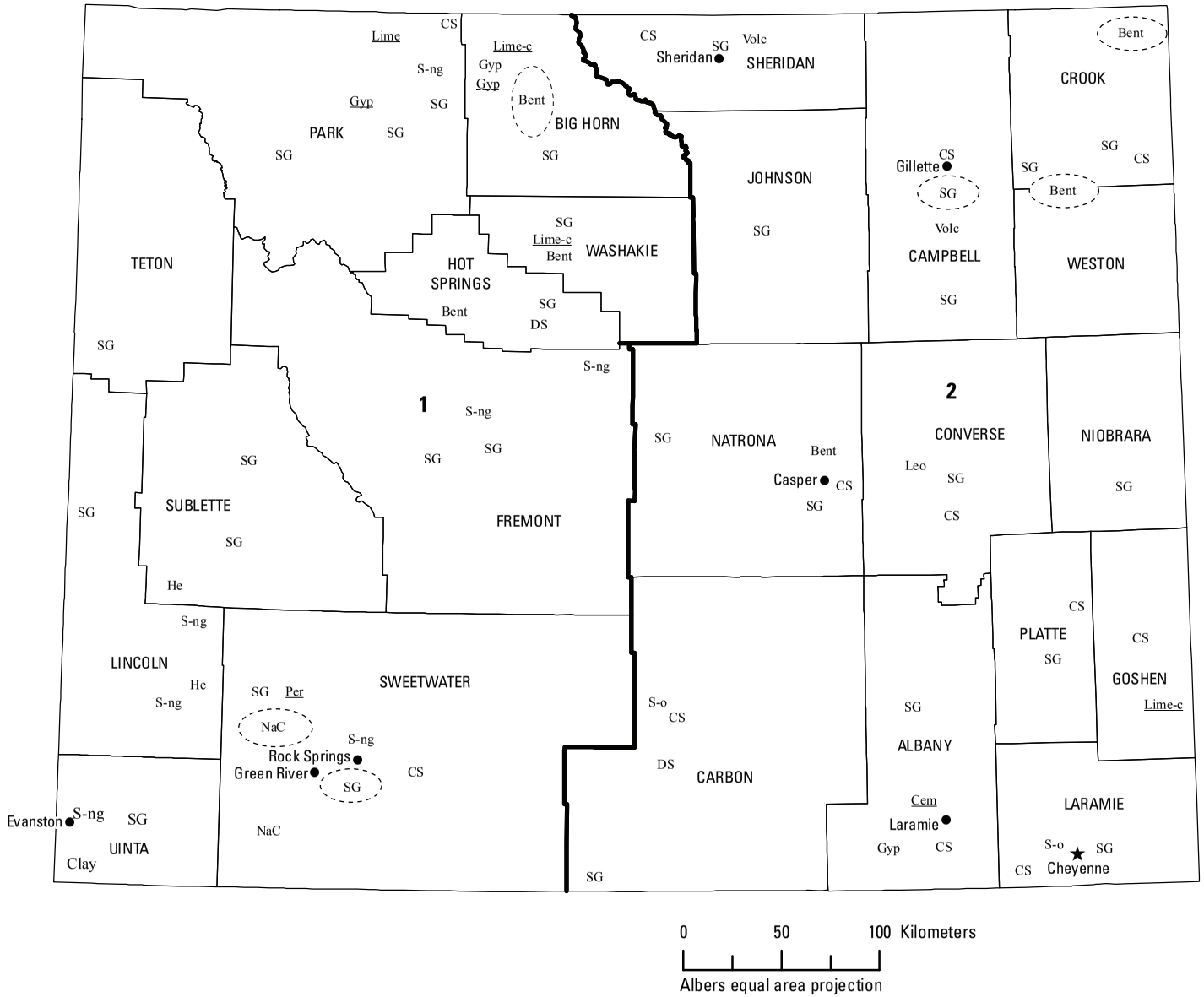
2009 Minerals Yearbook

WYOMING [ADVANCE RELEASE]

U.S. Department of the Interior
U.S. Geological Survey

July 2013
Revised July 2013

WYOMING



LEGEND

County boundary
★ Capital
● City
1 Crushed stone/sand and gravel district boundary

MINERAL SYMBOLS
(Principal producing areas)

Bent	Bentonite
Cem	Cement plant and quarry
Clay	Common clay
CS	Crushed stone
DS	Dimension stone
Gyp	Gypsum
Gyp	Gypsum plant
He	Helium
Leo	Leonardite
Lime	Lime plant
Lime-c	Lime plant (captive)
NaC	Sodium carbonate
Per	Perlite plant
SG	Construction sand and gravel
S-ng	Sulfur (natural gas)
S-o	Sulfur (oil)
Volc	Volcanic cinder

Concentration of mineral operations

Source: Wyoming State Geological Survey/U.S. Geological Survey (2009).

The Mineral Industry Of Wyoming

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

In 2009, Wyoming's nonfuel raw mineral production[1] was valued at $1.8 billion, based upon annual U.S. Geological Survey (USGS) data. This was a $230 million, or 11%, decrease from the State's total nonfuel mineral production value of $2.03 billion in 2008, which was up almost $277 million, or 16%, from a total of $1.76 billion in 2007. Even though the State's total production value was down in 2009 compared to that of 2008, the State rose in rank to 10th in 2009 from 11th in 2008, which in turn was up from 14th in 2007, among the 50 States in total nonfuel raw mineral production value. This is the highest rank for the State since 1992. In 2009, Wyoming accounted for 3.05% of the U.S. total production value, up from 2.8% in 2008. For the fourth consecutive year, the State ranked second in the Nation for the per capita production value of its nonfuel mineral industry. With a total population increase of 11,000, up to 544,000 in 2009 from 533,000 in 2008, the production value per capita was about $3,310, a decline of $470 per person, but 17 times the national average of $192 per capita.

Soda ash remained Wyoming's leading nonfuel mineral, by production value, followed by Grade-A helium, bentonite clay, construction sand and gravel, crushed stone, and portland cement. Together, these six mineral commodities have accounted for approximately 99% of the State's total nonfuel raw mineral production value since 2005.

Of the eleven mineral commodities produced in Wyoming in 2009, all but three declined in production value. The largest increase in production and production value took place with crushed stone, up approximately $18 million to over $75 million in 2009 from $57 million in 2008, followed by common clays, up $15,000, and gemstones, which saw no change in production value between 2008 and 2009. The quantity of crushed stone produced in Wyoming increased by 3.9 million metric tons (Mt) to 16 Mt from 12.1 Mt. This is a 10-year maximum for crushed stone production in the State: from 1999 to 2005, the State averaged 5.8 Mt of crushed stone production and 12.4 Mt from 2006 to 2008. The lowest level of crushed stone production in Wyoming was 2001, where only 4.4 Mt was produced.

Soda ash, which had the largest increase in production value—almost 19%—of any mineral commodity produced in the State from 2007 to 2008, saw the largest decrease in production value, almost 12%, in 2009 (actual values withheld—company proprietary data). Soda ash was followed by decreases in the production values of bentonite clay, portland cement, construction sand and gravel, and Grade–A helium.

Since at least 1986,[2] Wyoming continued to be ranked first in soda ash and bentonite clay production, and since at least 1987, second in Grade-A helium production. Since 2005, Wyoming has been one of only two soda ash-producing States, with California producing a significantly smaller amount. In 2009, the United States continued to be the world's leading producer of soda ash from natural sources and the second leading producer, after China, of natural and synthetic soda ash. Sweetwater County hosts the world's largest known deposit of trona, the major ore for soda ash production.

The Wyoming State Geological Survey[3] (WSGS) provided the following narrative information. Production data in the text that follows are reported by the WSGS and are based on the agency's own surveys and estimates. They may differ from production figures reported to the USGS.

Exploration and Development

Industrial Minerals

Gemstones.—Amateur rock collectors continued to comprise the majority of gemstone activity in Wyoming in 2009. Many rock and mineral clubs reported growth for those interested in low-budget activities, especially for families. Amateur interest ranged across the State's wide variety of precious and semiprecious gemstones, including chalcedony, agate, jade, corundum, and other rock types for both lapidary and academic interests.

Commercial activity, after the economic downturn in 2008, remained at low levels in 2009. Minor commercial collection of jade and various lapidary materials was reported across the State, but no significant production occurred. Individual prospectors continued to search for kimberlite and diamonds but no companies pursued larger, more organized samplings or other exploration activities. Previously held kimberlite or diamond claims appeared to have been maintained. The partial recovery of rough diamond prices in late 2009 and the predicted continued recovery in 2010 suggested a short-term resumption of more serious diamond exploration in the State.

Metals

Overview.—Metals exploration in Wyoming remained at relatively low levels during 2009 in response to the overall

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the 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 2009 USGS mineral production data published in this chapter are those available as of September 2011. All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—can be retrieved over the Internet at URL http://minerals.usgs.gov/minerals.

[2]The U.S. Bureau of Mines began to publish detailed mineral commodity rankings among States in the 1986 edition of the Minerals Yearbook.

[3]Wayne M. Sutherland, Geologist (gemstones, metals, and economic geology specialist), and Robert Gregory, Geologist (uranium and minerals specialist) of the Wyoming State Geological Survey, coauthored the text of the State mineral industry information.

economy. Copper and platinum-group metals prices, even after substantially recovering during most of 2009 after their fall in late 2008 and early 2009, remained insufficient to stimulate renewed exploration during 2009. Exploration activities for gold and rare earths, however, continued.

Gold.—Gold prices remained sufficiently high in 2009 to continue exploration, though efforts remained limited. Individual prospectors continued their activities across the State, but only one company, Evolving Gold Corp. (Vancouver, British Columbia, Canada), garnered widespread news media coverage for their exploration project in the State.

After confirming the coexistence of high-grade gold zones surrounded by a large halo of low-grade gold mineralization at the Rattlesnake Hills project west of Casper in Natrona County, Evolving Gold Corp. drilled almost 30,000 meters (m) in 78 holes in 2009. The company's exploration budget was reported as strong (Evolving Gold Corp., 2009a). Drilling results from the company's two target areas, Antelope Basin and North Stock, continued to generate long intercepts of potential bulk tonnage gold mineralization. Intercepts included 121 m at 1.15 grams per metric ton (g/t) (0.034 troy ounces per short ton (oz/T)) gold in drill hole RSC–049, and 128 m at 1.09 g/t (0.032 oz/T) gold in drill hole RSC–043, which included 5 m at 10.2 g/t (0.297 oz/T). The company's 2009 field sampling and mapping projects identified five additional new gold targets in the project area, which the company plans to drill in 2010 while continuing to delineate the main targets. The company planned to complete and release an updated Canadian National Instrument 43–101 report during the second quarter of 2010 (Evolving Gold Corp., 2009b). The NI 43–101 report is a Canadian Securities rule designed to ensure that the public disclosure of information, such as resource estimates, related to publicly traded mining-related stocks, achieves a reasonable degree of reliability so as to not mislead investors.

Golden Predator Royalty and Development Co. (a subsidiary of Golden Predator Mines Inc., of Vancouver, British Columbia, Canada) announced the lease of the Mineral Hill property, comprised of 20 patented and 69 unpatented mining claims in the Mineral Hill District of Crook County, in the extreme northeastern portion of the State. The Mineral Hill District is an alkaline gold system, similar to Evolving Gold Corp.'s Rattlesnake Hills project (Golden Predator Royalty and Development Corp., 2009).

Rare Earths.—In March, Rare Element Resources Ltd. (White Rock, British Columbia, Canada) released its NI 43–101-compliant mineral resource estimate of rare earth elements (REE) contained in the Bull Hill Southwest deposit of its Bear Lodge project. The company reported an initial 9.8-million-ton inferred mineral resource averaging 4.07% rare-earth oxides, with a cutoff grade of 1.5%. The estimate only addressed dike sets in the Bull Hill Southwest area where there is additional potential for expansion of the resource. Further potential exists for definition of other resources within the Bear Lodge property (Rare Element Resources Ltd., 2009a). The company released its NI 43–101 report in April, reporting that rare-earth oxides were present in the Bull Hill deposit—in order of decreasing abundance, CeO_2, La_2O_3, Pr_6O_{11}, Sm_2O_3, and others. More than 50% of the REE distribution on the property includes lanthanum, neodymium, praseodymium, and samarium (Rare Element Resources Ltd., 2009b). The company also announced the drill program in June (Rare Element Resources Ltd., 2009c) and announced a preliminary economic assessment and scoping study of the development potential of the property in October. The study, scheduled to be completed by midyear 2010, was expected to address metallurgy, environment analyses, permitting, as well as preliminary mine, plant, and geotechnical engineering (Rare Element Resources Ltd., 2009d).

Commodity Review

Industrial Minerals

Bentonite.—Bentonite production is estimated to be down about 27% from that of 2008. Nationally, uses of the material include as absorbents (accounting for 31% of total U.S. bentonite production), in domestic oil and gas development as drilling mud (20%), in iron ore pelletizing (15%), and foundry sand (15%) (Virta, 2011, p. 18.11).

Soda Ash.—Soda ash [also known as sodium carbonate (Na_2CO_3)] is refined from trona. In southwestern Wyoming, trona is found as an evaporite mineral in the Wilkins Peak Member of the Eocene Green River Formation. The Wilkins Peak Member consists of trona beds up to about 12 m (40 feet) thick separated intermittently by shale-like sediments, sandstone, and carbonate rocks at depths between roughly 180–610 m (about 600–2,000 feet). Approximately 1.8 metric tons (t) of trona, which is roughly 70% sodium carbonate, are required to produce 1 t of refined soda ash. Wyoming hosts the world's largest trona deposits with an estimated resource of more than 115 billion* metric tons (127 billion short tons) (Leigh, 1998). Four companies operate five plants in the Green River Basin in southwestern Wyoming—primarily Sweetwater County—and accounted for the vast majority of the approximately 9.3 Mt of all soda ash produced in the United States in 2009. Total U.S. production in 2009 was valued over $1.3 billion. Reduced production in 2009 resulted from the worldwide economic downturn that began in 2007. Poor market conditions, resulting from reduced demand for automotive and housing glass and fiberglass during 2009, combined with competition from the heavily subsidized Chinese synthetic soda ash industry, caused cutbacks that eventually cost about 100 jobs in southwestern Wyoming's trona patch (Gearino, 2010). Glass (48%), chemicals (29%), and soap and detergents (10%) accounted for an estimated 87% of the end uses for soda ash in 2009 (Kostick, 2010).

Stone, Crushed.—Pete Lien & Sons, Inc. (Rapid City, SD) remained in the permitting process for the new high-purity limestone quarry 16 km north of Laramie. The limestone is part of the Casper Formation, which crops out extensively along the western flank of the Laramie Mountains. Construction of the quarry and plant was expected to begin in late 2009, but did not commence by yearend and had no announced schedule. The plant was to employ about 50 workers.

---

*Correction posted on July 24, 2013.

Government Activities

The WSGS continued to be an active participant in the STATEMAP program. STATEMAP is a component of the congressionally mandated National Cooperative Geologic Mapping Program (NCGMP), through which the USGS distributes Federal funds to support geologic mapping efforts through a competitive funding process. The NCGMP has three primary components: (1) FEDMAP, which funds Federal geologic mapping projects; (2) STATEMAP, which is a matching-funds grant program with State geological surveys; and (3) EDMAP, a matching-funds grant program with universities that has a goal to train the next generation of geologic mappers. For additional information on the State's minerals and minerals production, geologic maps, recently printed and digital publications, and further information on the geology of Wyoming, visit the WSGS home page at http://www.wsgs.uwyo.edu/.

References Cited

Evolving Gold, 2009a, Evolving Gold Corp. closes $11.1 million private placement financing: Vancouver, British Columbia, Canada, Evolving Gold Corp. press release, November 25. (Accessed February 4, 2013, at http://www.bloomberg.com/apps/news?pid=conewsstory&tkr=EVOGF:US&sid=a4P_dumu7sQE.)

Evolving Gold, 2009b, EVG infill drilling demonstrates continuity of bulk tonnage targets at Rattlesnake Hills, Wyoming: Vancouver, British Columbia, Canada, Evolving Gold Corp. press release, December 3. (Accessed February 4, 2013, at http://www.bloomberg.com/apps/news?pid=conewsstory&tkr=EVG:CN&sid=al0f9.r5M3Uc.)

Gearino, J., 2010, Soda ash industry struggles—[WY] producers hope for some improvement in 2010: Casper [WY] Star-Tribune, January 3. (Accessed February 4, 2013, at http://trib.com/news/state-and-regional/soda-ash-industry-struggles/article_a21e24c0-f83b-11de-a51a-001cc4c03286.html.)

Golden Predator Royalty and Development Corp., 2009, Golden Predator acquires Mineral Hill alkali gold property, Crook County, WY: Vancouver, British Columbia, Canada, Golden Predator Royalty and Development Corp. press release, August 12. (Accessed June 25, 2013, at http://www.marketwire.com/press-release/Golden-Predator-Acquires-Mineral-Hill-Alkalic-Gold-Property-Crook-County-Wyoming-TSX-VENTURE-GPD-1029605.htm.)

Kostick, D.S., 2010, Soda ash: U.S. Geological Survey Mineral Commodity Summaries 2010, p. 148–149. (Accessed February 4, 2013, at http://minerals.usgs.gov/minerals/pubs/commodity/soda_ash/mcs-2010-sodaa.pdf.)

Leigh, T.R., 1998, Wyoming trona—An overview of the geology, *in* Proceedings of the First International Soda Ash Conference: Wyoming State Geological Survey Public Information Circular 40, v. II, 215 p.

Rare Element Resources Ltd., 2009a, Rare Element reports more than 125% increase *in* rare-earth mineral resource at Bear Lodge: White Rock, British Columbia, Canada, Rare Element Resources Ltd. press release, March 23. (Accessed February 4, 2013, at http://www.rareelementresources.com/s/NewsReleases.asp?ReportID=342327&_Type=News-Releases&_Title=Rare-Element-Reports-More-than-125-Increase-in-Rare-Earth-Mineral-Resource-...)

Rare Earth Resources Ltd., 2009b, Rare Element releases NI 43–101 technical report in support of Bear Lodge rare-earth resource estimate: White Rock, British Columbia, Canada, Rare Element Resources Ltd. press release, April 15. (Accessed February 4, 2013, at http://www.rareelementresources.com/s/NewsReleases.asp?ReportID=344953&_Type=News-Releases&_Title=Rare-Element-Releases-NI-43-101-Technical-Report-in-Support-of-Bear-Lodge-R...)

Rare Earth Resources Ltd., 2009c, Rare Element announces 2009 rare-earth exploration program: White Rock, British Columbia, Canada, Rare Element Resources Ltd. press release, June 15. (Accessed February 4, 2013, at http://www.rareelementresources.com/s/NewsReleases.asp?ReportID=352451&_Type=News-Releases&_Title=Rare-Element-Announces-2009-Rare-Earth-Exploration-Program)

Rare Earth Resources Ltd., 2009d, Rare Element begins a scoping study on rare-earth-element potential at Bear Lodge and updates the exploration status: White Rock, British Columbia, Canada, Rare Element Resources Ltd. press release, October 20. (Accessed February 4, 2013, at http://www.rareelementresources.com/s/NewsReleases.asp?ReportID=367980&_Type=News-Releases&_Title=Rare-Element-Begins-a-Scoping-Study-on-Rare-Earth-Element-Potential-at-Bear...)

Virta, R.L., 2011, Clay and shale, *in* Metals and minerals: U.S. Geological Survey Minerals Yearbook 2009, v. I, June, p. 18.1–18.23. (Accessed April 2, 2013, at http://minerals.usgs.gov/minerals/pubs/commodity/clays/myb1-2009-clays.pdf.)

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN WYOMING[1, 2]

(Thousand metric tons and thousand dollars)

Mineral	2007		2008		2009	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Bentonite	4,250	227,000	4,400 r	233,000 r	3,230	172,000
Common	59	226	37	89	41	104
Gemstones, natural	NA	15	NA	14	NA	14
Sand and gravel, construction	19,500 r	98,300 r	17,500 r	103,000 r	17,200	92,200
Stone, crushed	12,500	61,400	12,100	57,100	16,000	75,400
Combined values of cement (portland), gypsum (crude), helium (Grade–A), lime, soda ash, stone [dimension (2008–09)], zeolites (2007)	XX	1,370,000	XX	1,640,000	XX	1,460,000
Total	XX	1,760,000	XX	2,030,000 r	XX	1,800,000

[r]Revised. NA Not available. 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.

TABLE 2
WYOMING: CRUSHED STONE SOLD OR USED, BY TYPE[1]

Type	2008 Number of quarries	2008 Quantity (thousand metric tons)	2008 Value (thousands)	2009 Number of quarries	2009 Quantity (thousand metric tons)	2009 Value (thousands)
Limestone[2]	16	3,800 r	$22,700 r	13	3,420	$21,800
Granite	1	2,330	14,200	--	--	--
Volcanic cinder and scoria	12	3,290 r	18,500 r	9	6,880	34,400
Miscellaneous stone	3 r	2,680 r	1,710 r	4	5,710	19,300
Total	XX	12,100	57,100	XX	16,000	75,400

[r]Revised. XX Not applicable. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes limestone-dolomite reported with no distinction between the two.

TABLE 3
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2009, BY USE[1]

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
Construction:		
Coarse aggregate (+ 1½ inch), other	W	W
Coarse aggregate, graded:		
Concrete aggregate, coarse	W	W
Bituminous surface-treatment aggregate	W	W
Other graded coarse aggregate	W	W
Coarse and fine aggregates:		
Graded road base or subbase	101	950
Unpaved road surfacing	W	W
Terrazzo and exposed aggregate	W	W
Crusher run or fill or waste	W	W
Chemical and metallurgical, cement manufacture	W	W
Unspecified:[2]	10,900	49,700
Reported	14,900	69,200
Estimated	102	605
Total	16,000	75,400

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]Reported production without a breakdown by end use.

TABLE 4
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2009,
BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction:						
Coarse aggregate (+ 1½ inch)[2]	--	--	W	W	--	--
Coarse aggregate, graded[3]	--	--	W	W	--	--
Coarse and fine aggregate[4]	(5)	(5)	W	W	--	--
Chemical and metallurgical[6]	--	--	W	W	--	--
Unspecified:[7]						
Reported	209	1,640	11,900	66,700	2,850	868
Estimated	--	--	102	605	--	--
Total	209	1,640	12,900	72,900	2,850	868

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 other coarse aggregate.
[3]Includes concrete aggregate (coarse), bituminous surface-treatment, and other graded coarse aggregate.
[4]Includes crusher run or fill or waste, graded road base or subbase, unpaved road surfacing, and terrazzo and exposed aggregate.
[5]Withheld to avoid to avoid disclosing company proprietary data; included with "Unspecified: Reported."
[6]Includes cement manufacture.
[7]Reported and estimated production without a breakdown by end use.

TABLE 5
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2009,
BY MAJOR USE CATEGORY[1]

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	457	$5,940	$13.01
Plaster and gunite sands	168	896	5.33
Asphaltic concrete aggregates and other bituminous mixtures	336	4,220	12.57
Road base and coverings[2]	2,360	17,000	7.20
Fill	193	965	5.00
Snow and ice control	7	148	21.14
Railroad ballast	8	75	9.38
Other miscellaneous uses[3]	374	1,680	4.49
Unspecified:[4]			
Reported	11,600	51,100	4.39
Estimated	1,660	10,100	6.10
Total or average	17,200	92,200	5.36

[1]Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.
[2]Includes road and other stabilization, lime.
[3]Includes filtration.
[4]Reported and estimated production without a breakdown by end use.

TABLE 6
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2009,
BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate (including concrete sand)[2]	W	W	W	W	--	--
Asphaltic concrete aggregates and road base materials[3]	1,290	11,200	1,010	6,930	396	3,020
Fill	141	624	24	216	29	125
Other miscellaneous uses[4]	866	7,320	144	1,350	5	69
Unspecified:[5]						
Reported	3,220	15,200	3,180	16,500	5,240	19,400
Estimated	669	4,230	993	5,920	--	--
Total	6,180	38,600	5,350	31,000	5,670	22,600

W Withheld to avoid disclosing company proprietary data; included in "Other miscellaneous uses." -- 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 road and other stabilization (cement).

[4]Includes filtration, railroad ballast, and snow and ice control.

[5]Reported and estimated production without a breakdown by end use.