoned Mine Lands* describes active and passive recreation opportunities at AMLs and provides examples highlighting the successful reuse of AMLs as ski resorts, parks, and golf courses. Additional reports will describe opportunities associated with reusing AMLs to create "credits" associated with water quality, carbon sequestration, and wetlands and protecting the resources associated with AMLs through land conservation.

The following provides brief snap-shot summaries of several current and ongoing mine site redevelopment projects and partnerships in addition to those presented in the innovative reuse reports.

Green Mountain Wind Farm - Garrett, PA

- Located on Decker farm, which was once used for coal strip mining
- Partners included:
  - GreenMountain.com
  - National Wind Power - owner and operator (National Wind Power Ltd. of the United Kingdom and American National Power of Texas)
  - Nordex GmbH - Danish manufacturer of the turbines, towers, and blades
  - Somerset Rural Electric Cooperative - electricity produced by the wind turbines flows through underground cables to an existing substation owned by Somerset Rural Electric Cooperative
  - Distributed Generation Systems, Inc. (Disgen) of Evergreen, Colorado - developer of the project
  - Public Utility Commission
  - Exelon Community Energy - a green electricity marketing company headquartered in Wayne, Delaware County, Pennsylvania, who will market the wind power generated to commercial and residential customers
- Customers to buy wind energy generated included:
  - University of Pennsylvania
  - Penn State University
  - Carnegie Mellon University
  - Philadelphia Suburban Water Corporation
  - Giant Eagle Inc.
- Other supporters included:
  - Pennsylvania Department of Environmental Protection
  - Pennsylvania Public Utilities Commission Chairman, John M. Quain
  - Sierra Club's representative to the Mid-Atlantic Green E-Advisory Committee, Jeff Schmidt
  - Ridge-Schweiker Administration's Energy Task Force

Coyote Creek Parkway - Santa Clara, CA

- Formerly a sand and gravel mining quarry
- Presently transformed into a 60-mile paved trail used by bicyclists, rollerbladers, and hikers
- Partners included:
  - Graniterock - designed trail with cooperation of the County Parks and Recreation Department and wildlife habitat consultants, performed reclamation of the area and developed the trail, and paved and landscaped trail to enhance the contours created through mining operations
  - Santa Clara County Parks - worked with Graniterock in design of trail

Independence Mine State Historical Park - Willow Creek Valley, AK

- Previously gold and sheelite mines
- A state historical park that displays the history of the mining area, including a visitor center and guided tours
- In 1974, Independence Mine was entered into the National Register of Historic Places
- Partners included:
  - Alaska-Pacific Consolidated Mining Company (APC) - donated land to the Alaska Division of Parks and Outdoor Recreation to develop Independence Mine State Historical Park
  - Friends of Independence Mine - volunteer, nonprofit citizens' group dedicated to the preservation, continued restoration, and interpretation of this historic area
  - Alaska Division of Parks and Outdoor Recreation - established Independence Mine State Historical Park

There is a core group of programs and organizations dedicating funding, tools, information, and other resources to facilitate the cleanup of abandoned mine lands through restoration, reclamation, or other reuses. A compilation of these programs and organizations is provided in Appendix D.

Chapter 6 Sources

Alaska Department of Natural Resources/Division of Parks and Outdoor Recreation. Independence Mine State Historical Park, Web page. http://www.dnr.state.ak.us/parks/units/indmine.htm

EPA. Brownfields program Web site. http://www.epa.gov/epahome/hi-brownfields.htm

EPA. Superfund Redevelopment Program Web site. http://www.epa.gov/superfund/programs/recycle/

Green Mountain Energy Company. Green Mountain Wind Farm Celebrates One Year Anniversary Web Page. http://www.greenmountain.com/about/press_events/archive/20010607.jsp

Illinois Department of Natural Resources. Kickapoo State Recreation Area Web page. http://dnr.state.il.us/lands/landmgt/parks/r3/kickapoo.htm

Santa Clara County Department of Parks and Recreation. Coyote Creek Parkway Web page. http://www.parkhere.org/channel/0,4770,chid%253D16482%2526sid%253D12761,00.html

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Glossary[1]

For the purposes of this document, the following definitions are:

ACQUIRED LANDS - Lands in federal ownership which were obtained by the government through purchase, condemnation, gift, or by exchange. They are one category of public lands (Bureau of Land Management, 1999b).

ALLUVIUM - Natural accumulations of unconsolidated clay, silt, sand, or gravel that have been transported by water, wind, or gravity to their present position.

AQUIFER - A body of rock that contains sufficient saturated permeable material to conduct groundwater and to yield significant quantities of water to wells and springs.

BACKFILLING - The filling in again of a place from which the rock or ore has been removed.

BACKGROUND GEOCHEMISTRY - The abundance of an element in a naturally occurring material in an area where the concentration is not anomalous.

BASE METALS - Those metals usually considered to be of lesser value and of greater chemical reactivity compared to the noble (or precious) metals, most commonly copper, lead, zinc and tin.

BENEFICIATION - Improvement of the grade of ores by milling, flotation, sintering, gravity concentration, or other processes. Also termed "concentration".

CASUAL USE - Mining activities that only negligibly disturb BLM lands and resources.

CLAIM - The portion of mining ground held under the Federal and local laws by one claimant or association, by virtue of one location and record. Also called a "location."

CLOSURE - In this report the term refers to the point at which a company permanently stops activity (although it may still retain liabilities for unforeseen environmental or safety concerns).

COMMON VARIETY MINERALS - Mineral materials that do not have a special quality, quantity, character, or location that makes them of unique commercial value. On public lands such minerals are considered saleable and are disposed of by sales or by special permits to local governments.

CONCENTRATION - See "beneficiation." It also refers to the amount of a material in a host (e.g., the amount of gold in a ton of ore.)

[1]As cited from *Hardrock Mining on Federal Lands.* National Research Council, Committee on Hardrock Mining on Federal Lands, Committee on Earth Resources, Board on Earth Sciences and Resource, Commission on Geosciences, Environment, and Resources: NATIONAL ACADEMY PRESS, Washington, D.C. 1999. http://books.nap.edu/html/hardrock_fed_lands/index.html

CONSTRUCTION MINERALS (OR MATERIALS) - Materials used in construction, notably sand, gravel, crushed stone, dimension stone, asbestos, clay, cement, and gypsum.

COOPERATING AGENCY - Any federal, state, or local agency or Indian tribe with jurisdiction by law or special expertise enabling it to cooperate with the lead agency preparing an environmental impact statement under NEPA.

CORPORATE BONDING - As used in this report, the use of corporate assets as part or all of the financial assurance for the successful completion of reclamation or other corporate responsibility.

CRITICAL ENVIRONMENTAL CONCERN - Describes an area under BLM management and having special attributes.

CULTURAL RESOURCES - As used in this report, natural or man-made features having cultural or historical significance, such as structures, graves, religious sites, vistas, or bodies of water.

CUMULATIVE IMPACT - As used in this report, the collective impacts of several operations involving human activities, including mining, grazing, farming, timbering, water diversion or discharge, and industrial processing, also includes future impacts not immediately observable.

DEVELOPMENT - The preparation of a mining property so that an ore body can be analyzed and its tonnage and quality estimated. Development is an intermediate stage between exploration and mining.

DISCOVERY - As used in this report, initial recognition and demonstration of the presence of valuable mineral within a claim.

DUMP - A pile of ore, coal, or waste at a mine.

EMERGENCY FUNDS (re: for low-probability, post-closure events) - As used in this report, funds provided to deal with unexpected failures of reclamation on closed mining sites.

EPHEMERAL STREAM - A stream or reach of a stream that flows briefly only in direct response to precipitation in the immediate locality and whose channel is at all times above the water table.

EXPLORATION - As used in this report, the search for valuable minerals by geological, geochemical, geophysical, or intrusive physical examination. (See also "prospecting," which in this report is considered part of exploration.)

FEDERAL LAND MANAGEMENT AGENCIES - In this report the term refers to the Bureau of Land Management and the U.S. Forest Service; management agencies not discussed here might include the National Park Service, the Department of Energy, the Department of Defense, and others.

FERROUS METALS - Metals commonly occurring in alloys with iron, such as chromium, nickel, manganese, vanadium, molybdenum, cobalt, silicon, tantalum, and columbium (niobium).

FINANCIAL ASSURANCE - Funding or enforceable pledges of funding used to guarantee performance of regulatory obligations in the event of default on such obligations by the permittee.

GOOD SAMARITAN ACTION - An action taken for the benefit of part or all of the community at large rather than for that of the doer. In the context of this report, it usually refers to the correction of some prior detrimental environmental legacy as a convenience or as a public service, but without direct personal or institutional benefit.

GROUNDWATER - Underground water.

HARDROCK - Locatable minerals that are neither leasable minerals (oil, gas, coal, oil shale, sodium, phosphate, potassium, sulphur, asphalt, or gilsonite) nor saleable mineral materials (e.g., common variety sand and gravel). However, the EPA AML Team includes mining sites associated with phosphate extraction in this category even though they are categorized as "leasable minerals." Hardrock minerals include, but are not limited to, copper, lead, zinc, magnesium, nickel, tungsten, gold, silver, bentonite, barite, feldspar, fluorspar, and uranium. (BLM, 1999b) Usually refers to rock types or mining environments where the rocks are hard and strong and where blasting is needed to break them for effective mining. As used in this report, the term hardrock minerals is defined synonymous with “locatable minerals.”

HEAP LEACHING - As used in this report, a process for recovery of minerals from heaps of crushed ore by percolation of a solvent (such as cyanide for gold, or ferric sulfate and sulfuric acid for copper) through the heap, followed by chemical processing of the lixiviant.

LEACH PAD - The surface upon which ore is piled for heap leaching, including those facilities to collect the lixivant for mineral recovery.

LEASABLE MINERALS - A legal term that identifies a mineral or mineral commodity that is leasable by the federal government under the Mineral Leasing Act of 1920 and similar legislation. Leasable minerals include oil, gas, sodium, potash, phosphate, coal, and all minerals on acquired lands.

LIXIVIANT - A liquid medium that selectively extracts the desired metal from the ore or material to be leached rapidly and completely, and from which the desired metal can be recovered in a concentrated form.

LOCATABLE MINERALS - A legal term that identifies minerals acquired through the General Mining Law of 1872, as amended. Examples are given in Table A-1. Locatable minerals are distinguished from federally owned minerals that are disposed of by leasing (see leasable minerals). In some situations, the term “hardrock minerals” is applied to locatable minerals.

LOCATION - See “claim.” Also, the process of claiming or appropriating a parcel of mineral land.

LODE CLAIM - Synonymous with “vein claim.” As used in this report, a claim based on the presumption that the valuable mineral is a part of a bed-rock lode, vein, stockwork, stratum, or intrusion and is not dominantly a physical redistribution of values by surficial processes (the latter constitutes a placer deposit).

MINE - An opening or excavation in the ground for the purpose of extracting minerals.

MINERAL - Several other common meanings, but the following is used in this report: Any natural resource extracted from the earth for human use; e.g., ores, salts, coal, or petroleum.

MINERAL DEPOSIT - A mineral occurrence of sufficient size and grade that it might, under favorable circumstances, be considered to have economic potential.

MINERAL OCCURRENCE - A concentration of mineral that is considered to be valuable or that is of technical or scientific interest.

MINERAL SPECIES - Term used in this report to distinguish specific mineralogical species from the unmodified term "mineral" as defined above.

MULTIPLE USE - A combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output. [43 U.S.C. §1702 ©)].

NOTICE-LEVEL OPERATION - A mining or exploration operation on BLM land involving more than casual use but requiring that the operator submit only a Notice rather than a plan of operations. It is limited to an area of disturbance of 5 or fewer acres.

OPERATIONS - As used in this report, all activities and facilities involved in management, access, exploration, extraction, beneficiation, maintenance, or reclamation.

ORE - The naturally occurring material from which a mineral or minerals of economic value can be extracted profitably or to satisfy social or political objectives.

OVERBURDEN - Material of any nature, consolidated or unconsolidated, that overlies a deposit of useful minerals or ores.

OXIDATION - As used in this report, the reaction of ores or waste with oxygen (usually above the water table); in sulfide ores this results in the release of sulfuric acid that, in the absence of neutralization, mobilizes iron, copper, zinc, and other minerals. (See also redox.)

PATENT - Concerning the ownership of a mining claim: as a noun, A document that conveys title to the ground; or the process of securing a patent.

PERFORMANCE-BASED STANDARDS - Standards expressed in terms of a desired result or outcome rather than a method, process, or technology. See also "technically prescriptive standards."

PHREATOPHYTE - A plant that obtains its water supply from the zone of saturation or through the capillary fringe and is characterized by a deep root system.

PIT LAKE - As used in this report, a lake that forms within the open pit of a mining operation.

PLACER - A mineral deposit that has achieved its present distribution through the prior action of moving water or wind. Placers are usually in poorly consolidated materials and are the sources of much, but not all, tin, titanium, rare earths, diamonds, and zirconium, and some gold.

PLAN OF OPERATIONS - A plan for mining exploration or development on BLM land involving more than 5 acres or a plan for mining where the operator with preexisting, valid claims intends to mine in an area of Critical Environmental Concern or a Wilderness area.

POINT SOURCE DISCHARGE - Discharge of pollutant from a discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, or container.

POST-CLOSURE - As used in this report, referring to the time after a property formerly used for mining has been reclaimed.

PRECIOUS METAL - Any of several relatively scarce and valuable metals, such as gold, silver, and the platinum group metals.

PROSPECTING - The search for outcrops or surface exposures of mineral deposits. Searching for new deposits; also preliminary explorations to test the values of lodes or placers already known to exist. (See also "exploration".)

PUBLIC DOMAIN - Land owned, controlled, or heretofore disposed of by the U.S. government.

PUBLIC LAND - The part of the U.S. public domain to which title is still vested in the federal government and that is subject to appropriation, sale, or disposal under the general laws.

RECLAMATION - Restoration of mined land to original contour, use, or condition. But as used in this report, also describes the return of land to alternative uses that may, under certain circumstances, be different from those prior to mining.

RECORD OF DECISION - Under NEPA, a concise public record that states what an agency's decision was, identifies all alternatives considered by the agency and the factors considered by the agency, and states whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted or if not, why not.

REDOX - Adjective identifying chemical reactions involving oxidation (and reduction).

RESERVED LANDS - Federal lands which are dedicated to or set aside for a specific purpose or program and which are, therefore, generally not subject to disposition under the operation of all of the public land laws.

RESERVE - The quantity of mineral demonstrated to be present and known to be economically producible.

SALEABLE MINERALS - A legal term that defines mineral commodities that are sold by contract from the Federal Government. These are generally construction materials and aggregates.

SEDIMENTARY - A rock composed of sediments, or ores formed during a process of sedimentation.

SUCTION DREDGE - A dredge in which the material is lifted by pumping through a suction pipe.

TAILINGS - As used in this report, the waste from mineral beneficiation. They are usually regarded as liabilities, but under some circumstances they may be reprocessed to recover additional values.

TECHNICALLY PRESCRIPTIVE STANDARDS - As used in this report: standards expressed in terms of the techniques to be applied. See also "Performance-based standards."

UNCOMMON VARIETY MINERALS - Mineral materials that have a special quality, quantity, character, or location that makes them of unique commercial value. On public lands such minerals are locatable under the Mining Law of 1872, as amended. See Sidebar 1.2.

UNNECESSARY OR UNDUE - A surface disturbance greater than what would normally result when an activity is being accomplished by a prudent operator in usual, customary, and proficient operations of similar character and taking into consideration the effects of operations on other resources and land uses, including those resources and uses outside the area of operations. Failure to initiate and complete reasonable mitigation measures, including reclamation of disturbed areas or creation of a nuisance, may constitute unnecessary or undue degradation. Failure to comply with applicable environmental protection statutes and regulations thereunder will constitute unnecessary or undue degradation. Where specific statutory authority requires the attainment of a stated level of protection or reclamation, such as in the California Desert Conservation Area, Wild and Scenic Rivers, areas designated as part of the National Wilderness System administered by the Bureau of Land Management and other such areas, that level of protection shall be met.

WASTE - The part of an ore deposit that is too low grade to be of economic value at the time of mining, but which may be stored separately for possible treatment later.

WATER TABLE - As used in this report, the surface separating the zone is water-saturated from the zone containing air that is freely connected to the atmosphere.

WEATHERING - As used in this report, the process of decomposition of rocks or ores through the action of air and water.

WITHDRAWAL - Segregation of particular lands from the operation of specified public land laws, making those laws (including the mineral location and leasing laws) inapplicable to the withdrawn lands.

YEAR EVENT - The probabilistic frequency for an event of a given magnitude (e.g., a 1000-year flood).

228 AUTHORITY - U.S. Forest Service regulations found at 36 CFR Part 228.

261 AUTHORITY - U.S. Forest Service regulations found at 36 CFR Part 261.

3809 REGULATIONS - Bureau of Land Management regulations found at 43 CFR Subpart 3809.

Acronyms

A.I.M.	Arizona Abandoned and Inactive Mine
AMD	Acid Mine Drainage
AML	Abandoned Mine Lands
AMLIS	Abandoned Mine Lands Inventory System
AMLRP	Abandoned Mine Lands Reclamation Program
ARD	Acid Rock Drainage
AzMILS	Arizona Department of Mines and Mineral Resources Database
BLM	Bureau of Land Management
BOD	Biological Oxygen Demand
BOM	Bureau of Mines
CDBG	Community Development Block Grant
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CPFM	Colloid Polishing Fiber Method
CTSP	Conservation Technology Support Program
CVI	Canaan Valley Institute
CWA	Clean Water Act
DENR	Department of Environmental and Natural Resources
DEQ	Department of Environmental Quality
DO	Dissolved Oxygen
DOC	Department of Conservation
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DNR	Department of Natural Resources
EA	Environmental Assessment
EDA	U.S. Department of Commerce's Economic Development Association
EPA	Environmental Protection Agency
EMNRD	Energy, Minerals, and Natural Resources Department

ESA	Endangered Species Act
FFT	Filter Flow Technology
FHWA	U.S. Department of Transportation, Federal Highway Administration
FLMA	Federal Land Management Agency
FLPMA	Federal Land Policy and Management Act
FONSI	Finding of No Significant Impact
FS	see USFWS
FTA	Federal Transit Administration
FWS	see USFWS
GIS	Geographical Information System
GMI	Green Mountain Institute
GPS	Global Positioning System
HPF	Historic Preservation Fund
HUD	U.S. Department of Housing and Urban Development
IAM	Inactive and Abandoned Mine Lands
ICMM	International Council on Mining and Metals
ILS	In-line Aeration and Neutralization System
IMCC	Interstate Mining Compact Commission
IRP	USDA Intermediary Relending Program
ISM	Ionic State Modification Process
LEPC	Local Emergency Planning Committee
MAS/MIL	Mineral Availability System/Mineral Industry Location System
MBMG	Montana Bureau of Mines and Geology
MDE	Maryland Department of the Environment
MDIG	USGS Mine Drainage Interest Group
MEND	Mine Environment Natural Drainage
MEPA	Montana Environmental Protection Act
MPC	Mineral Policy Center
MRDS	USGS Mineral Resources Data Systems
MSHA	Mine Safety and Health Administration
MWCB	Mine Waste Cleanup Bureau

NASLR	National Association of State Land Reclamationists
NCP	National Contingency Plan
NEA	National Endowment for the Arts
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest Service
NHPA	National Historical Preservation Act
NMA	National Mining Association
NMLRC	National Mine Land Reclamation Center
NORM	Naturally Occurring Radioactive Materials
NPL	National Priorities List
NPO	Non-profit Organization
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NSE	National Science Foundation
OCS	Office of Community Services
OERR	Office of Emergency and Remedial Response
OSM	Office of Surface Mining
OSMRE	Office of Surface Mining Reclamation and Enforcement
RAMP	Rural Abandoned Mine Program
RC&D	Resource Conservation and Development
RCRA	Resource Conservation and Recovery Act
RMMLF	Rocky Mountain Mineral Law Foundation
RO	Reverse Osmosis
SERC	State Emergency Response Commission
SMARA	California Surface Mined Lands Reclamation Act
SRI	Superfund Redevelopment Initiative
TASWER	Tribal Association on Solid Waste and Emergency Response
TBA	Targeted Brownfields Assessment
TSS	Total Suspended Solids
UMTRA	Uranium Mills Tailing Remedial Action

UMTRCA	Uranium Mill Tailings Radiation Control Act
URP	Urban Resources Partnership
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WGA	Western Governors' Association
SMCRA	Surface Mining Control and Reclamation Act
SME	Society for Mining, Metallurgy, and Exploration, Inc.
SMRD	Surface Mining Reclamation Division
SRF	State Revolving loan Fund

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