

# **South Dakota Gold Mining: Regulations, Compliance, and Environmental History**

by

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## ABSTRACT

Approximately 1,390 t (44.7 million ounces) of gold have been produced in South Dakota since 1875. South Dakota's mining laws attempt to strike a balance between economic development and environmental protection by promoting mining as an industry while requiring prevention of pollution and reclamation of affected lands to a beneficial use. The mining laws have evolved since their inception in 1971, especially in response to gold mining. The laws have remained flexible to meet changing regulatory needs. Gold production has continued relatively unabated, even in the face of public scrutiny, two mining moratoriums, and isolated environmental problems. The department's system of "one-stop-shopping" for environmental permits streamlines the permit process, fosters quick resolutions to compliance problems, and helps keep enforcement actions out of the courts. Specific case histories at heap leach mines within the Black Hills are presented.

## INTRODUCTION

*Paha Sapa* means "Hills that are Black" in Dakota Sioux. Appearing dark from a distance due to a thick forest of Ponderosa Pine, the Black Hills were gold to many. The exact date that gold was discovered in the Black Hills remains debatable. An inscribed stone tablet found in 1887 near Spearfish, South Dakota recorded these words:

*"Came to these hills in 1833 seven of us DeLacompt, Ezra Kind, G.W. Wood, T. Brown, R. Kent, Wm. King, Indian Crow. All died but me Ezra Kind. Killed by Ind(ians) behind the high hill Got our gold June 1834. Got all the gold we could carry. Our ponies all got by the Indians. I have lost my gun and nothing to eat and Indians hunting me (Parker, 1966)".*

Regardless of the date of the first discovery, the gold rush of 1874-79 began after Horatio N. Ross of the Custer Expedition found gold along French Creek in the central Black Hills in 1874. Since that time, gold mining in the Black Hills remains a steady influence on the economy and lifestyle of western South Dakota.

Within a few years following the gold rush, the placers played out. Attention then focused on lode mining, particularly from the famous Homestake lode in Lead, SD. The largest gold mine in South Dakota, Homestake Mining Company's flagship mine has been in production for 123 years and has produced over 38 million ounces of gold.

The Black Hills is one of the world's richest gold metallogenic provinces, having produced about 354 kg per sq km. It is definitely elephant country. In addition, the variety of gold deposit types is unique. These include gold-uranium quartz pebble conglomerate deposits of early Proterozoic age, iron-formation-hosted and quartz vein gold deposits of middle Proterozoic age, paleoplacer gold in basal conglomerates of Cambrian age, early Tertiary epithermal igneous-hosted and sediment-hosted gold-silver deposits, and recent gold placer deposits (Paterson and Lisenbee, 1990).

With the advent of heap leach technology in the early 1980's, surface mining came into its own. Five large scale gold mines have been responsible for the majority of modern gold production in the Black Hills. These mines include Wharf Resources' Annie Creek Mine, Dakota Mining's Gilt Edge and Anchor Hill Mines, Golden Reward Mining Company, LAC Minerals' Richmond Hill Mine, and Homestake's flagship mine which produces from both the Open Cut and the underground mine.

## GOLD PRODUCTION

South Dakota gold mines have produced over 1,390 t (44.7 million ounces) of gold since 1875. In recent years, South Dakota typically ranks fourth in the nation in gold production, behind Nevada, California, and Utah. Annual gold production from the five large scale mines has recently ranged between about 550,000 oz to just over 600,000 oz. Figure 1 gives the production and corresponding gross value statistics from 1993 through 1996.

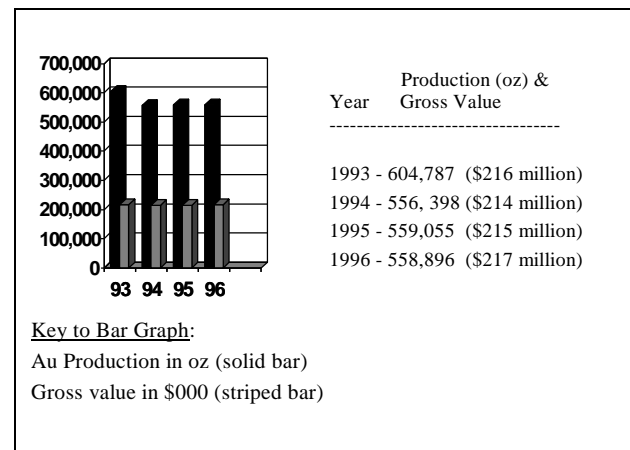


Figure 1. SD Gold Production & Gross Value Statistics (1993 - 1996).

The production of gold has remained at a relatively steady level during the past decade, even in the face of public scrutiny, two mining moratoriums, several initiated measures, and isolated environmental problems. This is in part due to the structure of South Dakota's mining laws and the state's approach toward addressing new environmental concerns and incorporating them into the regulatory system.

## SD MINING LAWS & REGULATIONS

Mining is regulated through the South Dakota Mined Land Reclamation Act (SD Codified Law, SDCL 45-6B) and the South Dakota Mined Land Reclamation Regulations (Administrative Rules of South Dakota, ARSD 74:29).

South Dakota's mining laws attempt to strike a balance between economic development and environmental protection by promoting mining as an industry while requiring: 1) prevention of pollution, and 2) reclamation of affected lands to a beneficial use. The environmental laws pertaining to mining have evolved since their inception in 1971, especially in

response to gold mining. The laws have remained flexible to meet changing regulatory needs and to allow mining to progress. The legislative findings and policy of South Dakota’s mining law states, in part:

*"The relatively unknown and as yet largely undeveloped mineral resources of this state consist in major proportion of minerals below the surface. The development and extraction of these minerals by means of entry through the surface and the processing of such ores are necessary for the economic development of the state and nation. Every effort should be used to promote and encourage the development of mining as an industry, but to prevent the waste and spoilage of the land and the improper disposal of tailings which would deny its future use and productivity. Proper safeguards must be provided by the state to ensure that the health and safety of the people are not endangered and that upon depletion of the mineral resources and after disposal of tailings the affected land is usable and productive to the extent possible for agricultural or recreational pursuits or future resource development; that water and other natural resources are not endangered; and that aesthetics and a tax base are maintained, all for the health, safety and general welfare of the people of the state. ..."* (South Dakota Mined Land Reclamation Act, SDCL Section 45-6B-2).

The South Dakota Department of Environment of Natural Resources (DENR) has been given the responsibility of administering the state mining laws. The section quoted above serves as our mandate from the legislature.

**HISTORY OF GOLD MINING REGULATION IN SOUTH DAKOTA**

As one reviews the evolution of South Dakota’s mining laws in concurrence with the issuance of new mine permits, it becomes apparent that an orderly progression has been maintained. As public concern is heightened over mining activities, additional regulatory requirements and

environmental safeguards are adopted and applied. Gold production has continued relatively unabated and major environmental problems have largely been avoided throughout this evolutionary period. This indicates that South Dakota’s regulatory system is successful in reaping the economic benefits of a healthy mining industry, while maintaining proper environmental protection. A chronology of regulatory and permit actions is provided in the Appendix.

A general argument is often made that additional regulatory requirements and new legislation cause additional burdens to the industry that may result in their departure for greener pastures. It is the DENR’s philosophy that a proper evolution of regulatory requirements designed to promote environmentally responsible mining, serves to allow mining to continue in a healthy, stable manner in an area where opposition, if left unaddressed, might otherwise thwart production. Consistency in South Dakota’s gold production is testimony to this principle. Concerns at the county level over certain mining proposals may have resulted in disapproval if an orderly progression of environmental regulation had not first been implemented at the state level to address public concerns.

**ONE STOP SHOPPING**

The DENR takes a multi-media permitting approach toward environmental permits, including mining. All mining-related environmental permits are issued by the DENR and its governor appointed citizen boards. All Programs within the DENR that work on these permits are located within one division, the Division of Environmental Services. Thus, identifying the institutional roles in South Dakota’s mine regulatory plan is relatively simple. We believe that this system minimizes the problems associated with interagency disputes that can occur under a less consolidated regulatory framework. The DENR’s organizational structure is shown in Figure 2.

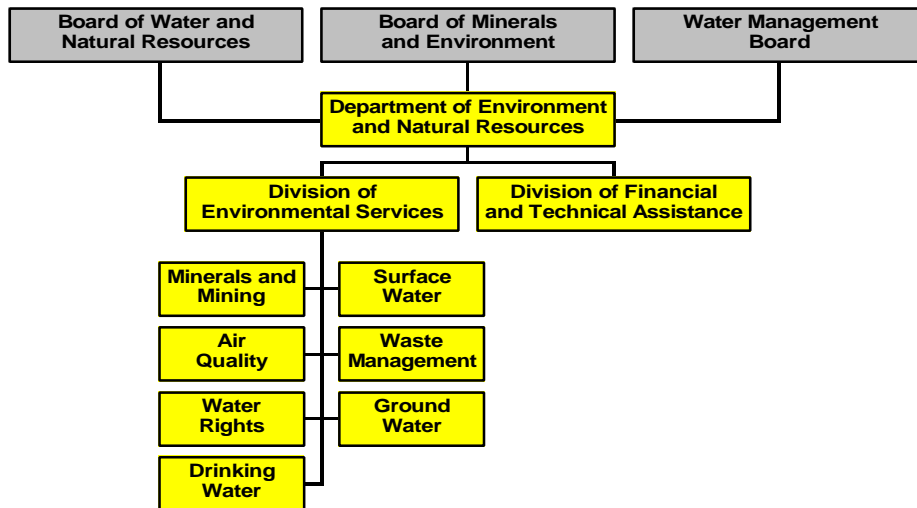


Figure 2. Organizational Chart of South Dakota Department of Environment and Natural Resources as Applied to a Mining Operation.

The Mine Permit is the lead permit. Other permits typically needed to operate a large scale gold mine in South Dakota include Air Quality, Surface Water Discharge (NPDES), Ground Water Discharge, Solid Waste (Rubble Permits for construction debris; mine waste is exempt under state solid waste laws), and Water Rights permits. Under South Dakota's regulatory scheme, these permits provide a multi-media approach such that all critical pollutant pathways are controlled and monitored (Pirner, 1990).

Another practical aspect of the DENR's One-Stop-Shopping approach is that almost all of the state regulators involved with a given mining operation are located in one building. This allows all the necessary people to be present at the table with an operator. In turn, this allows new operators to understand the regulatory requirements and get a feel for "how high the hurdle is" before entering into a permitting venture. It also facilitates the negotiation process and results in a quicker resolution of environmental problems when they develop.

In addition to conducting detailed annual permit audits and inspections at each large scale gold mine, the DENR interacts with the mining industry and the environmental community on a daily basis. Active large scale gold mines are inspected weekly. We continually strive to implement improved waste management practices to foster a high level of environmental protection. For example, the DENR negotiates with mine operators the design of containment facilities, monitoring systems, and improved reclamation techniques. Continual interaction with all customers facilitates a proper understanding of the issues, fosters environmental compliance, and assures that state-of-the-art waste management practices are implemented when necessary.

It should be noted there are other agencies inside and outside state government that also have regulatory roles in mining matters. These agencies include, in part, the state Department of Game, Fish and Parks for wildlife protection, the state Department of Education and Cultural affairs for protection of historical and cultural sites, local soil conservation districts for revegetation seeding mixes, local county governments for zoning requirements, the United States Forest Service for Forest Service Lands, the United States Bureau of Land Management for lands under their control, and the United States Corp of Engineers for 404 permits. These agencies, and several others not listed, have input to certain aspects of the mining project.

#### CUMULATIVE ENVIRONMENTAL EVALUATION (CEE)

Surface mining in the Black Hills increased significantly in the late 1980's. As a result of a growing concern over the potential cumulative impacts from those mines, the question was asked "When is one more mine one too many?"

In response to this concern, a section of the governor's Centennial Environmental Protection Act of 1989 included a requirement for a Cumulative Environmental Evaluation of large scale surface gold mines in the Black Hills. This study, termed the CEE, addressed the current status of the

environment and society in the Black Hills, the cumulative impacts that the existing mines were causing, the potential for future mining development, and possible methods for addressing potential cumulative impacts. The study was completed by December 1990. The governor appointed a seven member task force to evaluate the CEE and make recommendations to the South Dakota Board of Minerals and Environment.

In 1991, following several public meetings, the final recommendations of the CEE Task Force were presented to the Board of Minerals and Environment and included:

- \* A 6,000 acre limit on the total amount of land that can be affected by large scale surface gold mining at any one time.
- \* A requirement that at least 500 acres of surface mining disturbed land be reclaimed by September 1, 1997 and that an evaluation of the reclamation standards be conducted to determine their effectiveness and whether or not they need revision.
- \* A requirement for permit applicants to comprehensively describe critical resources potentially affected as part of the application for a mine permit.
- \* Requirements for post closure care and bonding for reclaimed mines.
- \* A requirement for operators to post up to \$500,000 in financial assurance to be used in the event of a cyanide spill.
- \* Annual reporting requirements for large scale surface gold mining and mineral exploration operations.

The state legislature passed the CEE Task Force recommendations as law in 1992.

#### 500 ACRE RECLAMATION REQUIREMENT

One of the laws enacted in 1992 as a result of the CEE required that 200 hectares (500 acres) of mine disturbed land undergo final reclamation by September 1, 1997. If the 200 hectare (500 acre) reclamation was not met by the September 1, 1997 deadline, a moratorium would have been placed on the issuance of new permits or permit amendments for large scale surface gold mines. Once 200 hectares (500 acres) were reclaimed, the Board of Minerals and Environment, a governor-appointed lay board responsible for the issuance of mine permits, was to review the adequacy of South Dakota's reclamation standards.

For purposes of this statute, reclamation was considered complete when the operator finished:

- \* Required grading;
- \* Topsoil replacement;
- \* Erosion and drainage control;
- \* Landscaping; and
- \* Any required planting or seeding.

In June 1997, large scale surface gold mines achieved the 200 hectare (500 acre) requirement. In July 1997, the South Dakota Board of Minerals and Environment conducted a public hearing to inspect the reclaimed lands and review the effectiveness of state mine reclamation standards. At the end of the three day hearing the board, on an unanimous vote, found the existing South Dakota reclamation standards effective.

## RETROSPECT ON ENVIRONMENTAL PROTECTION

With few exceptions, South Dakota's history of maintaining adequate environmental controls at mine sites has been successful and has withstood the test of time. Two cases of acid generating mines temporarily caused a deviation from this general rule. One of these sites has been fully reclaimed and is performing exceptionally well. The other is in the process of reclamation. Both cases of acid generating mines are discussed separately in a later section of this paper. An example is also given of a mine implementing acid rock drainage (ARD) prevention techniques to avoid environmental problems from the outset of operations.

The system in place to regulate conventional heap leach surface gold mines at non-acid generating mine sites has resulted in over a decade of environmentally responsible mining. A few short-lived periods of non-compliance and unpermitted releases of contaminants have occurred throughout this period, but each episode was dealt with in an effective, timely manner to regain compliance. Enforcement actions in South Dakota are usually settled out of court. Mitigation requirements are often specified in compliance orders.

Since 1984, fifteen enforcement actions have been taken against four heap leach surface gold mines in South Dakota. They range in issues from initiating construction of facilities prior to approval to unpermitted discharges of contaminated water, including acid rock drainage.

### Process Solution Containment

Over the past 15 years, South Dakota's requirements for process solution containment have evolved from single liners to double lined systems for leach pads and process ponds, complete with leak detection, collection, and recovery systems (LDCRS). The evolution of lining systems was done to minimize any leakage from process facilities and to protect ground and surface waters. The process of upgrading liner designs included lengthy negotiations with industry and detailed technical research into the effectiveness of various lining systems.

Current practice for lining system installation includes intensive construction quality assurance (CQA) from third parties and the DENR. The DENR also sets performance criteria for leakage through the primary liner of a double lined system. The performance criteria, also known as a leakage response plan, spells out the operator's response actions based on the leakage rate through the primary liner as measured in the LDCRS. The response action ranges from no action to shutdown of the pond or pad.

In addition to good CQA and LDCRS monitoring, a comprehensive system of ground water wells and surface water monitoring stations located near the facility is designed to detect any leakage from the process facilities.

### Neutralization of Spent Ore

Requirements for neutralization of spent ore prior to off-loading treated spent ore from reusable leach pads serve to protect state water resources. Spent ore effluent and/or pore water must be treated to 0.5 mg/L weak acid dissociable cyanide or less, prior to removal of material from the pad and disposal within spent ore depositories. Durkin (1990) explains the specific regulatory requirements for spent ore neutralization and describes the practices undertaken at individual mines.

Several studies have been conducted to determine the reliability of solid sample and effluent test procedures designed to monitor the adequacy of spent ore neutralization and to be used as a basis for off-load approval. These studies, combined with over a decade of real-world environmental monitoring results at and below the spent ore depositories, have shown that South Dakota's neutralization requirements for spent ore are sufficient to protect the environment.

Nitrate management: It has been found that a buildup of nitrate has occurred within spent ore depositories at certain Black Hills gold mines. Although the buildup of nitrate is manageable, it is enough of a problem to warrant inclusion in a discussion of spent ore neutralization. The nitrate buildup occurs as a result of: 1) cyanide degradation processes associated with spent ore neutralization and 2) residual ammonium nitrate fuel oil (ANFO) that carries over to the spent ore and waste rock depositories from incomplete detonation during blasting in the pit.

Several techniques have been implemented to manage the buildup of nitrate and subsequent release to the environment. In addition to improved blasting practices, nitrate has been managed using counter current ion exchange (CCIX) and biotechnology. The CCIX technology removes nitrate from neutralization solutions as spent ore is detoxified on the leach pads. The CCIX process creates a waste stream of ammonium nitrate, which is marketed as a fertilizer. The problem with the CCIX technique is that it is more expensive than originally anticipated and it is difficult to market the fertilizer product during winter months.

Continuing research into biotechnology indicates that naturally occurring, on-site nitrate-reducing bacteria can be successfully harnessed to remove nitrate from mine solutions at a reasonable cost. These bacteria have been very effective at safely lowering nitrate levels in open-air ponds at the Golden Reward Mine. A more controlled nitrate-reducing bacteria plant designed to handle up to 400 gpm was recently constructed at Wharf Resources' Annie Creek Mine. Although performance data is yet to be collected to verify the effectiveness of the Wharf biodegradation plant, preliminary bench test results confirm that the technology shows significant promise at field scale.

### Acid Rock Drainage Reclamation and Prevention Case Histories

Two heap leach gold mines in the Black Hills, permitted in the mid-1980's, experienced problems with acid rock drainage (ARD); LAC Minerals' Richmond Hill Mine and Brohm Mining Corporation's Gilt Edge Mine. ARD prediction capabilities have improved significantly since the time these two mines were permitted. South Dakota's regulatory approach to sulfide mining now takes advantage of these improved predictive capabilities and stresses the importance of ARD prevention from the start of operations.

The Richmond Hill Mine is described in terms of ARD "reclamation". Brohm Mining Corp.'s Anchor Hill Project, permitted in 1996 with state-of-the-art sulfide waste management practices incorporated into the mine plan, is cited as an example of ARD "prevention".

#### Richmond Hill Mine (ARD Reclamation)

LAC Minerals' Richmond Hill mine is an example of a successful ARD "reclamation" project. The state mine permit was issued in 1988 for this 160 hectare surface gold mine located at an elevation of about 1,675 to 1,830 m. Annual precipitation averages about 70 cm. Original ARD predictive requirements were not sufficient and resulted in underestimating the acid generating potential of the deposit.

The Richmond Hill ore body is associated with a Tertiary breccia pipe that intruded into Precambrian amphibolites, forming a near vertical contact. Sulfide and oxide components of the breccia exist. Oxidation of the ore deposit resulted in a well-developed hematitic-jarositic cap up to 80 m thick. Primary sulfide mineralization occurs below the oxide cap and consists of 70 to 80 percent feldspars, showing variable argillic alteration, and 10 to 20 percent pyrite and marcasite. The protolith of this rock was determined to be the Precambrian amphibolites, with the sulfide mineralization replacing the original mafic minerals. Unaltered amphibolites contain little to no sulfides (Duex, 1994).

ARD was detected in runoff from the mine's valley-fill waste rock depository in 1992. This led to a shut down of the mine, a significant increase in the reclamation surety bond from \$1.2 million to \$10.7 million, a settlement of \$489,000 for permit and water quality standard violations, and the development of an ARD reclamation plan.

Short-term mitigation of environmental impacts consisted of collecting and treating acid waters. A series of chemical treatment ponds was constructed below the waste depository, as well as a retention pond with capacity to contain runoff from a 10 year, 24 hour storm event. Contaminated alluvial ground water was collected in a cutoff trench. Partially treated surface and ground water was further treated to discharge standards in a conventional water treatment plant. Treated water was discharged under a state surface water discharge permit.

An extensive geochemical characterization program was undertaken at Richmond Hill to identify acid and non-acid generating rock. To mitigate long-term impacts, reactive waste rock was relocated from the valley-fill depository, backfilled in the

pit from which it was originally mined, and capped with a low permeability cover. This isolated the waste from surface runoff and prevents ground water degradation. A cross section of the cap is given in Figure 3.

The objective of the closure plan was to reduce the potential for long-term environmental risk to surface and groundwater, promote long-term hydrologic and geotechnical stability, and maintain acceptable post-closure land uses. Durkin (1996) describes the Richmond Hill ARD cleanup project through 1994, in detail.

Leach pad closure included amending acid generating spent ore with alkaline materials and capping.

Relocation and capping of reactive sulfide wastes in this manner provides the added benefit of avoiding the need for long-term active water treatment. With a minor amount of maintenance and routine post-closure monitoring, the reclamation strategy undertaken at Richmond Hill provides a near walk-a-way situation.

In 1995, the reclaimed pit impoundment was fitted with numerous performance monitoring devices designed to track the long term success of remedial measures. Results from gravity and barrel lysimeters, heat dissipation units, neutron probes, piezometers, pore gas (oxygen and CO<sub>2</sub>) monitoring, temperature probes, water quality and aquatic monitoring, and cap settlement surveys, all indicate that the reclaimed site is performing better than expected. Extensive post-closure performance data continues to be collected at the site. All performance data is on file at the DENR and is available to the public.

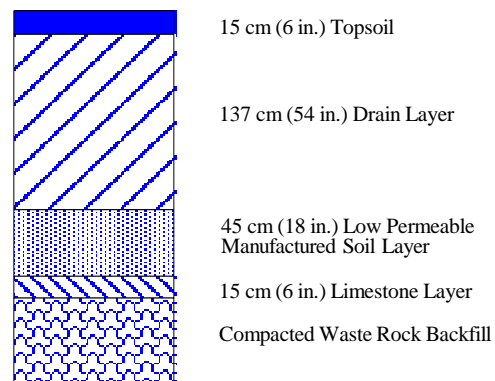


Figure 3. Cross Section of Richmond Hill Cap.

#### Anchor Hill Project (ARD Prevention)

Brohm Mining Corporation's Anchor Hill surface gold mine was permitted in 1996. Sulfide mineralization occurs within certain portions of the deposit. The mine is located immediately adjacent to Brohm's Gilt Edge Mine which was permitted in the mid-1980's and ran into ARD problems similar to the Richmond Hill site.

State-of-the-art ARD "prevention" mechanisms were designed into Brohm's Anchor Hill operating and reclamation plans to avoid ARD problems from startup to closure. Stringent requirements for pre-mining ARD static and kinetic predictive testing, followed by extensive operational "in-pit"

testing of mined rock, allow acid and non-acid rock to be identified early and disposed of accordingly.

Drill cuttings and core were sampled at 1.5 m increments during the pre-mining stage. Samples underwent extensive acid-base accounting and kinetic tests. Based on the results from hundreds of these predictive tests, sulfur cutoff limits were established for each rock type. Sulfur concentration data was entered into a computer block model to predict volumes and location of acid and non-acid rock.

Prior to permitting, great care was taken to assure that enough non-reactive rock was available to do the required reclamation, which includes backfilling, covering acid generating surfaces, and constructing caps.

After the Anchor Hill Project was permitted in the winter of 1996, and as mining progresses, every blast hole in the pit is analyzed for logged visual sulfides. To verify visual logs, drill cuttings from every other blast hole are subjected to total sulfur analysis using a Leco Furnace. Based on whether the samples report over or under the established cutoffs, the mined rock is tracked and handled as acid or non-acid generating. To date, over 20,000 data points have been entered into the database used to track the reactivity of mined rock and its ultimate disposal location.

Phase II of the project has a public lands component and is currently on hold, awaiting approval of an Environmental Impact Statement. Phase I of the project, on private lands, is completed and is behaving as predicted.

Improved ARD predictive capabilities were used at Anchor Hill to develop a wise operating plan in conjunction with a proper waste handling and reclamation plan. The Anchor Hill Project is a good example of how an ore deposit can be mined within a sulfide environment in an economically viable and environmentally responsible manner. Additionally, the project provides reclamation materials that improve upon ARD reclamation work currently underway at Brohm's adjacent Gilt Edge Mine.

## CONCLUSIONS

Over the past 27 years, South Dakota's mine regulatory system has evolved from infancy stage to one of technical complexity and maturity. It allows a balance between economic development and environmental protection to be maintained. Although most regulatory issues pertaining to surface heap leach gold mining have already been identified and addressed, new issues will undoubtedly arise as mining progresses. As new challenges in environmental regulation come to the forefront, it is important to maintain regulatory flexibility in meeting them.

Most aspects of modern mining in South Dakota continue to have a history of proper regulation and pollution prevention. The ARD problems that developed at the Richmond Hill and Gilt Edge Mines are being avoided at the Anchor Hill Mine which was permitted a decade later, after improved mine planning and sulfide waste management practices were identified. This is testimony to the benefits of remaining open

to new environmental challenges and maintaining a willingness to incorporate innovative regulatory options into site-specific permit projects.

## APPENDIX

### CHRONOLOGY OF REGULATORY AND PERMIT ACTIONS AS APPLIED TO GOLD MINING IN THE BLACK HILLS

#### 1971

The first state mining laws were passed in South Dakota.

#### 1981

At about the same time that interest in heap leach surface gold mining first arose in the Black Hills, the regulatory authority for mining transferred from the state Department of Agriculture to the Department of Environment and Natural Resources (DENR).

#### 1982

Legislative Revision and recodification of state mining laws resulted in the South Dakota Mined Land Reclamation Act (SDCL 45-6B), the South Dakota Mineral Exploration Act (SDCL 45-6C), and the South Dakota Uranium Exploration Act (SDCL 45-6D).

The first mine permit for a heap leach surface gold mine was issued to Wharf Resources for the Annie Creek Mine.

A mining permit was granted to Homestake Mining Company for their Open Cut surface gold mine in Lead.

#### 1984

Permit granted to Homestake Mining Company for a surface gold mine near the rim of Spearfish Canyon, a scenic area of the Black Hills. Because of continued controversy over its location, no mining has been done at the site.

#### 1986

Legislative Study of social and economic impacts of surface mining.

Two new mine permits were issued to Wharf Resources to expand the Annie Creek Mine.

Mine permit granted to Brohm Mining Corporation for the second heap leach surface gold mine in the Black Hills, the Gilt Edge Mine.

The DENR and US Forest Service enter into a Memorandum of Understanding to eliminate duplication of reclamation and bonding requirements for mining operations on Forest Service lands.

1987

Based on findings of the Legislative Study on impacts of surface mining, several laws were passed that included requirements for socioeconomic impact studies for new mines, clarification of local controls over mining, revisions to reclamation bonding requirements, and specifications for developing reclamation plans.

A six-month moratorium on the issuance of new mine permits was declared by the governor to allow the DENR staff and the Board of Minerals and Environment time to draft new rules governing mining. The Governor appointed a special 10-member task force to develop a set of draft rules to be presented to the Board as a recommendation. The task force held a series of 10 public meetings statewide to allow the public an opportunity to have input into rule development. The Board adopted 9 separate chapters of rules as a result of this effort.

1988

St. Joe Gold Corporation was granted a mine permit for the Richmond Hill open pit, heap leach surface gold mine. The mine was later acquired by LAC Minerals.

Golden Reward Mining Company was granted a permit for the Golden Reward mine, a heap leach surface gold mine located at the base of Terry Peak, South Dakota's premier ski resort.

Legislature passed law specifying mine permit amendment fees, mine permit transfer requirements, and staff processing times.

Two statewide initiated measures on mining failed. One would have required all large scale surface mines to return mined land to approximate original contour. The other would have imposed an additional 4% tax on gross sales of precious metals produced by surface mining.

1989

Legislature passed Governor Mickelson's Centennial Environmental Protection Act. Several sections deal with mining including:

- \* A requirement that a Cumulative Environmental Evaluation (CEE) be conducted of large scale precious metals surface mining in the Black Hills. A moratorium on the issuance of new mine permits is imposed during the study period.

- \* A requirement that small scale mines using cyanide comply with large scale permit requirements.

- \* A requirement that operators of open pit surface gold mines using cyanide for extractive purposes pay a fee of two cents per pound of cyanide used to the Groundwater Research and Education Fund for a period of five years.

- \* A requirement for operators using cyanide for extractive purposes to post up to \$500,000 in financial assurance with the Board of Minerals and Environment to be used in the event of

accidental releases of cyanide. This is in addition to the reclamation bond that is based on the actual cost of reclamation.

Legislature passed a law concerning the designation of lands as special, exceptional, critical or unique and authorizing the Board of Minerals and Environment to promulgate rules.

1990

CEE was completed at a cost of \$250,000. All costs were paid by the mining industry.

Legislature passed a law requiring the Governor to appoint a seven-member task force to evaluate the CEE and make recommendations to the Board of Minerals and Environment.

Statewide initiated measure failed that would have limited the total amount of surface gold mining allowed in the Black Hills to 3,100 acres.

The Divisions of Land and Water Quality and Air Quality and Solid Waste were reorganized into a single Division of Environmental Regulation. The Minerals and Mining Program takes on air quality functions related to mining.

The Board of Minerals and Environment adopted special, exceptional, critical or unique land rules after two public hearings. Since then, several areas have been added to the preliminary list of special and unique lands following public hearings, including Spearfish Canyon.

1991

CEE Task Force final recommendations were presented to the Board of Minerals and Environment.

1992

Legislature passed CEE Task Force recommendations as law.

The DENR detected discharge of acid rock drainage at the Richmond Hill gold mine. The discharge impacted the trout fishery in Squaw Creek. The DENR issued the company a Notice of Violation and Order. In settlement of the order, the company agreed to pay \$489,000 and was required to take immediate steps to eliminate the discharge and to submit a mitigation plan in the form of a mine permit amendment.

A statewide initiative passed that limits new large scale surface gold mines to a maximum size of 320 acres and allows existing mines to expand up to an additional 200 acres.

Homestake Mining Company was granted a permit to expand Open Cut operation.

1993

Legislature passed a mining industry sponsored bill that requires the DENR, in conjunction with the South Dakota School of Mines and Technology, to prepare an inventory of abandoned mines in the Black Hills.



The DENR's Minerals and Mining Program established an annual large scale gold mine permit audit program involving all DENR Programs with regulatory responsibilities related to mining.

The DENR discovered a discharge of acid mine drainage to the environment at Brohm Mining Corporation's Gilt Edge gold mine. A Notice of Violation and Order was issued to Brohm, requiring the company to submit a mitigation and reclamation plan in the form of a mine permit amendment.

#### 1994

After a public hearing, the Board of Minerals and Environment approved LAC Minerals' mine permit amendment to mitigate acid mine drainage at the Richmond Hill Mine. Estimated reclamation costs exceeded \$10 million, a ten-fold increase over the original reclamation bond.

#### 1995

Legislature passed a bill to ban new surface mining permits on private land from "rim to rim" in Spearfish Canyon. Legislature also passed a resolution that encouraged the US Forest Service to designate Spearfish Canyon as a Scenic Byway, which would effectively ban surface mining on federal land within the Canyon.

After a public hearing, the Board of Minerals and Environment approved Brohm Mining Corporation's mine permit amendment to mitigate acid mine drainage at their Gilt Edge Mine. Estimated costs to implement the plan exceeded \$8 million.

The DENR entered into a Memorandum of Understanding with EPA that provides protection from liability under Superfund while engaged in the inventory or cleanup of abandoned mines.

The DENR issued a Notice of Violation and Order to Wharf Resources for a discharge of improperly treated cyanide solution that resulted in a fishkill in Annie Creek. Wharf agreed to pay \$150,000 in settlement of the violation.

LAC Minerals completed cap over backfilled pit impoundment designed to provide long term closure of acid generating waste rock at the Richmond Hill Mine.

Brohm Mining Corporation completes relocation/reclamation of the historic, acid generating Strawberry Creek tailings. The project significantly improved water quality and aquatic habitat in the Bear Butte Creek watershed.

In November 1995, the Homestake mine reached a milestone by producing its 38th million ounce of gold.

#### 1996

Brohm Mining Corporation (wholly owned subsidiary of Dakota Mining Corporation) was granted a permit by the Board of Minerals and Environment to mine the Anchor Hill open pit/heap leach surface gold mine project, located adjacent to the

existing Gilt Edge Mine. The Anchor Hill permit was unanimously granted by the Board after hearing 3 days of testimony summarizing the detailed operating and reclamation plan designed to minimize and safely manage acid generating sulfide wastes. The Anchor Hill project, as designed, was found to provide superior reclamation materials to improve upon ARD reclamation at the Gilt Edge site.

Golden Reward ceased mining operations and applied for and was granted a five year temporary cessation. Reclamation activities continue at the site.

Wharf Resources submitted an application for the Clinton Project, which would extend the life of the mine through 2007. The application was procedurally incomplete at year's end.

Lawrence County voters narrowly passed an initiated zoning ordinance that would effectively ban surface mining on 48,000 acres in the Spearfish Canyon watershed.

#### 1997

Large scale surface gold mines surpassed the 500-acre reclamation requirement pursuant to the 1992 state statute. The Board of Minerals and Environment found the reclamation standards to be effective.

Brohm temporarily suspended mining in September until a required EIS is completed for portions of the Anchor Hill Project located on federal land.

LAC Minerals completed the capping system over its leach pads at the Richmond Hill Mine.

Homestake Mining Company proceeded with construction of the third raise on the Grizzly Gulch tailings impoundment, providing additional storage capacity through 2035 (Woodward-Clyde, 1996).

A federal judge struck down the Lawrence County zoning ordinance banning surface mining in Spearfish Canyon watershed that was narrowly passed as an initiated measure by Lawrence County voters in November 1996. The matter was appealed to the Federal Eighth Circuit Court of Appeals by the proponent of the initiative.

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