



STATE MINING AND GEOLOGY BOARD

DEPARTMENT OF CONSERVATION

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Open-Pit Metallic Mine Backfill Regulations Pre-Rulemaking Workshop Questionnaire

The State Mining and Geology Board (SMGB) is considering revising California Code of Regulations, Title 14, section 3704.1 (hereinafter Metallic Mine Backfill Regulations). As reflected in the SMGB Informational Report 2007-02 (included), the SMGB adopted the Metallic Mine Backfill Regulations upon determining that the large open-pit quarries resulting from the extraction of metallic minerals were not necessarily left in a useful and beneficial condition, contrary to the intent of the Surface Mining and Reclamation Act of 1975 (Public Resources Code (PRC) section 2710 et seq., "SMARA"). Since 2003, significant changes have been made to the California Environmental Quality Act (PRC section 21000 et seq., "CEQA") pertaining to Green House Gasses, Climate Change, consultation with Tribal communities, etc. During this same time, there have been a number of major conservation efforts by the State and the United States Department of Interior to change Wilderness boundaries, establish new Monuments, and implement the Desert Renewable Energy Conservation Plan (DRECP). Fifteen years have passed since the adoption of the Metallic Mine Backfill Regulations, and the SMGB is now seeking public comments and suggestions to help guide pre-rulemaking considerations on possible revisions to the Metallic Mine Backfill Regulations.

Responses to the following discussion questions will aid the SMGB's consideration to potentially update the Metallic Mine Backfill Regulations.

1. Does the rationale establishing the Metallic Mine Backfill Regulations described in SMGB Informational Report 2007-02 remain valid today? Might the rationale, or some parts of it, not be valid today?
2. How might the SMGB revise the Metallic Mine Backfill Regulations to consider beneficial alternate end uses?
3. Is CEQA and the participation of Responsible Agencies (CA Department of Fish and Wildlife, Regional Water Quality Control Boards, CA Air Resources Board, etc.) effective in evaluating beneficial end use alternatives for guiding SMARA performance standards for final reclamation? Why or why not?
4. Who should determine the beneficial alternate end uses? What are the pros and cons for the CEQA lead agency or the SMGB making these determinations?

5. How should backfill requirements interact with the treatment, storage, and disposal of mine waste regulations promulgated by the United States Environmental Protection Agency?
6. Should regional conservation goals be included in the reclamation performance standards?
7. Under what conditions should backfill be required, if it can be shown that alternative environmentally beneficial end uses can be successfully achieved? What should be the degree of evidence necessary to support such a finding?
8. Which metallic minerals require unique or different considerations under current regulations and why?
9. What are the economic costs and environmental impacts of limiting the height of waste rock piles to less than 25 feet above the original land elevation?
10. What are the benefits/environmental impacts of leaving large open pits surrounded by waste rock piles following the completion of mining?
11. What constitutes an alternative and beneficial end use when mine lands are returned to a status of "Open Space" following mining? What constitutes successful reclamation?

From the list below, what should be the 3 most important considerations when permitting a metallic mine?

- Mineral Resources Production, Conservation, and Economic Growth
- Greenhouse Gas Emissions and Climate Change
- Surface and Groundwater Protection
- Physical Hazards and Hazardous Material Impacts to Public Health and Safety
- Limiting the Area of Disturbance
- Reclaimed Topography Restrictions
- Cultural and Paleontological Resources Protection
- Biological Resources and Habitat
- Aesthetics and Recreation
- Other?

General Comments:



SMGB Information Report 2007-02

STATE MINING AND GEOLOGY BOARD

Report on Backfilling of Open-Pit Metallic Mines in California



**Department of Conservation
Resources Agency**

January 2007

**This Special Report 2007-02
of the State Mining and Geology Board
was presented, in part, at its regular business meeting held on
December 14, 2006.**

**This report does not set forth policy, but rather presents information that the
SMGB considers in setting policy.**



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Report on Backfilling of Open-Pit Metallic Mines in California

Stephen M. Testa¹ and James S. Pompy²

Thirty years ago, Congress required that coal mines be backfilled as a routine element of reclamation when it passed the Surface Mining Control and Reclamation Act (SMCRA). Until recently, the concept has not been generally applied to non-coal surface mines. In 2003, California's State Mining and Geology Board (Board) evaluated reclamation of open-pit metallic mines in the state. With few exceptions, it was determined that open pits were not being reclaimed, despite California's Surface Mining and Reclamation Act of 1975 (SMARA) that went into effect in 1976. Upon recognizing that open pits were not being reclaimed, the board set forth regulations for the backfilling of open-pit metallic mines. The need for such regulation reflected several issues. Open pit metallic mineral mines often create very large excavations with at least equally large overburden and rock waste piles, with the creation of overburden and rock waste piles having greater volumes than the pit from which the material was excavated by as much as 40 percent. In addition, metallic mineral mines that employ the cyanide heap leach method for mineral segregation and collection frequently generate very large leach piles. These features remain on the landscape following the conclusion of mining operations, and recent re-evaluation of so called reclaimed sites have been shown to pose adverse soil and groundwater contamination conditions. In summary, leaving large, open pits in the surface surrounded by millions of cubic yards of waste rock does not leave the site in a useful condition, and clearly leaves the site in a less useful and beneficial condition than before it was mined. It is the intent of SMARA that completed mine sites present no additional dangers to the public health and safety, and that the mined lands are returned to an alternate, useful condition. To date, no large, open pit metallic mines in California have been returned to the conditions contemplated by SMARA, and these sites continue to pose significant environmental problems. The goal of the Board's regulations was to require mining companies to address the problems identified above and to take responsibility for cleaning up their mine sites after the completion of surface mining operations, and return them to a condition that allows alternative uses and avoids environmental harms, thereby meeting the purpose and intent of SMARA. Board regulations, which took effect in 1993, establish performance standards for reclamation pursuant to SMARA, including standards for backfilling which provide that, where backfilling is required for resource conservation purposes, fill material must be backfilled "to the standards required for the resource conservation use involved".

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INTRODUCTION

Historical Perspective

Thirty years ago, Congress required that coal mines be backfilled as a routine element of reclamation when it passed the SMCRA. The concept has not been generally applied to non-coal surface mines, however, until 2003 when the Board evaluated reclamation of open pit metallic mines in the state.

Large open pit metallic mines were not common in California until the discovery of large disseminated gold deposits. The Carlin Mine was discovered in 1961 in northern Nevada. Carlin became the first large gold mine on what is now known as the Carlin Trend. Carlin-type deposits are characterized by extremely fine-grained gold that cannot be seen by the human eye nor concentrated by panning. By 1970 another other mine, the Cortez operation, had been found and developed in northern Nevada. Then came the discovery of the Pinson, Preble, Sterling, and Dee mines and development of the Gatchell Trend, second only to the Carlin Trend in Nevada gold production. These successes and higher gold prices fueled a Nevada exploration boom during the 1980s. The gold rush quickly spread to California.

Cyanide heap leaching technology made it possible for very large low grade deposits to be mined economically. Low grade deposits that could not be mined economically by underground or open pit methods, especially when using more costly vat leaching processes, were suddenly sought out. Numerous large open pit mines began to spring up along the gold bearing trends in Nevada and California.

Most regulatory frameworks for open pit mining were adopted prior to the discovery of the large disseminated gold deposits and proliferation of large open pit gold heap leach operations. The surge in large open pit metallic mines was not anticipated when California's Surface Mining and Reclamation Act was adopted in 1975. As more and more large new open pit mining operations sprang up, there was renewed interest in mine reclamation.

In 2003, the Board evaluated the effectiveness of the backfilling standard in achieving reclamation of mines throughout the state. The board determined that aggregate and other non-metallic mineral mines were often not backfilled during reclamation because there was insufficient mine waste available for backfill material. Generally, however, aggregate mines are located in urban areas near to where it is utilized by the construction industry. Thus, reclamation was occurring at these sites because land values made it economical to backfill the property for development.

The Board found that pits associated with open pit metallic mines were not being reclaimed. Generally, these pits were left in the final mining configuration with few efforts to backfill or reclaim them to a beneficial end use. So, in 2003, California became the first state to adopt a backfilling standard requiring that open pit metallic mines be backfilled.

The Rationale for Backfilling Regulations for Metallic Surface Mines

The purpose of SMARA is to “*create and maintain an effective and comprehensive surface mining and reclamation policy so as to assure that adverse environmental impacts are prevented or minimized and that mined lands are reclaimed to a usable condition which is readily adaptable for alternative land uses*” and that “*residual hazards to the public health and safety are eliminated*”(Public Resources Code [PRC] Sections 2712(a) and (c); see also PRC Section 2711(a)). In addition, SMARA states, “*the reclamation of mined lands...will permit the continued mining of minerals and provide for the protection and subsequent beneficial use of the mined and reclaimed land.*” (PRC Section 2711(b). SMARA defines reclamation as “*the combined process of land treatment that minimizes water degradation, air pollution, damage to aquatic or wildlife habitat, flooding, erosion, and other adverse effects from surface mining operations, including adverse surface effects incidental to underground mines, so that mined lands are reclaimed to a usable condition which is readily adaptable for alternate land uses and create no danger to public health or safety.*” (PRC Section 2733). *The reclamation process “may extend to affected lands surrounding mined lands, and may require backfilling, grading, resoiling, revegetation, soil compaction, stabilization, or other measures”(id.).* In furtherance of these requirements, a *reclamation plan must provide a description of the proposed use or potential uses of the mined lands after reclamation*” (PRC Section 2772(c)(7)).

Reclamation is applicable to a specific piece of property or properties, and is based upon the character of the surrounding area and such characteristics of the property as type of overburden, soil stability, topography, geology, climate, stream characteristics, and principal mineral commodities. Reclamation also establishes site-specific criteria for evaluating compliance with the approved reclamation plan, including topography, revegetation and sediment, and erosion control. Board regulations adopting statewide reclamation standards included backfilling, regarding, slope stability and recontouring, among other reclamation standards (PRC Article 5 Section 2773). The Board has the authority to adopt regulations concerning backfilling and all surface mining operations shall include, but shall not be limited to, measures to be employed by lead agencies in specifying grading and backfilling, resoiling, revegetation, soil compaction, and other reclamation requirements (PRC Section 2756).

SMARA requires all surface mining operations to have an approved reclamation plan and financial assurance, and no person can conduct surface mining operations without obtaining a permit to mine, an approved reclamation plan and financial assurance, from its SMARA lead agency (PRC Section 2770(a)). Prior to approving a surface mining operations reclamation plan, financial assurances, including existing financial assurances reviewed by the lead agency, are required to be submitted by the lead agency to the director of the Department of Conservation for review (PRC Section 2774(c)).

As stated above, SMARA requires that upon the termination of surface mining operations, lands affected by the mining operations shall be, “*reclaimed to a usable*

condition which is readily adaptable for alternate land uses and create no danger to public health or safety.” Often, open-pit metallic surface mines with reclamation plans approved by their lead agencies did not require the backfilling of the excavation or the recontouring of affected mined lands, thereby leaving large, unfilled pits and mounds of overburden or mine-waste rock material on the surrounding landscape. Often, too, the end use to which the site was to be readily adaptable was given as an undefined “open space”.

Where open pit excavations remain on the landscape, it often is difficult to envision how the remaining open pit is readily adaptable for a beneficial alternate use, or how the “open space” itself is usable. Open pit metallic mineral mines often create very large excavations with at least equally large overburden and rock waste piles. Material “swelling” may create overburden and rock waste piles having greater volumes than the pit from which the material was excavated. Industry statements provide that swelling by as much as 40 percent occurs. In addition, metallic mineral mines that employ the cyanide heap leach method for mineral segregation and collection frequently generate very large leach piles. These features remain on the landscape following the conclusion of mining operations, and may pose a contamination problem when residual cyanide (or any other processing solution) not removed by rinsing is exposed to precipitation percolating through the pile and flushing the processing solution into surface waters.

As stated in the Final Statement of Reasons for 14 CCR Section 3704.1 (page 1-2) “In summary, leaving large, open pits in the surface surrounded by millions of cubic yards of waste rock does not leave the site in a useful condition, and clearly leaves the site in a less useful and beneficial condition than before it was mined...[I]t is the intent of SMARA that completed mine sites present no additional dangers to the public health and safety... and that the mined lands are returned to an alternate, useful condition. To date, no large, open pit metallic mines in California have been returned to the conditions contemplated by SMARA, and these sites remain demonstrably dangerous to both human and animal health and safety.”

Emergency Regulation Adoption

In 2002, the Resources Agency and the State Legislature informed the Board of their concerns with the detrimental impacts caused by large metallic mining projects on California’s environment and landscape, particularly when large, open-pit excavations remain as open craters, and piles of overburden and waste rock materials remain on the surface, following the termination of mining operations. The Board was requested to consider adopting into state policy, on an urgency basis, reclamation regulations that would provide for the backfilling of open-pit excavations caused by large metallic surface-mining operations.

At its November 14, 2002 regular business meeting, and again at its December 12, 2002 meeting, the SMGB received comments on this issue from the California State Legislature, the Resources Agency, the Quechan Indian Tribe, The Mineral Policy Center (Washington, D. C.), the Center for Biological Diversity, the Sierra Club of

California, Defenders of Wildlife, California Wilderness Coalition, the California Mining Association, Glamis Gold, Ltd., and other interested parties and surface mine operators. Following receipt of these comments, the Board made findings that an emergency condition existed and adopted on December 12, 2002, an emergency regulation adding Section 3704.1 to Title 14, California Code of Regulations (CCR), addressing the backfilling of open pit excavations caused by large metallic surface mining operations. This emergency regulation remained in effect until April 18, 2003.

The Board subsequently instructed the Executive Officer (at this time Dr. John Parrish, current State Geologist of California) to coordinate the development of permanent regulatory language with the guidance of an *ad hoc* committee consisting of two Board members appointed by the Chairman, and present proposed text for consideration for approval by the Board at its January 16, 2003 regular business meeting. During this process:

- The public was given ample opportunity to comment on the proposed regulation over the course of several months;
- Over 2,500 comments were received; and
- Only four comments received were in opposition to the proposed regulation.

No comments were received regarding the text in the proposed regulation. Following comments and suggestions from Board members, the Board made minor modifications to the text and approved the regulation on April 13, 2003. The Notice of Proposed Rulemaking for this regulation was published in the California Regulatory Notice Register on February 14, 2003. This action commenced the 45-day public comment period, which closed April 1, 2003.

In summary, the goal of the Board regulations was to require mining companies to address the problems identified above and to take responsibility for cleaning up their mine sites after the completion of surface mining operations, and return them to a condition that allows alternative uses and avoids environmental harms, thereby meeting the purpose and intent of SMARA. Board regulations, which took effect in 1993, establish performance standards for reclamation pursuant to SMARA, including standards for backfilling (14 CCR Section 3704). The standards provide that, where backfilling is required for resource conservation purposes, fill material must be backfilled *“to the standards required for the resource conservation use involved”* (14 CCR Section 3704(b)). *New section 3704.1 of the regulations merely ‘clarifies and makes specific the conditions under which the backfilling of open pit excavations for metallic surface mines must be undertaken’ to meet SMARA reclamation requirements.* (see Final Statement of Reasons for 14 CCR Section 3704.1, page 1). CCR Section 3704.1 also contains a grandfather provision, which exempts from this section any surface mining operation *“for which the lead agency has issued final approval of a reclamation plan and a financial assurance prior to*

December 18, 2002.” (14 CCR Section 3701.4(i).

OPEN-PIT METALLIC MINES

In 2003, to assess the effectiveness of SMARA in assuring that open pit mines are reclaimed to a productive end use, thirteen large-scale open pit metallic mines located throughout the state were evaluated. Figure 1 shows the location of each of the mines included in the evaluation. Reclamation was evaluated based success in returning the mined lands to a productive end use, how well reclaimed mines blended visually into the surrounding area, and the success in eliminating residual environmental effects of mining (Table 1).



Figure 1. Map showing approximate location of major open-pit metallic mines throughout California.

Table 1
Select Open-Pit Metallic Mines in California
(from north to south)

Mine Name	Date opened	Date closed	Type Processes	(Troy) Ounces produced	End use	Acres disturbed	Environmental Issues
McLaughlin	1985	1996	Carbon-in-Pulp	3.3 million ounces	Open space	1450	Pits filled with water, with low pH and dissolved metals.
Royal Mountain King	1988	1994	Heap leach	Uncertain	Open space	650	Pits filled with water with elevated levels of arsenic.
Jamestown	1983	1994	Carbon-in-Pulp	660,000 troy ounces	Open space	1600	Pits filled with water with elevated levels of arsenic.
CR Briggs	1996	2004	Heap leach	543,000 oz.	Open space	618	Pits not reclaimed, with difficulty revegetating waste dumps.
Rand (includes Yellow Aster & Baltic)	1983	2003	Heap leach	1 million ounces	Open space	1200	Pits not reclaimed, with difficulty revegetating waste dumps.
Coliseum	1986	1993	Carbon-in-Pulp	450,000 troy ounces	Open space	413	Pits not reclaimed, with difficulty revegetating waste dumps.
Mesquite	1985	Idle	Heap leach	3,000,000 troy ounces	Open space	1600	Pits not reclaimed, with difficulty revegetating waste dumps.
Morning Star	1983	1990	Heap leach	200,000 troy ounces	Open space	150	Abandoned, and unreclaimed.
Castle Mountain	1991	2001	Heap leach	1,150,000 troy ounces	Open space	862	Two pits not reclaimed, with difficulty revegetating waste dumps.
Picacho	1981	2000	Heap leach	388,000 troy ounces	Open space	2778	Pit not reclaimed, with difficulty revegetating waste dumps.
American Girl	1989	1996	Heap leach	550,000 ounces	Open space	577	Pit not reclaimed, with difficulty revegetating waste dumps.

Northern California Mines

Three open pit mines in northern California were observed: McLaughlin Mine (Figure 2), Royal Mountain King (Figure 3), and Jamestown Mine (Figure 4). McLaughlin and Jamestown Mine were in the final stages of reclamation at the time of the evaluation; whereas, the Royal Mountain King Mine was no longer under SMARA oversight.



Figure 2. Homestake's McLaughlin Mine in northern California. The main pit is approximately a mile in length and 750 feet deep, with acid water. The smaller pit is also considered reclaimed.

Homestake's McLaughlin Mine situated in Napa, Lake and Yolo counties, conducted mining and cyanide leaching of gold ore from 1985 until 1996, ranking number one in California gold production from 1985-1995 (Figure 2). Mining operations ceased in 1996, but gold processing continued through 2002. Barrick Gold Corporation acquired the Homestake Mining Company in 2001. Approximately 3.3 million ounces of gold and 2.2 ounces of silver were recovered over the life of the McLaughlin Mine.

At the end of gold mining, McLaughlin Mine had disturbed 1450 acres. Reclamation continues with the land being reclaimed to open space in accordance with a Mine Reclamation Plan approved in 1983. The company also cleaned up three abandoned mercury mines on the 11,000-acre site. The University of California's established the

McLaughlin Natural Reserve in 1992 and after 2002, has administered the parcel as part of the University's Natural Reserve system.

Problems have been encountered in closing the tailings facility in accordance with the approved closure plan. Water quality concerns have arisen regarding the two open pits that are filling with low pH water that may pose an ecological hazard to wildlife. Homestake is evaluating alternatives for closing the site in an environmentally sound manner.



Figure 3. The reclaimed Royal Mountain King Mine is located near Copperopolis, California. The pit is approximately 1600 by 500 feet in dimension, and 400 feet in depth. High arsenic levels are reported for the pit water.

The Royal Mountain King Mine is located west of Highway 4 and south of Rock Creek Road near Copperopolis, California. Operations included open pit mining and heap leach recovery for gold and silver. Meridian Minerals Company began gold mining operations in February 1989. These operations ceased in 1994. A reclamation plan for the permitted 650 acres was approved in 1988. The mine is closed with no intent to resume, and the pit has filled with water with elevated levels of arsenic.



Figure 4. The reclaimed Jamestown Mine located just outside Jamestown California. The pit is approximately 2700' x 800' x 500' deep, with high arsenic levels in the pit water.

The Jamestown mine is located in the Jamestown mining district in western Tuolumne County, California (Figure 3). The mine covers 489 acres and is made up of several parcels owned by different individuals. This open pit gold mine was operated between 1986 and 1994. Sonora Mining mined and processed about 17,000,000 short tons of ore, with an overall stripping ratio of about 4.5:1, yielding about 660,000 troy ounces of gold. Most of this material came from the Harvard pit, which attained dimensions of about 2700 ft (830 m) in length, 1500 ft (460 m) in width, and 600 ft (185 m) in depth. Since mining operations ceased in mid-1994, the open pit has been filling with water with elevated levels of arsenic. Arsenic levels in the pit are more than 200 times greater than permitted drinking-water levels. The waste rock storage piles have been reclaimed, but the tailings facility, pit, and processing area remain unreclaimed.

Central California Mines

Seven open pit mines in south central California were included in the evaluation: Baltic, Castle Mountain Mine (Figure 5), CR Briggs (Figure 6), Glamis Rand Mine (Figure 7), Morning Star (Figure 8), Coliseum (Figure 9), and Yellow Aster. At the time of this evaluation, CR Briggs was active, Castle Mountain and Rand mines were in the final

stages of reclamation, Morning Star Mine had been abandoned, and the other three mines had been closed and reclaimed in accordance with SMARA.



Figure 5a. Castle Mountain Mine was comprised of three open pits, one of which was backfilled. The cyanide leach pad in the foreground is approximately 7700 by 1675 feet in dimension (about 265 acres), and attains a height of 180 feet.



Figure 5b. The two reclaimed pits at the Castle Mountain Mine exceed 500 feet in depth. The backfilled pit is situated in the upper right portion of the image, where a portion of the pit rim is still evident.

The Castle Mountain Mine is located in San Bernardino County, California, approximately 70 miles south of Las Vegas, Nevada. Viceroy Gold Corporation and MK Gold began mining operations at the site in June 1991, followed by commercial production in April 1992. After producing some 1.1 million ounces of gold from 36 million tons of ore with an average grade of approximately 0.04 ounces of gold per ton, mining was curtailed in May of 2001. Although mining ceased in 2001, ore recovery continued through 2004, with some 72,000 ounces of gold recovered during 2002 and 2003. Reclamation in accordance with a plan approved in 1998 of about 862 acres disturbed by mining is nearing completion. As apparent in Figure 5, the difference in reclamation quality between the backfilled pit and the two open pits is dramatic.



Figure 6. Canyon Resources Briggs Mine is located in the Panamint Range of Southern California. The pit encompasses about 140 acres, and the cyanide leach pads encompass about 137 acres.

Canyon Resources Corporation's Briggs Mine in Inyo County operated from 1996-2004, with some ore processing from heap leaching continuing into 2005 (Figure 6). Briggs

was the second largest gold producer in the state in 2001 and 2002, and led the state in gold production in 2004. During the mine's 8-year lifespan, a total of 543,000 ounces of gold and 152,432 ounces of silver were produced.

Canyon Resources started exploratory programs in 2001 through 2005 adjacent to and north of their existing pits on Bureau of Land Management (BLM) land. The acreage encompassing the explorations could add up to 3,000 acres to the 1000-plus acres formerly permitted for open-pit mining, but a mining and reclamation plan as yet been submitted.

The original site is in the process of being reclaimed to open space by seeding with native plant species. One of the pits was partially backfilled. Salvaged growth media was placed on waste piles and leach pads prior to planting.



Figure 7a. The Rand Mine located near Randsburg, California. Two open pits are evident, along with a cyanide leach pad in the lower right, and two large waste piles in the central portion of the image. The larger cyanide leach pad in the upper right of the image is about 1.8 by 2.1 miles in extent.



Figure 7b. Close-up view of a portion of the Rand Mine located near Randsburg, California.

Glamis Rand Mining Company and its parent company, Glamis Gold LTD, own minerals rights under an estimated 3,942 acres of claimed public land in California and Nevada. The Rand Mine in Kern County operated from 1983 to 2003. Three open pits in this complex, the Yellow Aster, Lamont, and Baltic, are generally referred to as the Rand Mine in the historic Randsburg mining district. In 2002, Rand led the state in gold production with a total of 67,000 ounces. Upon completion of heap leaching in 2005, the mine had recovered nearly 1 million ounces of gold.

The 987 acres of disturbed land was reclaimed to open space. Months after it ceased its operations, Glamis collaborated with BLM on an agreement to mitigate the land it disturbed through the process of mining, but also by reclaiming 17 off-site mine shafts. The mine is in the final stages of reclamation. While the heap leach pads are being planted with native plants, the steep areas in the open pits are allowed to “reclaim naturally”.



Figure 8. Abandoned Morningstar Mine located in the Mojave National Preserve.

Vanderbilt Gold Corporation commenced open pit mining at Morningstar Mine in southern San Bernardino County during late 1984. Gold and silver were extracted from the ore using the cyanide heap leaching process. The mine employed about 70 people. An estimated total of 32 million tons of overburden and ore were removed creating a single open pit. Total area disturbed is about 150 acres. The company went bankrupt in the mid 1990's, and the mine was never reclaimed. The abandoned mine is now within the Mojave National Preserve managed by the National Park Service (NPS). NPS is evaluating alternative approaches to remove the scar left by the unreclaimed open pit mining and heap leach operation.



Figure 9. Reclaimed Coliseum Mine located in the Mojave National Preserve, north of Clark Mountain. The main pit is approximately 650 feet in depth.

Coliseum Inc., a subsidiary of Lac Minerals Ltd., conducted mining and cyanide (carbon-in-pulp) leaching of gold/silver ore in the Clark Mountain Range of southeastern California from 1988 to 1993. The mine footprint occupied approximately 284 acres (Figure 9). Two breccia pipes (ore bodies) were mined using the open pit method; the north pit (300 feet deep) and the south pit (760 feet deep). Total reserves were estimated at 3.9 million tons of ore with an average grade of 0.040 troy ounces of gold per ton. On the average, the mine employed 110 people, with peak employment of 300 during the construction phase in 1987. Mining ceased on July 10, 1992 after four and one-half years of operation.

At the end of mining, waste rock piles were to be graded to eliminate any “mesa-like” appearance. Revegetation of the waste rock piles was to occur “naturally.” The pits were left un-reclaimed because, with a sufficient increase in the price of gold, mining could resume. The tailings impoundment was covered with topsoil (to the extent available) and seeded with indigenous plants. Although the mine was reclaimed in accordance with an approved reclamation plan, evidence of reclamation remains difficult to discern.

Southern California Mines

Three open pit mines in the southeast corner of the state were observed: Mesquite Mine (Figure 10), Picacho Mine (Figure 11), and American Girl Mine (Figure 12). Mesquite Mine was active at the time of the evaluation; whereas, Picacho Mine and American Girl Mine had been closed and reclaimed in accordance with SMARA.



Figure 10. The active Mesquite Mine located about 52 miles northwest of Yuma, Arizona. Three pits, intervening waste dumps and a large cyanide leach pad is evident.

Mesquite Mine is located in Imperial County, California, about 52 miles northwest of Yuma, Arizona. The mine, owned by Western Goldfields, Inc. was operated as an open pit, heap leach operation between 1985 and 2001, and produced over three million ounces of gold during its operating life. An expansion of the mine has been approved that will allow the company to continue extracting and processing economical gold deposits on an additional 350 acres of Federal, State and private (patented) land. The plan modification proposes to process approximately 89 million tons of ore and 242 million tons of waste rock.

According to the reclamation plan for the site, (1) pit slopes will not be actively revegetated, and (2) native seeds will be collected in three ways: directly from plants,

from seed accumulations below shrubs in windrowed washes, and seed banks from salvaged soil.



Figure 11a. The Glamis Picacho Mine located in easternmost Imperial County, California, approximately eighteen miles north of Yuma, Arizona.



Figure 11b. A vertical view of the main pit of the Glamis Picacho.

Glamis Gold Ltd. operated the Picacho mine situated in southeastern California from 1981 to early 2000, and produced a total of 388,000 ounces during its 20 years of operation. The Picacho Mine property consists of 600 acres of fee lands and 1,650 acres of unpatented lode mining claims. The total disturbed area amounts to approximately 330 acres.

Glamis Gold Ltd. commenced final reclamation on their heap leaching facility at the Picacho Mine in 2000, and final reclamation was completed in March 2002. The reclamation plan for the site states that upon termination of operations the area involved will be revegetated with plants and/or grasses to control erosion and dust, and to return the area to a natural appearance as soon as possible. The reclamation plan further states that when the surface mining operation is complete, that the side slopes of any cut or fill shall be finished in a workmanlike manner, with slopes that are stable.



Figure 12. American Girl Mine located in the Cargo Muchaco Mountains in southeastern Imperial Valley, Southern California. About 200 acres are disturbed.

The American Girl surface mining operation is located in the Cargo Muchaco Mountains in the southeastern Imperial Valley of Southern California. The mine was operated by American Girl Mining Joint Venture from 1989 to 1996. The American Girl Mine Project consisted of two adjacent operating components: the Padre Madre operation and the American Girl Canyon operation.

The Padre Madre operation involved the annual mining and heap leaching of approximately 200,000 tons of ore, and the annual mining and stockpiling of approximately 400,000 tons of waste rock. Cumulative totals of 3.5 million tons of ore and 12.5 million tons of waste rock were authorized. The American Girl Canyon operation was authorized to extract 8.5 million tons of surface- and underground-mined ore, and excavate and stockpile 17 million tons of waste rock. The cumulative total surface disturbance for both of these operations was estimated to be 618 acres. Reclamation activities were completed in February 2000.

DISCUSSION

The Board in 2006 received a petition requesting amendment to its backfilling regulation. The Board concluded following review of the petition request that its backfilling regulations were of significant environmental importance, and that the regulations corrected the common past mining practice of leaving large steep-walled open-pits, and expansive waste and leach piles, which remained as public eyesores and safety hazards. The Board reiterated its position that without backfilling, permanent scar are left on the community and the land for decades or longer. In addition, metallic mineral mines that employ the cyanide heap leach method for mineral segregation and collection frequently generated very large leach piles. These features remain on the landscape following the conclusion of mining operations. As a result, these piles generate potential adverse environmental conditions when residual cyanide (or any other processing solution) not removed by rinsing was exposed to precipitation percolating through the pile and flushing the processing solution into surface waters. SMARA requires that upon the termination of surface mining operations, lands affected by the mining operations shall be, *“reclaimed to a usable condition which is readily adaptable for alternate land uses and create no danger to public health or safety.”* Often, open-pit metallic surface mines with reclamation plans approved by their lead agencies did not require the backfilling of the excavation or the recontouring of affected mined lands, thereby leaving large, unfilled pits and mounds of overburden or mine-waste rock material on the surrounding landscape. Often, too, the end use to which the site was to be readily adaptable was given as an undefined “open space”. Where open pit excavations remain on the landscape, it often is difficult to envision how the remaining open pit is readily adaptable for a beneficial alternate use, or how the “open space” itself is usable. The petition was subsequently denied at its December 2006 meeting.

The goal of the SMGB regulations was to require mining companies to address the problems identified above, take responsibility for cleaning up their mine sites after the completion of surface mining operations, and return these sites to a condition that allows alternative uses and avoids environmental harms, thereby meeting the purpose and intent of SMARA. SMGB regulations, which took effect in 1993, establish performance standards for reclamation pursuant to SMARA, including standards for backfilling (14 CCR Section 3704). The standards provide that, where backfilling is required for resource conservation purposes, fill material must be backfilled “*to the standards required for the resource conservation use involved*” (14 CCR Section 3704(b)). *New section 3704.1 of the regulations merely ‘clarifies and makes specific the conditions under which the backfilling of open pit excavations for metallic surface mines must be undertaken’ to meet SMARA reclamation requirements.*” (see to Final Statement of Reasons for 14 CCR Section 3704.1, page 1). CCR Section 3704.1 also contains a grandfather provision, which exempts from this section any surface mining operation “*for which the lead agency has issued final approval of a reclamation plan and a financial assurance prior to December 18, 2002.*” (14 CCR Section 3701.4(i)).

As stated in the Final Statement of Reasons for 14 CCR Section 3704.1 (pages 1-2) “*In summary, leaving large, open pits in the surface surrounded by millions of cubic yards of waste rock does not leave the site in a useful condition, and clearly leaves the site in a less useful and beneficial condition than before it was mined...[I]t is the intent of SMARA that completed mine sites present no additional dangers to the public health and safety... and that the mined lands are returned to an alternate, useful condition. To date, no large, open pit metallic mines in California have been returned to the conditions contemplated by SMARA, and these sites remain demonstrably dangerous to both human and animal health and safety.*”

APPENDIX A

**The Board's Reclamation Regulations
California Code of Regulations, Article 9, Reclamation Standards,
Section 3704.1**

§ 3704.1 Performance Standards for Backfilling Excavations and Recontouring Lands Disturbed by Open Pit Surface Mining Operations for Metallic Minerals

Notwithstanding the provisions of Section 3700(b) of the Article, no reclamation plan, including any reclamation plan in which the end use is for wildlife habitat, wildland conservation, or open space, or financial assurance for a surface mining operation subject to the provisions of this section, shall be approved by a lead agency unless the reclamation plan meets the provisions of this section. Financial assurances must be maintained in an amount sufficient to provide for the backfilling and contour grading of the mined lands as required in this section.

(a) An open pit excavation created by surface mining activities for the production of metallic minerals shall be backfilled to achieve not less than the original surface elevation, unless the circumstances under subsection (h) are determined by the lead agency to exist.

(b) Backfilling shall be engineered, and backfilled materials shall be treated, if necessary, to meet all of the provisions of Title 27, California Code of Regulations, Division 2, Chapter 7, Subchapter 1, Mining Waste Management, commencing with Section 22470, and the applicable Regional Water Quality Control Board's Water Quality Control Plan.

(c) Excavated materials remaining in overburden piles, waste rock piles, and processed or leached ore piles not used in the backfilling process and remaining on the mine site shall be graded and contoured to create a final surface that is consistent with the original topography of the area. Care shall be taken to avoid the creation of un-natural topographic features, impediments to natural drainage, or conditions hazardous to human life and wildlife.

(d) Backfilling, recontouring, and revegetation activities shall be performed in clearly defined phases to the engineering and geologic standards required for the end use of the site as stipulated in the approved reclamation plan. All fills and fill slopes shall be designed to protect groundwater quality, to prevent surface water ponding, to facilitate revegetation, to convey runoff in a non-erosive manner, and to account for long term settlement.

(e) The requirements of subsections (a), (b), (c), and (d) notwithstanding, no final reclaimed fill slopes shall exceed 2:1 (horizontal:vertical), nor shall the resultant topography exceed in height the pre-mining surface contour elevations by more than 25 feet. Final fill slopes shall have static and dynamic factor of safety, as determined by an engineer licensed in California, that are suitable for the proposed end use of the site and meet or exceed the requirements of applicable building or grading codes, ordinances, statutes, and regulations. Final slopes must be capable of being revegetated, and shall blend in visually with the local topography. Surface soil shall be salvaged, stored, and reapplied to facilitate revegetation of recontoured material in accordance with the requirements of Section 3711 of this Article.

(f) For the purposes of this section, a metallic mine is defined as one where more than ten percent of the mining operation's gross annual revenues as averaged over the last five years are derived from the production of, or any combination of, the following metallic minerals by the open pit extraction method:

Precious metals (gold, silver, platinum);
Iron;
Nickel;
Copper;
Lead;
Tin;
Ferro-alloy metals (tungsten, chromium, manganese);
Mercury;
Uranium and thorium;
Minor metals including rubidium, strontium, and cesium;
Niobium and tantalum;

(g) For the purposes of this regulation, an open pit mine is the same as an open pit quarry, opencast mine, or opencut mine, and is defined as a mine working or excavation that is open to the surface and in which the opening is approximately the full size of the excavation.

(h) The requirement to backfill an open pit excavation to the surface pursuant to this section using materials mined on site shall not apply if there remains on the mined lands at the conclusion of mining activities, in the form of overburden piles, waste rock piles, and processed or leached ore piles, an insufficient volume of materials to completely backfill the open pit excavation to the surface, and where, in addition, none of the mined materials has been removed from the mined lands in violation of the approved reclamation plan. In such case, the open pit excavation shall be backfilled in accordance with subsections (b) and (d) to an elevation that utilizes all of the available material remaining as overburden, waste rock, and processed or leached ore.

(i) This regulation does not apply to any surface mining operation as defined in Public Resources Code Section 2735(a) and (b) for which the lead agency has issued final approval of a reclamation plan and a financial assurance prior to December 18, 2002.

NOTE

Authority cited: Sections 2755 and 2756, Public Resources Code. Reference: Sections 2733, 2772 and 2773, Public Resources Code.

HISTORY

- 1. New section filed 12-18-2002 as an emergency; operative 12-18-2002 (Register 2002, No. 51). A Certificate of Compliance must be transmitted to OAL by 4-17-2003 or emergency language will be repealed by operation of law on the following day.*
- 2. New section refiled 4-15-2003 as an emergency; operative 4-15-2003 (Register 2003, No. 16). A Certificate of Compliance must be transmitted to OAL by 8-13-2003 or emergency language will be repealed by operation of law on the following day.*
- 3. Certificate of Compliance as to 4-15-2003 order, including repealer and new section, transmitted to OAL 4-18-2003 and filed 5-30-2003 (Register 2003, No. 22).*