

THE MINERAL INDUSTRY OF SOUTH DAKOTA

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

South Dakota remained 35th in the Nation in total nonfuel mineral production value¹ in 1996, according to the U.S. Geological Survey (USGS). The estimated value for 1996 was \$353 million, a more than 6% increase from that of 1995. With this, South Dakota reached a new all time high, previously set at \$337 million in 1993. The 1996 increase followed a 3% increase from 1994 to 1995 (based on final 1995 data). The State accounted for almost 1% of the U.S. total nonfuel mineral production value.

Gold remained South Dakota's leading nonfuel mineral by value; the quantity and value have been withheld for 1994 and 1996 to avoid disclosing company proprietary data. In 1996, the values of gold and of the State's second and third leading nonfuel minerals, portland cement and construction sand and gravel, respectively, significantly increased, leading the State to its record year. Only granite dimension stone showed any sizable decrease in 1996 with a drop of about \$4 million, following an increase of like magnitude from 1994 to 1995. Changes in value for other nonfuel minerals were small relative to these. Lime, silver, iron ore, and mica values increased in 1996. Values that decreased included those of masonry cement, common clays, and feldspar.

Compared with USGS estimates of the quantities produced in the other 49 States during 1996, South Dakota remained fourth of 14 U.S. gold-producing States, fourth in crude mica production, and rose from eighth to seventh in the production of dimension stone. A small quantity of iron ore was mined in the State mainly for use by a South Dakota cement company as an ingredient in its cement manufacturing process.

The following narrative information was provided by the South Dakota Geological Survey (SDGS)² of the State's Department of Environment and Natural Resources (DENR). According to information gathered by the SDGS, the gold mines in the northern Black Hills produced 17.4 metric tons³ of gold in 1996, which approximately equaled the amount produced in 1995. The average price of gold in 1996 was \$387.76 per troy ounce, yielding a gross value of about \$217 million. In 1996, SDGS-reported production was as follows: Homestake Mining Co., 12.7 metric tons; Wharf Resources, 3.3 tons; Brohm Mining Corp., 0.7 tons; and Golden Reward

Mining Co., 0.7 tons. All mines are surface heap-leach operations with the exception of Homestake.

In January 1996, the State issued a new mine permit for Brohm Mining Corp.'s Anchor Hill Project, which is a fully owned subsidiary of Dakota Mining Corp. The project is estimated to yield about 7.8 million tons of ore and 7.5 tons of gold during a 6-year period. The permit incorporates stringent requirements for characterizing the reactivity of ore and waste rock and for preventing acid mine drainage. Brohm's Anchor Hill Project offers the added benefit of improving upon a previously permitted reclamation plan to mitigate acid mine drainage at the company's adjacent Gilt Edge Mine, which was permitted in 1986 and is now in its closure stage.

In November 1996, Wharf Resources Ltd. submitted a mine permit application for its Clinton Project, which involved 21.6 million tons of ore, 50.3 million tons of waste, and 21.1 tons of proven and probable total gold reserves. The project was scheduled to be presented in front of the State Board of Minerals and Environment in the summer of 1997, and, if permitted, production was projected to continue through 2007. Homestake Mining Co. began construction on the third lift of its Grizzly Gulch tailings dam. The raise is estimated to provide additional storage capacity until 2013. The Golden Reward Mine entered a period of temporary cessation in December 1996 in order to resolve land ownership issues and complete permitting of additional reserves.

In 1996, 435 industrial mineral companies had active mine licenses in South Dakota. An operator must obtain a license in order to mine for sand, gravel, pegmatite minerals, materials used in the process of making cement or lime, or rock to be crushed and used in construction. Sand and gravel was the major nonmetallic industrial mineral commodity produced with 12 million tons reported removed, based on SDGS estimates. Sand and gravel is produced in nearly every county in South Dakota and is used mainly for road construction projects. Sioux Quartzite was the next largest nonmetallic industrial mineral commodity produced with 2.3 million tons reported removed. It is quarried from four locations in southeastern South Dakota, and most of the quartzite is crushed and used in construction. Some larger blocks are used for riprap, railroad ballast, and occasionally for

decorative purposes. Pegmatite mining, mainly in the southern Black Hills, produced 8,636 tons of pegmatite minerals such as feldspar, mica, and rose quartz. The South Dakota Cement Plant reported mining 1.8 million tons of limestone, 134,929 tons of shale, and 33,500 tons of gypsum. A total of 143,000 tons of granite was mined by Dakota Granite Co. and Cold Spring Granite Co. from quarries near Milbank, SD. Because of its beauty, Milbank Granite is used primarily by the building industry and for decorative stone purposes. Much of it goes to international markets. Sales from 1996 production totaled \$19.5 million.

Exploration

Nine exploration permits were issued in 1996 to the following companies: Wharf Resources, Naneco Minerals Inc., Golden Reward Mining Co., REM Co., and Lew and April Wight. Primary minerals explored were gold and silver. A total of 701 test holes, 2 bulk samples, and 1 exploration drift were permitted for exploration in Lawrence and Pennington Counties. Diamond core drilling methods will be used for holes drilled up to 4,570 meters in depth. Reverse circulation, percussion, and rotary drilling methods will be used for shallow holes. In addition to routine fill-in and step-out drilling at existing mines, a renewed exploratory interest was noted in a geologically complex Precambrian iron formation-hosted gold deposit south of Rochford, SD. This site has undergone extensive exploration by other operators in the past and is currently being explored by Naneco Minerals. Results continue to indicate that the deposit, if mined, will primarily be an underground operation.

Environmental Issues

No notices of violation were issued to mining companies during 1996. Based on 1996 performance monitoring results at LAC Minerals Ltd.'s Richmond Hill Mine, reclamation efforts to mitigate acid mine drainage problems that developed in 1992 were successful. Reactive waste rock (3.2 million tons) was relocated from a valley-fill depository, backfilled in the pit from which it was originally mined, and capped in order to isolate the waste from surface runoff and to prevent soluble contaminants from degrading ground water. Relocation and capping were completed 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 carbon dioxide)

monitoring, temperature probes, water quality and aquatic monitoring, and cap settlement surveys, all have indicated that the reclaimed site is performing better than expected. In June 1996, the DENR approved LAC Minerals Ltd.'s closure plan for its three leach pads. Pad closure activities were largely completed in 1996. They included amending spent ore in one heap with alkaline material and capping all three pads.

Brohm Mining Corp. continued efforts at its Gilt Edge Mine to reclaim acid mine drainage, which included treating and discharging acid water collected from the base of the waste rock depository and that which was stored in the pits. Active treatment by a water treatment plant was the most effective way of treating and discharging acid waters at Brohm in 1996. In 1997, forced air evaporation will be pursued as a significant supplemental, less expensive method of reducing acid water stored in the pits. Backfilling of the Gilt Edge Mine pits with nonreactive material from the Anchor Hill project began in 1996 and will continue.

A significant amount of reclamation took place at the large-scale gold mines in 1996. By the end of the year, 175 hectares of land affected by surface mining were reclaimed. Because of concerns over the cumulative impacts of mining in the Black Hills, a law was passed in 1992 requiring that 202 hectares of land attributable to surface mining for gold be reclaimed by September 1, 1997. If the 202-hectare reclamation requirement is not met by that time, no new permits or amendments to existing permits for surface gold mines can be issued. The DENR projects that the required 202 hectares will have been reclaimed by the September deadline. At that time, the State Board of Minerals and Environment will review the effectiveness of the reclamation standards set forth in South Dakota's mining laws and regulations.

¹The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on 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 1996 USGS mineral production data published in this chapter are estimates as of February 1997. For some commodities (for example, 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. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at <http://minerals.er.usgs.gov/minerals/contacts/comdir.html>

²T.V. Durkin, E.H. Holm, and B.A. Regynski of the South Dakota

Department of Environment and Natural Resources' Office of Minerals and Mining jointly authored the text of mineral industry information submitted by the SDGS.

³All tons are metric unless otherwise specified.

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

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1994		1995		1996 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clay (common)	W	W	136	W	106	W
Gemstones	NA	110	NA	173	NA	W
Gold 3/ kilograms	W	W	17,100	214,000	W	W
Sand and gravel (construction)	7,700	23,700	8,730	26,200	9,540	31,000
Silver 3/ metric tons	4	696	4	668	7	1,190
Stone (crushed) 4/	5,490	24,500	5,420	25,700	5,800	28,000
Combined value of cement, clays (common), feldspar, iron ore (usable), lime, mica (scrap), stone [crushed granite and miscellaneous (1995-96), crushed miscellaneous (1994), dimension granite], and values indicated by symbol W	XX	274,000	XX	65,300	XX	293,000
Total	XX	323,000	XX	332,000	XX	353,000

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

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

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

4/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
SOUTH DAKOTA: 1/ CRUSHED STONE 2/ SOLD OR USED BY PRODUCERS
IN 1995, BY USE 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone 4/	249	\$1,540	\$6.20
Coarse aggregate, graded:			
Concrete aggregate, coarse	359	1,870	5.20
Bituminous surface-treatment aggregate	143	852	5.96
Railroad ballast	108	576	5.33
Coarse and fine aggregates:			
Graded road base or subbase	344	1,570	4.57
Other construction materials 5/	398	1,620	4.06
Chemical and metallurgical:			
Cement manufacture	(6/)	(6/)	1.70
Lime manufacture	(6/)	(6/)	4.51
Glass manufacture	(6/)	(6/)	19.46
Unspecified: 7/			
Actual	1,990	12,100	6.10
Estimated	709	3,150	4.45
Total	5,420	25,700	4.74

1/ To avoid disclosing company proprietary data; "District tables were not produced in 1995."

2/ Includes limestone and quartzite; excludes granite and miscellaneous stone from State total to avoid disclosing company proprietary data.

3/ Data are rounded to three significant digits; may not add to totals shown.

4/ Includes filter stone and other coarse aggregate.

5/ Includes bituminous aggregate (coarse), crusher run or fill or waste, stone sand (bituminous mix or seal), and screening (undesignated).

6/ Withheld to avoid disclosing company proprietary data; included in "Total."

7/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 3
SOUTH DAKOTA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1994 2/				1995 3/			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	5	2,850	\$9,520	\$3.34	4	2,680	\$9,550	\$3.56
Quartzite	5	2,640 r/	15,000	5.67 r/	6	2,740	16,200	5.90
Total	XX	5,490 r/	24,500	4.46 r/	XX	5,420	25,700	4.74

r/ Revised. XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Excludes miscellaneous stone from State total to avoid disclosing company proprietary data.

3/ Excludes granite and miscellaneous stone from State total to avoid disclosing company proprietary data.

TABLE 4
SOUTH DAKOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1995,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 2/	902	\$4,680	\$5.18
Asphaltic concrete aggregates and other bituminous mixtures	256	1,010	3.95
Road base and coverings 3/	4,100	10,500	2.56
Fill	618	1,140	1.85
Snow and ice control	32	117	3.66
Other 4/	54	190	3.52
Unspecified: 5/			
Actual	691	2,620	3.79
Estimated	2,080	5,940	2.86
Total or average	8,730	26,200	3.00

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes plaster and gunite sands.

3/ Includes road and other stabilization (cement).

4/ Includes railroad ballast.

5/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 5
SOUTH DAKOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1995,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	313	1,830	W	W	W	W	312	1,340
Asphaltic concrete aggregates and road base materials	--	--	W	W	W	W	129	366
Roadbase and coverings 3/	870	1,780	841	2,130	842	2,210	1,540	4,380
Fill	--	--	5	9	145	338	469	796
Snow and ice control	4	43	--	--	--	--	28	74
Railroad ballast	--	--	--	--	W	W	--	--
Other miscellaneous uses	8	13	112	676	328	1,610	10	49
Unspecified: 4/								
Actual	153	436	69	115	52	140	417	1,930
Estimated	476	1,460	534	1,500	446	1,330	625	1,670
Total	1,820	5,550	1,560	4,430	1,810	5,620	3,530	10,600

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes plaster and gunite sands.

3/ Includes fill and road and other stabilization (cement).

4/ Includes production reported without a breakdown by end use and estimates for nonrespondents.