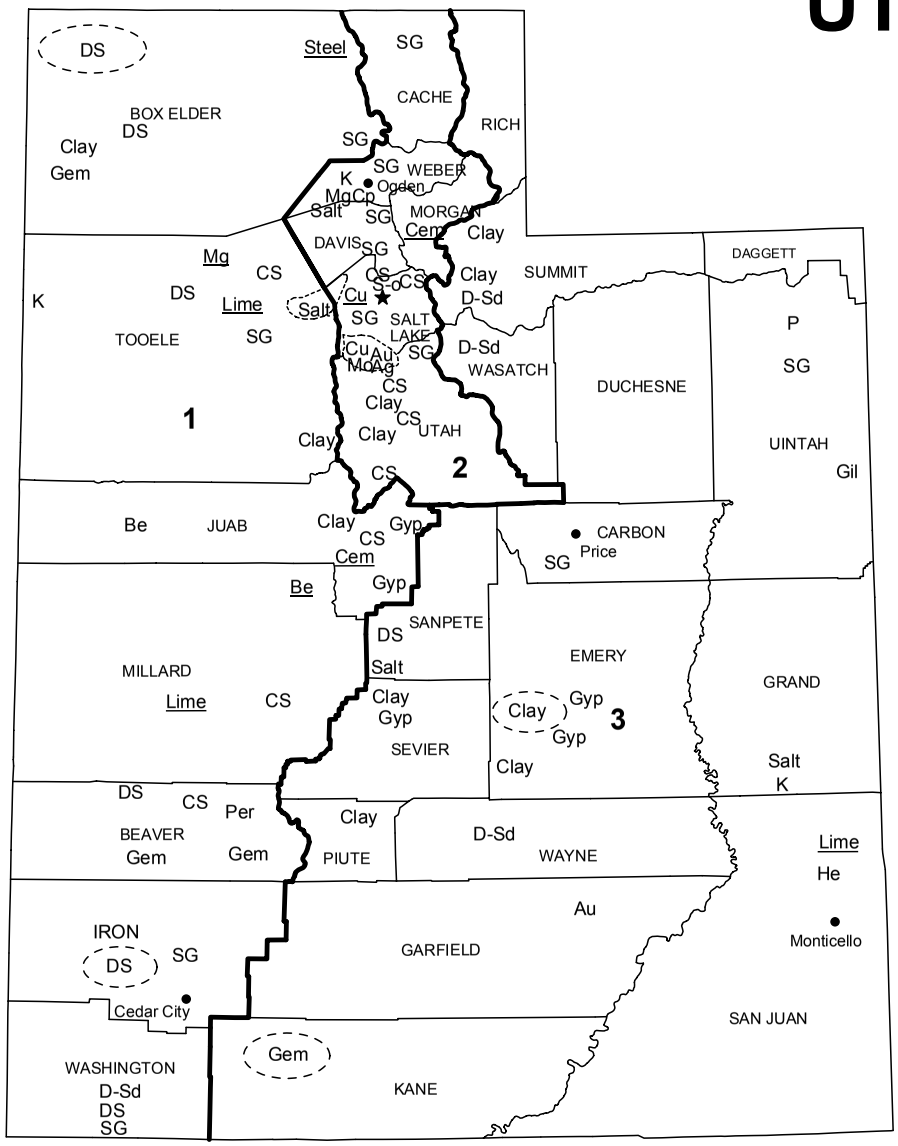
UTAH



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Ag	Silver
Au	Gold
Be	Beryllium
Be	Beryllium plant
Cem	Cement plant
Clay	Common clay
CS	Crushed stone
Cu	Copper
Cu	Copper plant
D-Sd	Dimension sandstone
DS	Dimension stone
Gem	Gemstones
Gil	Gilsonite
Gyp	Gypsum
He	Helium
K	Potash
Lime	Lime plant
Mg	Magnesium metal plant
MgCp	Magnesium compounds
Mo	Molybdenum
P	Phosphate rock
Per	Perlite
S-o	Sulfur (oil)
Salt	Salt
SG	Construction sand and gravel
Steel	Steel plant
⬭	Concentration of mineral operations

Source: Utah Geological Survey/U.S. Geological Survey (2004)

THE MINERAL INDUSTRY OF UTAH

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

In 2004, Utah's nonfuel raw mineral production was valued[1] at $1.94 billion, based upon annual U.S. Geological Survey (USGS) data. This was an increase of nearly 43% compared with the State's total nonfuel mineral value for 2003,[2] which was up nearly 10% from 2002. The State rose to 6th from 8th in rank among the 50 States in total nonfuel mineral production value and accounted for more than 4% of the U.S. total value.

Metals accounted for about 69% of Utah's nonfuel mineral production value, and copper accounted for more than one-half of the State's entire metal value. In 2004, the most substantial changes were in the metals sector—the value of molybdenum concentrates was up by more than 400% and the values of copper and magnesium metal were up more than 40% each. The upward trend in molybdenum concentrate prices began in December 2002 and continued throughout 2003 and 2004. For example, the average annual price of molybdic oxide rose from $8.27 per kilogram in 2002 to $11.75 per kilogram in 2003 to $36.73 per kilogram in 2004 and reached $68.86 per kilogram in December 2004. Molybdenum concentrate prices remained high and continued to increase, although more gradually, during the early months of 2005. (Prices were reported in Platts Metals Week in dollars per pound of contained molybdenum.)

Other mineral commodities with significant increases in value in 2004 included potash, portland cement, construction sand and gravel (up $12 million), gold, phosphate rock, silver, and crushed stone (up about $5 million), lime, and common clays (up $2.3 million) (descending order of change) (table 1).

In 2003, Utah's increase in total value substantially resulted from an increase in copper production, accounting for the largest increase in value for a commodity for the year, value up more than 20%. This was followed by smaller yet significant increases in the values of—in descending order of change—magnesium metal, magnesium compounds, portland cement, construction sand and gravel (value up $9 million, although production was down slightly), salt, molybdenum concentrates, and crushed stone (up $2 million). The only substantial decrease in value was that of gold with significantly smaller decreases taking place in common clays and bentonite (table 1).

In 2004, nearly every commodity showed an increase in production; only bentonite and perlite showed decreases in the quantities produced. Utah continued to be the only State to produce beryllium concentrates and magnesium metal. The State remained second in rank in the quantities of copper and potash produced, as well as, third in molybdenum concentrates and gold, fourth in phosphate rock, silver, and perlite, fifth in bentonite, and sixth in salt. The State decreased to third from second in the production of magnesium compounds and also was a significant producer of portland cement, construction sand and gravel, lime, common clays, and gemstones (commodities listed in descending order of value).

The Utah Geological Survey (UGS)[3] provided the following narrative information. UGS production data were based upon its surveys, estimates, and information gathered from company annual reports. These data may differ from some USGS annual production figures, which were based upon USGS company surveys and estimates.

Exploration and Development Activities

The continued rebound in mineral commodity prices during 2004 significantly encouraged increased activity in the exploration and development sectors. Exploration in Utah began to increase in the last half of 2004, lagging somewhat behind increasing metal prices, and continued to improve into early 2005. During 2004, the Utah Division of Oil, Gas and Mining (DOGM) received 14 new notices of intent (NOIs) for exploration, of which nine were approved. Of the 14 NOI applications, eight were for precious metals, four for industrial minerals, and two for base metals. More than 2,900 claims were staked in Utah during the 2004 calendar year. Land acquisition for mineral exploration was particularly active in Beaver (copper and gold), Emery (uranium), Iron (gold and iron), San Juan (copper and uranium), Tooele (copper and gold), and Washington (gold) Counties. In addition, 84 State mineral leases were issued during the year, more than one-half of which were for metals (William Stokes, mineral resource specialist, Utah School and Institutional Trust Lands Administration, written commun., October 2005).

During 2004, DOGM received 13 large mine permit applications [2 hectares (ha) and larger land disturbance] and 18 new small mine permit applications (less than 2 ha disturbance). The 13 large mine permit applications included 3 new mine applications and 10 applications to change from a small mine permit to a large mine permit. All the small mine permits were for new operations.

Development activity started slowly within the State, but in the last half of 2004, several developments were initiated that will significantly add to Utah's metal mining sector. Two of the more significant developments were the beginning of construction of the

[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 2004 USGS mineral production data published in this chapter are those available as of December 2005. All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—also can be retrieved over the Internet at URL http://minerals.usgs.gov/minerals.

[2] Values, percentage calculations, and rankings for 2003 may differ from the Minerals Yearbook, Area Reports: Domestic 2003, Volume II, owing to the revision of preliminary 2003 to final 2003 data. Data and rankings for 2004 are considered to be final and are not likely to change significantly.

[3] Kenneth Krahulec, Geologist, and Roger Bon, Industry Outreach Specialist, of the Utah Geological Survey authored the text of the State mineral industry information provided by that State agency.

Constellation Copper (Constellation) Corp.'s Lisbon Valley copper mine in southeastern Utah and the Kennecott Utah Copper Corp.'s (Kennecott) announcement of a $170 million expansion at its Bingham Canyon Mine (copper-molybdenum-gold-silver), 32 km southwest of Salt Lake City, that added nearly 148 million metric tons (Mt) of better-than-average-grade copper-molybdenum ore to the existing reserve. The Bingham Canyon Mine, which produced more than one-half of Utah's total value of all nonfuel minerals (more than $1 billion), celebrated a century of copper-gold-silver production in 2004. The main metal exploration and development areas are discussed below.

Bingham District

Work at Kennecott's Bingham Canyon Mine in 2004 focused on extending the mine life beyond 2013. The thrust of this work was a geotechnical program, infill resource-definition drilling in the pit, and mine dewatering. The geotechnical program consisted of geological mapping and modeling, core drilling, inclinometer and piezometer installation, and water well and horizontal drain drilling.

The economic and engineering study for a $170 million pit expansion to the northeast was approved in February 2005. In addition to the pit expansion, Kennecott will purchase new equipment, expand operations at the company's Copperton concentrator, and relocate and build facilities. The new pit design added nearly 150 Mt of better-than-average-grade copper-molybdenum ore that will extend mine life until 2017, and does not preclude future underground mining. Other mine options currently being considered are an additional open pit expansion, underground block caving, underground skarn mining, or any combination of the above. The targeting of deep porphyry and skarn mineralization was planned for 2005 (Rio Tinto, 2005, p. 48).

Gold Hill District

Dumont Nickel, Inc. continued exploration in the old Gold Hill mining district in western Tooele County in 2004 that it began in 2003. Dumont focused on bulk-minable gold and gold-copper targets, overall assembling an 87-square-kilometer (km^2) property position. The company defined five project areas within the district: the Kiewit property (gold), the old Cane Springs Mine area (a gold-bearing shear zone), the IBA property in the southwestern part of the district (copper-silver-gold), the Clifton Shears zone area (a northeast-trending zone with more than 40 shear zones that contained gold, silver, lead, and zinc), and an unspecified jasperoid silica-breccia zone area (gold). Work in 2003 and 2004 included drilling 16 core holes totaling 2,260 m, collecting 5,200 soil samples over a 54 km^2 area, and taking 2,500 rock samples over a 24 km^2 area. The most successful exploration work in 2004 took place in the Kiewit area, where the historic Kiewit gold zone of quartz stockwork was delineated in granodiorite. This zone was tested by five holes totaling 465 m of drilling. Two drill sites were chosen 60 m apart, and a fan of three holes was drilled from one site and two from the other. Each of the five holes cut were drilled at between 6.6- to 43.7-m intervals and had 1.0 gram per metric ton (g/t) gold or greater at shallow depths. Additional definition drilling was planned for 2005 (Dumont Nickel, Inc., 2005§[4]).

Iron Springs-Pinto District

In 2004, Palladon (65% joint-venture ownership) and WUCC (35% joint-venture ownership) laid the groundwork for entering into an agreement with Iron Ore Mines LLC to purchase its iron properties in the Iron Springs-Pinto mining district in southwestern Utah for $10 million, which was completed in late January 2005. Iron Ore Mines' property contains two iron deposits, the Comstock/Mountain Lion and the Rex. The Iron Springs-Pinto District has been one of the most productive iron ore districts in the western United States. The bulk of the district's production took place between 1923 and 1995, with its most productive period between 1947 and 1965 while being operated by U.S. Steel Corporation.

The Iron Ore Mines' property contains approximately 2,000 ha of patented mining claims, other fee lands, and an additional 400 ha of unpatented mining claims. The measured reserve remaining in the Comstock/Mountain Lion pits was 25 Mt of ore averaging 47.1% iron with a stripping ratio of 0.3 cubic meters waste per metric ton of ore. The Rex deposit, which has never been mined, contained a measured reserve of 89.1 Mt of ore averaging 39.1% iron with a 15% iron cutoff grade and could be amenable to open pit mining. Near the Comstock/Mountain Lion deposit are several low-grade stockpiles estimated to contain about 12.5 Mt of ore averaging 42% iron (Wray, 2005§).

Lisbon Valley Mining District

The Lisbon Valley mining district in northeastern San Juan County (southeastern Utah) was one of the most active exploration areas in the State in 2004. Companies actively acquired land in the district for copper and uranium, but most actively pursued copper exploration and development. Constellation had the most advanced project in the district where the company was constructing an open pit, heap-leach, solvent extraction – electrowinning (SX-EW) operation. Copper production was expected to begin in September 2005, with full production by yearend. The three currently planned open pits are typically 30 to 46 meters (m) deep with roughly a 0.1% copper cutoff grade. The Utah portion of the Lisbon Valley copper project has a 7-year expected mine life based on a reserve of 33.3 Mt averaging 0.51% copper. Capital costs were projected to be $55 million with an annual cost of $18 million in goods and services, $10 million in taxes, and $9 million in wages for a staff of 146. The Lisbon Valley project is projected to produce 25,000

[4]References that include a section mark (§) are found in the Internet References Cited section.

metric tons per year (t/yr) of copper with cash costs of about $1.10 per kilogram (kg) of copper and a total cost, including overhead, of $1.65 per kilogram. (Parkison and Thorson, 2005; Washnock, 2005). The mine initially will produce about 16,300 metric tons per day (t/d) of ore with a 2.25 to 1 stripping ratio, and at full capacity, the mining rate will be 54,500 t/d of ore.

A used processing plant was purchased and moved from the porphyry molybdenum-copper mine near Tonopah, NV. In 2004, all the facilities were relocated to a laydown yard at Lisbon Valley. Mined ore will pass through a primary and secondary crusher, agglomerated with sulfuric acid to jumpstart the leaching, and then stacked to create the heap-leach pad. The pregnant liquor from the leach pad will then be pumped to the SX-EW facility for processing. The leach pads will be triple-lined and the acid will come from the Kennecott smelter near Salt Lake City. Tests show that the oxide ores are expected to leach in about 30 days, mixed ores (oxide-sulfide) in roughly 120 days, and sulfide ores in more than 150 days (Parkison and Thorson, 2005; Washnock, 2005).

Constellation obtained all required permits from the State, closed on a $33 million financing package, and made an initial deposit on four new Komatsu 730E[5] haul trucks [186-metric ton(t) capacity] and one new Komatsu WA1200 wheel loader (34.3-cubic-meter bucket capacity). The company commenced construction of the foundations for the crushing and SX-EW processing facilities in November 2004. Exploration continued for additional copper reserves, in the mine area and along trend.

Marysvale District

Unico, Inc. continued exploration to delineate zinc-silver-copper-lead-gold resources in the Upper Deer Trail Mine and the PTH Tunnel workings in the Marysvale District in Piute County. Initial work consisted of surface rock-chip sampling and underground confirmation sampling of old mine assays. A preliminary round of 28 reverse-circulation holes testing the Upper Deer Trail Mine served to focus further work to the north and above the existing workings. Phase 2 drilling was designed to test known mineralized horizons in the PTH Tunnel area for new mineralization at depth. In addition to exploration work, significant improvements and additions were made to the mine's surface infrastructure (W.D. Proctor, chief geologist, Unico, Inc., written commun., December 2005).

Milford Area

In late 2003, Palladon Ventures, Ltd. optioned a 65% interest in Western Utah Copper Co.'s (WUCC) Milford area properties in the Rocky, Beaver Lake, San Francisco, and Blue Mountain areas in Beaver County. Palladon initiated an aggressive exploration program of drilling and geophysical surveys in 2004. In total, the company drilled 73 exploration and confirmation holes totaling more than 10 kilometers (km) on its 24,000-ha property. Drilling at the Maria open pit (three holes), the Hidden Treasure Mine (three holes), and the Sunrise ore body (seven holes) confirmed previous mining grades. The best of these stepout holes was PMA-2 at Maria, which cut 46 m of mineralization averaging 1.86% copper with minor gold-silver-molybdenum-tungsten mineralization, and PSU-2 at Sunrise, which intersected 53 m of mineralization running 1.81% copper. Weak supergene chalcocite mineralization was intersected by drilling southwest of the OK Mine (18 holes). Seven holes testing the Comet breccia pipe cut narrow intervals of gold-copper mineralization (Dave Hartshorn, company official, Palladon Ventures Ltd., written commun., December 2005).

The Palladon/WUCC joint venture completed phase I of a two-phase program of detailed induced polarization (IP) and ground magnetic surveying. Phase I covered areas hosting known mineral resources to define the geophysical expression of mineralization and to examine potential extensions of the currently defined resources. The geophysical program showed that significant IP chargeability, resistivity, and magnetic anomalies associated with the known mineralization and provided some potential drill targets at depth. Phase 2 of the program, expected to begin in February 2005, was planned to cover potential copper porphyry areas (Palladon Ventures, Ltd., 2005§).

Tintic District

Atlas Mining Co. was in the process of reopening the old Dragon halloysite mine in the southern part of the Tintic mining district (northeastern Juab County). Halloysite is an unusual, bright-white, microtubular, high-value clay that, because of its distinctive structure, is used in specific ceramic, paint, and other unique applications. Atlas has driven a 90-m-long, 15-degree decline into the halloysite deposit, where they have drifted about 18 m using a small road header, installed a chain crusher (100% to minus 325 mesh), and built an air classifier; the company began test mining in late 2004. Atlas anticipates a mining rate of 900 to 1,800 metric tons per month (t/mo), based on market demand (William Jacobson, President and CEO, Atlas Mining Co., oral commun., November 2005).

Commodity Review

Industrial Minerals

Industrial-minerals production, valued at more than $643 million, was at an alltime high and was the second largest contributor to the value of nonfuel minerals produced statewide in 2004 (behind base metals). The value of industrial minerals has increased substantially during the past 5 years; based upon UGS estimates and surveys it has increased from $500 million in 2000 to $643

[5]Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

million in 2004, a 29% increase. The commodities or commodity groups that realized significant gains included crushed stone and sand and gravel; lime and portland cement; and salines, including magnesium chloride, potash (potassium chloride), salt, and sulfate of potash (SOP). These commodities account for about 90% of the total value of the industrial minerals segment. Other important commodities produced in Utah, in descending order of value, include phosphate, gilsonite, expanded shale, common clay, bentonite, and gypsum.

Bentonite and Clays.—Based upon UGS surveys, approximately 100,000 t of bentonite and about 282,000 t of common clay were produced by eight companies in 2004, which was a 64% increase in the amount of bentonite produced and a 45% increase in common clay compared with 2003. The total value was estimated to be about $6.1 million. Two companies [Western Clay Co. and Redmond Inc. (holding company for Redmond Minerals)] mined bentonite from pits in central Utah, mostly for use as an additive to oil- and gas-drilling fluids, a binder in foundry molds, a pet-waste absorbent (litter-box filler), and a sealant. Statewide, there were 27 mine permits held by clay operators in 2004, many of these mines operated intermittently. In descending order of production, the three largest producers of common clay were Interstate Brick Co., Interpace Industries, and Ash Grove Cement Co. More than 75% of all common clay was used in the manufacture of brick. ECDC Environmental, LLC (ECDC) intermittently produced clay for use at its waste disposal facility near the town of East Carbon in Carbon County. Sufficient stockpiled material will preclude any additional clay mining by ECDC in the foreseeable future.

Construction Sand and Gravel and Crushed Stone.— Construction sand and gravel and crushed stone (including limestone and dolomite) were the leading contributors to the value of industrial minerals produced in Utah during 2004 (up from the third-highest in 2003); these commodities had an estimated value of $201 million, which was about $61 million (44%) more than in 2003. These materials are produced in nearly every county in Utah by commercial operators and by Federal, State, and county agencies. Because of the large number of operations (approximately 122 active sand and gravel pits and 20 stone quarries), the UGS did not send production questionnaires to this group. However, production data for 2004, as compiled by the USGS, showed production of 29.8 Mt of sand and gravel with a value of $125 million and 8.0 Mt of crushed stone with a value of nearly $45 million. Crushed stone production included raw material for cement and lime plants. In comparison, 2003 values were 27.4 Mt of sand and gravel and 7.8 Mt of crushed stone.

Gilsonite.—Gilsonite production for 2004 of about 63,600 t (up from nearly 52,000 t in 2003) was estimated to be valued at approximately $22.3 million. Gilsonite is an unusual solid hydrocarbon that has been mined in Utah for more than 100 years. All the gilsonite mines were located in southeastern Uintah County. The three companies that produced gilsonite were, in descending order of production, American Gilsonite Co., Zeigler Chemical and Minerals Co., and Lexco, Inc.

Gypsum.—In 2004, six companies produced about 380,000 t of gypsum (nearly 32,000 t more than in 2003) valued at approximately $2.6 million. In descending order of production, the three largest producers were U.S. Gypsum Co., H.E. Davis and Sons, and Nephi Gypsum, Inc. U.S. Gypsum operated the only active wallboard plant in Utah near the town of Sigurd in Sevier County. The Georgia-Pacific Gypsum Corp. plant, which was also near Sigurd, closed in 2002 and the company's mines in Utah operated only intermittently. Georgia-Pacific shifted wallboard manufacturing to the company's Las Vegas, NV, facility.

Most gypsum produced in Utah was used for making wallboard, but several operators supplied raw gypsum to regional cement companies, where it was used as an additive to retard the setting time of cement, and to the agricultural industry for use as a soil conditioner.

Lime and Portland Cement.—Lime and portland cement were the second-leading industrial minerals by value that were produced in 2004 (down from first in 2003), with a combined value of $180 million, which was about $13 million (8%) more than 2003. Lime production was about 12% higher in 2004 than in 2003, with an estimated production of more than 600,000 t. There were two suppliers of lime in Utah, with a combined capacity of more than 900,000 t/yr—Graymont, which was approximately 56 km southwest of Delta in Millard County and produced dolomitic quicklime and high-calcium quicklime; and Chemical Lime Co., which was about 13 km northwest of Grantsville in Tooele County and produced dolomitic quicklime and hydrated lime. Both operations served markets in Utah and the surrounding States. An additional 13 to 15 operators quarried about 2 Mt of limestone and dolomite in 2004, which was used mainly for construction as well as fluegas desulfurization in coal-fired powerplants. A small amount of dolomite and limestone was also crushed to a fine powder and marketed as rock dust to the coal mining industry.

Two operators produced portland cement in Utah: Ash Grove Cement Co. and Holcim (US), Inc. Ash Grove Cement's Leamington plant and limestone quarry were east of Lynndyl in Juab County, and Holcim's Devil's Slide plant and limestone quarry were east of Morgan in Morgan County. The companies had a combined production capacity of more than 1.4 million metric tons per year (Mt/yr) of cement. Both plants operated at about capacity in 2004, and, according to the UGS, produced a total of nearly 1.5 Mt. In addition to limestone, Ash Grove Cement and Holcim mined modest amounts of sandstone and shale that were used in the manufacture of cement.

Perlite.—Two companies, Utelite Corp. and Basin Perlite Co., produced lightweight expanded products from perlite and shale for use primarily in the construction and building industries. Combined production was about 290,000 t in 2004. Utelite manufactures expanded shale for use as a lightweight aggregate from its mine located east of the town of Wanship in Summit County. Basin Perlite manufactures expanded perlite that is used mainly in building construction products from its North Pearl Queen perlite mine located northeast of the town of Milford in Beaver County.

Phosphate Rock.—Simplot Phosphates LLC (formerly SF Phosphates), Utah's only phosphate producer, produced about 3.5 Mt (UGS estimate) of ore in 2004, which was about 5% more than that produced in 2003. The company's phosphate operation, located 18 km north of Vernal in Uintah County, produced roughly 2.7 to 3.6 Mt/yr of ore, which was processed into 0.9 to 1.8 Mt of phosphate concentrate. The concentrate was transported in slurry to the company's Rock Springs, WY, fertilizer plant by way of a 144-km-long underground pipeline.

Salt and Other Brine-Derived Products (Magnesium Chloride and Potash).—Brine-derived products, which included salt, were the third-highest contributors (down from second highest in 2003) to the value of industrial minerals production in Utah during 2004; they had a combined value of $179 million, which was about $24 million (15%) greater than in 2003. The statewide production of salt and other brine-derived products, excluding magnesium metal, was estimated to be 3.44 Mt in 2004, which was about the same as 2003. Potash production, including sulfate of potash (SOP's), was estimated to be about 450,000 t in 2004, approximately 86,000 t more than 2003. In addition to salt, brine-derived products included magnesium chloride and potash (potassium chloride and SOP). One company (North Shore Limited Partnership) produced a small amount of concentrated, mixed brine that was used as an ingredient in mineral food supplements.

Salt production alone was estimated to be at least 2.7 Mt in 2004, which was about 200,000 t more than in 2003, with most of the production coming from three operators that processed brine from the Great Salt Lake. These operators were, in descending order of production, Great Salt Lake Minerals Corp., Cargill Salt, and Morton International Inc. In addition, three other companies produced salt and/or potash from operations that were not on Great Salt Lake; they were Moab Salt, LLC, which was near Moab in Grand County (salt and potash); Redmond Inc., which was near Redmond in Sanpete County (salt); and Reilly Industries Inc. at Wendover, which was in Tooele County (salt and potash). In the second half of 2004, Intrepid Mining, LLC (the owner of Moab Salt) purchased the Reilly Wendover plant.

Metals

Base-metal production, estimated to be about $1.14 billion (an alltime high), was the largest contributor to the value of nonfuel minerals produced in Utah in 2004. Those metals were, in descending order of value, copper, molybdenum, magnesium metal, and beryllium (value not available). The 2004 base-metal value was about $446 million (65%) greater than that of 2003. Precious-metal production was valued at $158 million, including gold (85% of total value) and silver (15% of total value). In 2004, precious-metal values were $21.8 million, or 16%, more than in 2003. Overall, metal prices essentially doubled between 2001 and 2004, with 2004 being the strongest year since the early 1980s. Kennecott's Bingham Canyon Mine in Salt Lake County, was the State's sole producer of copper and molybdenum and the major producer of gold and silver. The combined value of minerals produced from the Bingham Canyon Mine was more than one-half of the total value of all minerals produced statewide in 2004.

Beryllium.—Utah continues to be the Nation's sole producer of beryllium concentrates. Beryllium ore (bertrandite) was mined at Brush Resource's Topaz and Hogs Back Mines in Juab County and processed along with stockpiled beryl at the company's plant 18 km northeast of Delta in Millard County. The product (beryllium hydroxide) was then sent to the company-owned refinery and finishing plant in Ohio, where it was converted into beryllium metal, alloys, and oxide; also, some of the product was sold to other companies. In 2004, nearly 15,000 t of ore was mined and trucked to the processing plant. (Based upon Brush Resources' 2004 Annual report, the USGS estimates that as much as 35,000 t of ore may have been processed, containing an estimated 88 t of beryllium.) The mine produced substantially less ore than in previous years owing to increased processing of stockpiled ore.

Copper.—Copper was the largest contributor to the value of nonfuel minerals in Utah. Substantial price increases in 2003 and 2004 raised the value of copper near to an alltime high, also raising the total value of base-metal production statewide to more than $1 billion for only the second time. Copper prices rebounded in 2003 and 2004, closing the year 2004 at more than $3.30 per kilogram and averaging $3.00 per kilogram. Copper production from Kennecott's Bingham Canyon Mine decreased slightly in 2004 to approximately 264,000 t from 2003 production of approximately 282,000 t of copper metal. Kennecott reports that the Bingham Canyon Mine produces more than 10% of the annual refined copper requirements in the United States (Rio Tinto, 2005, p. 48).

Gold and Silver.—In 2004, gold production was estimated to be about 9,950 kg, a 3% decrease from the production in 2003. Gold was produced from two surface mines owned by Kennecott, one primary producer (Barneys Canyon Mine) and one byproduct operation (Bingham Canyon Mine), both located in Salt Lake County. Several other small mines in the State are known to produce minor amounts of gold and silver, but their minor metal-specific production was not reported and was not included in the above totals. The Barneys Canyon Mine ceased mining in late 2001, but continued to produce gold from its heap-leach pads at a much reduced rate and it is anticipated that this will continue into 2006. The Bingham Canyon Mine produced slightly more gold in 2004 than 2003. Silver was also a byproduct metal from the Bingham Canyon Mine, production was estimated at approximately 109,000 kg in 2004, basically unchanged from 2003.

Magnesium.—Magnesium metal was the third largest contributor to the value of base metals in 2004. Magnesium metal was produced from Great Salt Lake brines by U.S. Magnesium LLC at its electrolytic plant in Rowley, Tooele County. The plant's capacity was 43,000 t/yr of magnesium metal (99.8% purity); it is the only active primary magnesium production facility in the United States. In September 2004, the company announced that it would increase plant capacity to 51,000 t/yr through the addition of a third line of electrolytic cells (Platts Metals Week, 2004). The line was expected to begin production in June 2005 and be at full capacity in 2006. Magnesium metal prices reached a 12-year low in 2003, but increased substantially during 2004. U.S. Magnesium LLC also produces magnesium alloys, magnesium chloride, and other byproduct chemicals.

Molybdenum.—The sole molybdenum producer in Utah was Kennecott's Bingham Canyon Mine, which produced about 6,500 t of byproduct molybdenum in 2004, about 37% more than in 2003. The Bingham Canyon Mine was one of only seven molybdenum-producing mines in the United States in 2004. Recent price increases in molybdenum have surpassed those of the other metals, the average annual price surging more than five-fold from $5.20 per kilogram in 2001 to $36.73 per kilogram in 2004. The USGS reports that the total U.S. mine output of molybdenum increased by 24% in 2004 (Magyar, 2005).

Environmental Issues and Mine Reclamation

Significant progress on several Utah environmental concerns took place in 2004. The U.S. Environmental Protection Agency (EPA), U.S. Department of Energy (DOE), Utah Department of Environmental Quality (UDEQ), and Utah DOGM are nearing completion of remediation work at several old base-metal mill and smelter sites in western Utah and uranium plant sites in southeastern Utah. The base-metal projects included work at the Eureka mills (Tintic), International smelter (Tooele), Flagstaff/Davenport smelter (Cottonwood Canyon), and Jacobs smelter (Stockton). In southeastern Utah, reclamation included work at the Monticello and Moab uranium-mill tailings piles.

The DOE issued the draft environmental impact statement (EIS) on the Atlas uranium-mill tailings pile located 5 km northwest of Moab near the Colorado River. The preferred alternative, backed by the Utah State government, is for active ground water remediation and offsite tailings disposal at Crescent Junction. Federal legislation to fund this proposal was awaiting U.S. Congressional approval.

Agreement was reached between the three parties in UDEQ's Southwest Jordan Valley Project, which was designed to cleanup ground water contaminated from mining activities in the West Mountain District in southwestern Salt Lake County. During the next 40 years, extraction and treatment of ground water will remove sulfate contaminants and provide municipal-quality drinking water to the public in the affected area. By removing the contaminated water from the underlying aquifer, the project will improve ground water quality and prevent further migration of the contamination.

The Utah DOGM's abandoned mine reclamation program completed work on 89 individual mining sites during 2004. This program included three projects in the Cottonwood Wash uranium-vanadium district of San Juan County (53 sites) and one project in the Leamington base-metal district in the Fishlake National Forest of Millard County (36 sites). An additional 16 projects are in various stages of assessment and planning (Mark Mesch, program administrator, Abandoned Mine Reclamation, DOGM, written commun., September 2005).

Legislation and Government Programs

In 2002, the Utah State legislature passed the Utah Mined Land Reclamation Act (Section 40-8-1). This law governs the inspection, regulation, and reclamation of mining activities as well as provides for liabilities and penalties for violation of these rules. The new rules (R647-6) were promulgated by the Utah DOGM in June 2004 (Tom Munson, senior reclamation specialist/hydrologist, Minerals Reclamation Program, written commun., December 2005).

The UGS continued mapping projects in several regions of the State. The UGS has been an active participant in the STATEMAP program. STATEMAP is a component of the congressionally mandated national Cooperative Geological Mapping Program (NCGMP), which distributes Federal funds to support geologic mapping efforts through a competitive funding process. The NCGMP has three primary components: FEDMAP, which funds Federal geologic mapping projects, STATEMAP, which is a matching-funds grant program with State geological surveys, and EDMAP, a matching-funds grant program with universities that has a goal to train the next generation of geologic mappers. In addition to STATEMAP, FEDMAP and EDMAP mapping projects are also active in the State.

Information on geology, maps, and publications could be found at the UGS Web site at URL http://geology.utah.gov. The Web site also contains information on geologic hazards, energy resources, mineral collecting, educational resources for teachers, and online publications, which included survey notes and other topics related to the geology of Utah.

Outlook

The value of mineral production was projected to increase again in 2005 owing to anticipated production increases for most nonfuel minerals with higher unit values of all base and precious metals, and the same for most major industrial minerals. Base- and precious-metal prices increased significantly in 2003 and 2004, and were projected to remain near or above their respective 2004 yearend prices during 2005. Industrial-mineral prices also were expected to remain firm, although a reduction in demand for several commodities is projected for the latter portion of the year.

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

(Thousand metric tons and thousand dollars)

Mineral		2002 Quantity	2002 Value	2003 Quantity	2003 Value	2004 Quantity	2004 Value
Beryllium concentrates	metric tons	1,970	NA	2,100	NA	2,210	NA
Clays:							
Bentonite		W	W	W	W	73	W
Common		349	5,010	300	3,270	443	5,600
Gemstones		NA	230	NA	233	NA	235
Salt		2,090	113,000	2,200	119,000	2,250	107,000
Sand and gravel, construction		27,600	104,000	27,400	113,000	29,800	125,000
Stone, crushed		7,640	38,100	7,820	40,100	8,020	44,900
Combined values of cement (portland), copper, gold, gypsum (crude), helium (Grade-A), lime, magnesium compounds, magnesium metal, molybdenum concentrates, perlite (crude), phosphate rock, potash, silver, stone (dimension sandstone), and values indicated by symbol W		XX	980,000	XX	1,080,000	XX	1,660,000
Total		XX	1,240,000	XX	1,360,000	XX	1,940,000

NA Not available. W Withheld to avoid disclosing company proprietary data. Withheld values included in "Combined values" data. 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
UTAH: CRUSHED STONE SOLD OR USED, BY KIND[1]

Kind	2002				2003				2004			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	12	4,510	$24,800	$5.50	12	4,090	$17,200	$4.20	12	3,810	$25,700	$6.75
Dolomite	3	2,080	7,450	3.59	3	2,090	8,190	3.92	3	2,860	10,400	3.62
Sandstone and quartzite	5	W	W	4.71	6	W	W	6.09	6	767	4,870	6.34
Volcanic cinder and scoria	3	W	W	5.22	2	W	W	20.36	2	W	W	19.66
Miscellaneous stone	7	283	2,270	8.03	6	557	3,680	6.61	6	576	3,660	6.35
Total or average	XX	7,640	38,100	4.99	XX	7,820	40,100	5.12	XX	8,020	44,900	5.59

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

TABLE 3a

UTAH: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2003, BY USE[1]

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Construction:			
Coarse aggregate (+1½ inch):			
Macadam	W	W	$6.42
Riprap and jetty stone	W	W	6.78
Filter stone	W	W	6.43
Total or average	134	$881	6.57
Coarse aggregate, graded:			
Bituminous aggregate, coarse	W	W	6.42
Bituminous surface-treatment aggregate	W	W	6.42
Railroad ballast	W	W	6.34
Total or average	447	2,830	6.34
Fine aggregate (-⅜ inch), stone sand (bituminous mix or seal)	(2)	(2)	6.42
Coarse and fine aggregates:			
Graded road base or subbase	146	570	3.90
Unpaved road surfacing	W	W	2.76
Crusher run or fill or waste	W	W	6.43
Total or average	356	1,920	5.38
Agricultural:			
Agricultural limestone	W	W	25.26
Poultry grit and mineral food	W	W	28.48
Total or average	14	376	26.86
Chemical and metallurgical:			
Cement manufacture	W	W	3.83
Lime manufacture	W	W	4.21
Sulfur oxide removal	W	W	10.80
Total or average	3,850	16,000	4.15
Unspecified:[3]			
Reported	2,460	15,200	6.16
Estimated	560	2,900	5.17
Total or average	3,020	18,000	5.98
Grand total or average	7,820	40,100	5.12

W Withheld to avoid disclosing company proprietary data; included in "Total or average."

[1]Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

[2]Withheld to avoid disclosing company proprietary data; included in "Unspecified: Reported."

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

TABLE 3b

UTAH: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2004, BY USE[1]

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Construction:			
Coarse aggregate (+1½ inch), riprap and jetty stone	W	W	$5.51
Coarse aggregate, graded, railroad ballast	W	W	6.66
Fine aggregate (-⅜ inch), screening, undesignated	W	W	2.20
Coarse and fine aggregates:			
Graded road base or subbase	(2)	(2)	5.79
Unpaved road surfacing	(2)	(2)	2.76
Terrazzo and exposed aggregate	(2)	(2)	28.80
Crusher run or fill or waste	(2)	(2)	6.32
Other coarse and fine aggregates	7	$23	3.29
Total or average	59	520	8.81
Agricultural:			
Agricultural limestone	(2)	(2)	27.46
Poultry grit and mineral food	(2)	(2)	27.59
Other agricultural uses	4	13	3.25
Total or average	17	381	22.41
Chemical and metallurgical:			
Cement manufacture	(2)	(2)	3.73
Lime manufacture	(2)	(2)	12.66
Sulfur oxide removal	(2)	(2)	9.00
Total or average	3,550	23,700	6.68
Special, mine dusting or acid water treatment	W	W	19.30
Unspecified:[3]			
Reported	3,180	12,700	4.01
Estimated	660	3,700	5.59
Total or average	3,840	16,400	4.28
Grand total or average	8,020	44,900	5.59

W Withheld to avoid disclosing company proprietary data; included in "Grand total or average."

[1]Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

[2]Withheld to avoid disclosing company proprietary data; included in "Total or average."

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

TABLE 4a

UTAH: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2003, BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction:								
Coarse aggregate (+1½ inch)[2]	--	--	W	W	W	W	--	--
Coarse aggregate, graded[3]	W	W	W	W	--	--	--	--
Fine aggregate (-⅜ inch)[4]	--	--	(5)	(5)	--	--	--	--
Coarse and fine aggregate[6]	W	W	W	W	W	W	--	--
Agricultural[7]	W	W	W	W	--	--	--	--
Chemical and metallurgical[8]	W	W	W	W	W	W	--	--
Unspecified:[9]								
Reported	308	6,280	1,720	6,170	19	112	412	2,610
Estimated	280	1,600	270	1,300	--	--	--	--
Total	3,690	21,300	3,610	15,400	117	795	412	2,610

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 filter stone, macadam, and riprap and jetty stone.

[3]Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.

[4]Includes stone sand (bituminous mix or seal).

[5]Withheld to avoid disclosing company proprietary data; included in "Unspecified: Reported."

[6]ncludes crusher run (select material or fill), graded road base or subbase, and unpaved road surfacing.

[7]Includes agricultural limestone and poultry grit and mineral food.

[8]Includes cement manufacture, lime manufacture, and sulfur oxide removal.

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

TABLE 4b

UTAH: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2004, BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction:								
Coarse aggregate (+1½ inch)[2]	--	--	--	--	(3)	(3)	--	--
Coarse aggregate, graded[4]	W	W	--	--	--	--	--	--
Fine aggregate (-⅜ inch)[5]	--	--	W	W	--	--	--	--
Coarse and fine aggregate[6]	W	W	W	W	--	--	--	--
Agricultural[7]	W	W	W	W	--	--	--	--
Chemical and metallurgical[8]	W	W	W	W	--	--	--	--
Special[9]	W	W	--	--	--	--	--	--
Unspecified:[10]								
Reported	1	2	2,690	9,650	37	212	471	2,990
Estimated	180	950	380	2,200	95	550	--	--
Total	3,120	23,600	4,300	17,500	132	757	471	2,990

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 riprap and jetty stone.

[3]Withheld to avoid disclosing company proprietary data; included in "Unspecified: Reported."

[4]Includes railroad ballast.

[5]Includes screening (undesignated).

[6]Includes crusher run or fill or waste, graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, and other coarse and fine aggregates.

[7]Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.

[8]Includes cement manufacture, lime manufacture, and sulfur oxide removal.

[9]Includes mine dusting or acid water treatment.

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

TABLE 5a
UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2003,
BY MAJOR USE CATEGORY[1]

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	1,530	$7,330	$4.80
Concrete products (blocks, bricks, pipe, decorative, etc.) [2]	51	266	3.52
Asphaltic concrete aggregates and other bituminous mixtures	1,000	4,570	4.57
Road base and coverings [3]	3,550	13,400	3.78
Fill	1,950	4,220	2.17
Snow and ice control [4]	35	109	3.11
Other miscellaneous uses	34	56	1.65
Unspecified: [5]			
Reported	8,100	34,300	4.24
Estimated	11,000	48,000	4.36
Total or average	27,400	113,000	4.12

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

TABLE 5b
UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2004,
BY MAJOR USE CATEGORY[1]

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	1,730	$9,170	$5.29
Concrete products (blocks, bricks, pipe, decorative, etc.) [2]	44	264	6.01
Asphaltic concrete aggregates and other bituminous mixtures	640	3,960	6.19
Road base and coverings [3]	4,410	17,000	3.85
Fill	2,170	5,200	2.40
Snow and ice control	19	54	2.89
Other miscellaneous uses [4]	361	1,700	4.71
Unspecified: [5]			
Reported	9,410	39,000	4.14
Estimated	11,000	48,000	4.38
Total or average	29,800	125,000	4.18

[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 railroad ballast and roofing granules.
[5]Reported and estimated production without a breakdown by end use.

TABLE 6a

UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2003, BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products[2]	451	1,700	618	2,890	336	2,150
Asphaltic concrete aggregates and other bituminous mixtures	W	W	69	305	W	W
Road base and coverings[3]	W	W	1,490	5,390	W	W
Fill	282	713	1,390	2,610	273	905
Other miscellaneous uses[4]	834	3,590	35	58	1,480	6,330
Unspecified:[5]						
Reported	2,100	8,830	5,520	24,300	87	297
Estimated	2,300	15,000	7,800	29,000	1,000	4,500
Total	6,020	30,000	17,000	64,300	3,170	14,200

	Unspecified districts	
	Quantity	Value
Concrete aggregate and concrete products[2]	171	849
Asphaltic concrete aggregates and other bituminous mixtures	469	1,810
Road base and coverings[3]	242	642
Fill	--	--
Other miscellaneous uses[4]	--	--
Unspecified:[5]		
Reported	389	851
Estimated	--	--
Total	1,270	4,150

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 railroad ballast and snow and ice control.

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

TABLE 6b

UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2004, BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars unless otherwise specified)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates and concrete products[2]	708	3,640	670	3,020	398	2,780
Asphaltic concrete aggregates and other bituminous mixtures	285	2,230	W	W	268	1,380
Road base and coverings[3]	904	3,680	1,510	5,100	1,640	7,190
Fill	542	1,430	1,150	2,640	419	974
Other miscellaneous uses[4]	75	952	304	805	5	31
Unspecified:[5]						
Reported	3,000	12,000	5,400	24,000	640	2,500
Estimated	2,100	15,000	7,900	30,000	1,000	3,800
Total	7,650	39,100	16,900	64,900	4,420	18,600

Use	Unspecified districts	
	Quantity	Value
Concrete aggregates and concrete products[2]	--	--
Asphaltic concrete aggregates and other bituminous mixtures	W	W
Road base and coverings[3]	361	996
Fill	52	157
Other miscellaneous uses[4]	81	314
Unspecified:[5]		
Reported	358	592
Estimated	--	--
Total	852	2,060

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 railroad ballast, roofing granules, and snow and ice control.

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