THE MINERAL INDUSTRY OF SOUTH DAKOTA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the South Dakota Geological Survey for collecting information on all nonfuel minerals.

In 1999, the preliminary estimated value[1] of nonfuel mineral production for South Dakota was $226 million, according to the U.S. Geological Survey (USGS). This was a 12% decrease from that of 1998,[2] and followed a 21.3% decrease from 1997 to 1998.

Gold remained South Dakota's leading nonfuel mineral by value, accounting for about 39% of the State's total nonfuel mineral production value. In 1999, decreases in the values of gold, construction sand and gravel, and granite dimension stone (descending order of change) accounted for most of the State's drop in value. Relatively small decreases also occurred for crushed stone, iron ore, and common clays. Portland cement, lime, and mica showed increases of $1 million or less. In 1998, construction sand and gravel had the only significant increase in value, up about $1.5 million. The decreased values of gold, crushed stone, and portland cement accounted for most of the decrease in the State's mineral value for the year (table 1).

Based upon USGS estimates of the quantities produced in the 50 States during 1999, South Dakota remained fifth in gold and mica and seventh in feldspar. Additionally, South Dakota was the second-leading State in the production of granite dimension stone.

The following narrative information was provided by the South Dakota Department of Environment and Natural Resources' (DENR) Minerals and Mining Program[3] (MMP) in association with DENR's South Dakota Geological Survey (SDGS). Production data in the text that follows are those reported by the MMP based upon the agency's own surveys and estimates. They may differ from some production figures reported to the USGS.

Gold production continued to decline in South Dakota in 1999. The gold mines in the northern Black Hills produced 9,962 kilograms (kg) of gold in 1999. This represented an 18% drop in the amount of gold produced in 1998, but gold continued to remain the leading mineral commodity in South Dakota in terms of value. The average price of gold in 1999 was about $279 per troy ounce, yielding a gross value of about $89 million. While the amount of gold produced in 1999 dropped by 18% from the previous year, the lower gold price caused a 22% drop in gross value. The mines are surface heap leach operations with the exception of Homestake Mining Co.

Production from the Homestake Open Cut decreased from 4,975 kg in 1998 to 790 kg in 1999. The reason for the decrease is that Homestake completed mining in the Open Cut in September 1998, and the only production in 1999 came from stockpiled ore. Meanwhile, production increased in Homestake's underground mine from 3,653 kg in 1998 to 5,825 kg in 1999. This was due to Homestake instituting its new underground mining plan.

Wharf Resources (USA), Inc. and Brohm Mining Corp. were the only other companies to report gold production in 1999. Wharf reported gold production of 3,335 kg in 1999, a slight decrease from the 3,427 kg reported in 1998. Brohm produced only 11 kg in 1999, which were recovered from residual gold in process solutions early in the year.

Brohm, Homestake, and Wharf also produced silver as a byproduct in the gold recovery process. A total of 2,045 kg of silver was recovered in 1999. At an average price of $5.22 per ounce, the value of the silver was $343,000. This was a decrease from the 2,818 kg and $501,974 value reported in 1998.

The Golden Reward Mine remained under temporary cessation and produced no gold. LAC Minerals' Richmond Hill Mine was no longer producing gold and the mine was undergoing final reclamation.

Twelve mine permits covered 7 large-scale gold mining operations in the State. No new mine permits or mine permit amendments were issued to large-scale gold operations in 1999.

During the 1999 reporting period, 491 companies had active mine licenses in South Dakota. Operators were required to obtain a license to mine for sand, gravel, pegmatite minerals, materials used in the process of making cement or lime, and rock to be crushed and used in construction. There were also 40 mine permits that covered the mining of other minerals, such as slate, bentonite, placer gold, and dimension stone.

Sand and gravel was the major nonmetallic industrial mineral commodity produced with 13.3 million metric tons (Mt) reported removed. Sand and gravel was produced in nearly every county in South Dakota and was used mainly for road construction projects.

The second largest nonmetallic mineral commodity produced in 1999 was limestone with 3.4 Mt tons produced. The South Dakota Cement Plant of Rapid City alone produced 1.1 Mt of limestone. It also produced 183,000 metric tons (t) of shale, 48,000 t of gypsum, and 33,488 t of sand.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1999 USGS mineral production data published in this chapter are preliminary estimates as of May 2000, and are expected to change. For some mineral commodities, such as, construction sand and gravel, crushed stone, and portland cement, estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at URL http://minerals.usgs.gov/minerals/contacts/comdir.html, by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists), or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at URL http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1998 may vary from the Minerals Yearbook, Area Reports: Domestic 1998, Volume II, owing to the revision of preliminary 1998 to final 1998 data. Data for 1999 are preliminary and are expected to change; related rankings may also be subject to change.

[3]E.H Holm, D.K. Burtts, M.R. Nelson., and Erik Nelson of the DENR's Minerals and Mining Program jointly authored the text of mineral industry information used in the remainder of this publication.

Sioux quartzite was the third largest nonmetallic industrial mineral commodity produced with 2.6 Mt reported removed. It was quarried from four locations in southeastern South Dakota. Most of the quartzite was crushed and used in construction. Some larger blocks were used for rip-rap, railroad ballast, and occasionally for decorative purposes.

Granite was mined by Dakota Granite Co. and Cold Spring Granite Co. from quarries near Milbank, SD. Due to its beauty and distinctive red color, the mahogany granite was used primarily for floor tiles, monuments, and building construction. Much of it went to international markets. Other industrial minerals produced in lesser amounts in 1999 included bentonite, iron ore, mica schist, pegmatite minerals (feldspar, mica, rose quartz), placer gold, and slate.

Exploration activities in the State slowed in 1999, primarily due to lower gold prices. Two exploration permits were granted during the year. Wharf Resources permitted 1,454 drill holes and completed 125 reverse circulation and diamond core drill holes in the vicinity of its existing operations in Lawrence County. Wharf was exploiting disseminated epithermal gold deposits in the Bald Mountain mining district. Exploration drilling in Wharf's American Eagle area reportedly increased Wharf's gold reserves by 1,900 kg to 32,000 kg. Homestake Mining Co. continued operations at its underground mine in Lead throughout 1999, but completed no surface exploration activities. Apex Minerals Inc. received an exploration permit in Custer County to explore for placer gold and associated detrital heavy minerals in Oligocene terrace gravel deposits. The Apex permit involved trenching and channel sampling, followed by sample analysis at its facility in Newell, SD. Currently, 113 exploration permits remain active in South Dakota primarily for gold and silver exploration within the northern Black Hills.

In the early part of the year, Dakota Mining Corp. (Brohm's parent corporation) was hopeful that it could still mine phase 2 of the Anchor Hill Mine sometime in 1999. The corporation was in the process of settling a lawsuit with environmental groups and was working with the U.S. Forest Service (USFS) to submit an operating plan. However, because of the drop in gold prices and delays in obtaining USFS approval for phase 2, Dakota's creditors would not continue to finance the mining operation. As a result, Dakota filed for bankruptcy in Canada in July 1999. The bankruptcy was filed just days before the settlement agreement was reached with the environmental groups.

Due to the bankruptcy and environmental problems at the site, the State intervened. The first State action taken was to prevent the discharge of acid water from the Gilt Edge Mine. The Gilt Edge Mine, owned by Dakota, has been shut down since 1997. The Governor authorized payment of funds for water treatment from the State's Regulated Substance Response Fund. By doing this, the State did not use the reclamation bond to pay for water treatment, thus preserving it for actual reclamation work. The water treatment plant was brought back into operation on July 27, 1999, and continued operating throughout the remainder of 1999. Since July, Brohm personnel have been working with the DENR to successfully treat acid water at the site. The volume of acid water was reduced from about 570 million liters (ML) in July to 488 ML by December. There is now enough room at the site to collect and store acid drainage from a 100-year storm event.

The U.S. Bureau of Reclamation, through an interagency agreement with the U.S. Environmental Protection Agency, (EPA), prepared a site closure plan. In general, the plan for the Gilt Edge Mine is to:

1. Partially remove the Ruby waste rock dump as pit backfill;
2. cap and revegetate the remainder of the Ruby waste rock dump in place;
3. seal historic underground mine workings;
4. partially backfill the mine pits;
5. cap the mine pits, as necessary; and
6. remove spent ore from the leach pad for pit backfill and cap construction.

When acid mine drainage was discovered at the mine in 1993, Brohm did not have money to increase its reclamation bond to cover the costs of acid mine drainage mitigation. The State negotiated an agreement with Brohm to provide an additional $1 million in cash to add to the bond and a promissory note. While Brohm was complying with a State order to mitigate the acid mine drainage at the mine, it developed a mine plan for a new gold deposit near the existing mine called the Anchor Hill project. Brohm proposed to use the cash flow and the low sulfide rock from this project to concurrently cap and reclaim the acid producing areas of the mine. The State granted a permit for this project in 1996, but with the following conditions to increase the cash portion of the reclamation bond:

1. Brohm had to deposit cash bonds with the State before any new areas were disturbed;
2. Brohm had to leave all interest from the bond in a State account; and
3. Brohm had to deposit 1% of gross gold sales into a State account.

Before Dakota Mining's bankruptcy, Brohm complied with the permit conditions and made progress in increasing the cash portion of the reclamation bond to over $6 million by mining Phase I of the Anchor Hill project. However, after the bankruptcy, Brohm had no more money to add to the cash bond. After reviewing cost estimates to close the mine, it was clear there would be a shortfall in reclamation funding due to the promissory note not being met.

During the 2000 legislative session, the Governor introduced several measures to the legislature to obtain funding to make up the shortfall in reclamation funding. He asked the legislature to use $8 million of tobacco settlement money to make up the shortfall. However, the legislature did not want to use tobacco settlement money for mine reclamation. The Governor then introduced a bill that would require the other mining companies to act as emergency response contractors and to indemnify them as agents of the State. Because of mining industry opposition, the bill did not pass. Finally, the Governor proposed a bill to increase the severance tax on gold, with the money going into a reclamation fund. This bill also was not approved.

With no other legislative options available, the Governor had no choice but to ask the EPA to place the mine site on the Superfund National Priority List. The State is currently working with the EPA to have the site listed and to begin reclamation work sometime in the summer of 2001.

With regard to reclamation efforts at the Richmond Hill Mine, the pit impoundment, backfilled with acid-generating rock and covered with a low-permeability capping system, continued to exceed expectations in 1999. Four seasons of monitoring data show that only minimum amounts of oxygen and water were being detected in the impoundment. This indicates the cap was effective in limiting oxygen and water infiltration and was preventing acid generation. No signs of settling or slumping were found during

several inspections of the pit impoundment. Only minor erosion was noted on a few portions of the impoundment. A dense, self-sustaining vegetative cover was becoming established on the pit impoundment and waste dump area.

The capped leach pads were also performing well. No signs of settling or slumping were found on the leach pads. Only minor erosion was noted in several areas. A good vegetative cover was becoming established. Monitoring data showed that the capping systems were effective in reducing water infiltration into the spent ore. Because of the low metal concentrations in the pad effluent, LAC thinks that passive treatment may be feasible for long-term water treatment. A pilot plant has been constructed to test passive treatment, and test results are encouraging so far.

Ground and surface water quality around the mine site continued to improve. Biological assessments of Squaw Creek below the mine showed that the stream was healthy. At the end of 1999, LAC discontinued water treatment for the winter because the volume of water requiring treatment had been reduced to minimal levels. Only seasonal water treatment will be conducted, starting in the summer of 2000. Because of decreased water treatment and reclamation requirements at the site, LAC reduced its workforce to three employees at yearend.

The DENR continued working with the USFS, the U.S. Bureau of Land Management (BLM), and the EPA to reclaim two historic abandoned mine sites in the northern Black Hills. Both mines had open adits and shafts, acid mine drainage, eroding streamside tailings, and small sulfide waste rock piles.

An engineering evaluation and cost analysis was completed by the USFS to evaluate and select remedial alternatives for the Minnesota Ridge Mine, about 6 kilometers (km) northeast of Rochford. The USFS, the EPA, and the DENR were reviewing various remedial alternatives and costs. It is uncertain at this time if EPA funding will be available for the private portions of the mine site. The USFS may begin reclamation of the public land portions as early as next summer.

BLM started reclamation of the Belle Eldridge Mine, about 2.4 km southeast of Deadwood. Last fall, the BLM contractor regraded the waste rock pile and removed about 8,000 cubic meters of tailings and placed them in a temporary storage area. During summer 2000, the tailings will be placed in a capped repository near the mine site. A wetland may be constructed to passively treat acid water discharging from the mine opening and acid seeping from the mine.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN SOUTH DAKOTA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1997		1998 r/		1999 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Clay: Common		182	W	188	W	190	W
Gemstones		NA	98	NA	W	NA	W
Gold 3/	kilograms	W	W	12,100	115,000	9,840	88,500
Gypsum, crude		51	469	W	W	W	W
Sand and gravel: Construction		10,200	34,100	10,100	35,600	9,510	34,100
Silver 3/	metric tons	4	693	2	321	2	261
Stone: Crushed		5,900	30,200	5,720	24,600	54,000	23,900
Combined values of cement, feldspar, iron ore (usable), lime, mica (crude), stone (dimension granite), and values indicated by symbol W		XX	263,000	XX	83,100	XX	79,000
Total		XX	328,000	XX	258,000	XX	226,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined
XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to no more than three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

TABLE 2
SOUTH DAKOTA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value	1998 Number of quarries	1998 Quantity (thousand metric tons)	1998 Value (thousands)	1998 Unit value
Limestone	4	3,110	$11,900	$3.82	4	2,920	$12,100	$4.15
Granite	1	1	13	13.00	2	W	W	W
Quartzite	9	2,790	18,300	6.55	9	W	W	W
Total or average	XX	5,900	30,200	5.11	XX	5,720	24,600	4.31

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

TABLE 3
SOUTH DAKOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1998, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	W	W	$7.09
Filter stone	W	W	6.14
Other coarse aggregate	51	$168	3.29
Coarse aggregate, graded:			
Concrete aggregate, coarse	W	W	5.75
Bituminous aggregate, coarse	W	W	4.02
Bituminous surface-treatment aggregate	W	W	5.89
Railroad ballast	W	W	6.27
Other graded coarse aggregate	678	2,990	4.41
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	W	W	4.20
Screening, undesignated	W	W	4.24
Other fine aggregate	37	162	4.38
Coarse and fine aggregates:			
Graded road base or subbase	262	1,110	4.25
Crusher run or fill or waste	W	W	4.62
Other coarse and fine aggregates	256	1,130	4.41
Chemical and metallurgical:			
Cement manufacture	1,200	3,950	3.31
Lime manufacture	W	W	4.51
Unspecified: 3/			
Actual	W	W	4.41
Estimated	91	402	4.42
Total or average	5,720	24,600	4.31

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes granite, limestone, and quartzite.
3/ Reported and estimated production without a breakdown by end use.

TABLE 4
SOUTH DAKOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1998,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	W	W	--	--	W	W
Coarse aggregate, graded 4/	W	W	--	--	W	W
Fine aggregate (-3/8 inch) 5/	W	W	--	--	W	W
Coarse and fine aggregate 6/	W	W	--	--	W	W
Other construction materials	845	4,270	--	--	1,340	6,080
Chemical and metallurgical 7/	(8/)	(8/)	--	--	--	--
Unspecified: 9/						
Actual	(8/)	(8/)	(10/)	(10/)	(10/)	(10/)
Estimated	490	3	--	--	90,700	400
Total	2,920	12,100	(10/)	(10/)	(10/)	(10/)

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials." -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ No production reported in District 2.
3/ Includes filter stone, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (bituminous mix or seal), and screening (undesignated), and other fine aggregates.
6/ Includes crusher run (select material or fill), graded road base or subbase, and other coarse and fine aggregates.
7/ Includes cement manufacture, and lime manufacture.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Reported and estimated production without a breakdown by end use.
10/ Withheld to avoid disclosing company proprietary data.

TABLE 5
SOUTH DAKOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1998,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate and concrete products	1,290	$6,730	$5.20
Plaster and gunite sands	74	389	5.26
Asphaltic concrete aggregates and other bituminous mixtures	735	2,610	3.55
Road base and coverings	3,660	8,940	2.44
Fill 2/	492	1,320	2.69
Snow and ice control	15	54	3.60
Unspecified: 3/			
Actual	626	2,510	4.00
Estimated	3,240	13,000	4.02
Total or average	10,100	35,600	3.51

1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes roofing granules.
3/ Reported and estimated production without a breakdown by end use.

TABLE 6
SOUTH DAKOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1998,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	W	W	117	689
Asphaltic concrete aggregates and other bituminous mixtures	--	--	W	W
Road base and coverings	620	1,310	837	1,710
Fill 3/	6	7	13	28
Unspecified: 4/				
Actual	W	W	W	W
Estimated	543	1,810	757	2,490
Total	1,580	5,540	2,170	6,400
	District 3		District 4	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	W	W	876	4,160
Asphaltic concrete aggregates and other bituminous mixtures	W	W	295	1,130
Road base and coverings	707	1,420	1,490	4,490
Fill 3/	94	266	394	1,080
Unspecified: 4/				
Actual	W	W	443	1,970
Estimated	1,140	4,820	801	3,920
Total	2,090	6,900	4,300	16,800

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes snow and ice control and roofing granules.
4/ Reported and estimated production without a breakdown by end use.