

## ZEOLITES (NATURAL)

(Data in metric tons unless otherwise noted)

**Domestic Production and Use:** In 2021, six companies in the United States operated nine zeolite mines and produced an estimated 87,000 tons of natural zeolites, slightly more than that of 2020. Chabazite was mined in Arizona, and clinoptilolite was mined in California, Idaho, New Mexico, Oregon, and Texas. Minor quantities of erionite, ferrierite, mordenite, and (or) phillipsite also likely were produced. New Mexico was estimated to be the leading natural zeolite-producing State in 2021. The top three companies accounted for approximately 75% of total domestic production.

An estimated 76,000 tons of natural zeolites was sold in the United States during 2021, slightly more compared with that of 2020. Domestic uses were, in descending order of estimated quantity, animal feed, odor control, unspecified end uses (such as ice melt, soil amendment, and synthetic turf), water purification, pet litter, wastewater treatment, fungicide or pesticide carrier, oil and grease absorbent, air filtration and gas absorbent, fertilizer carrier, desiccant, and aquaculture. Animal feed, odor control, and water purification applications likely accounted for about 60% of the domestic sales tonnage.

<b><u>Salient Statistics—United States:</u></b>	<b><u>2017</u></b>	<b><u>2018</u></b>	<b><u>2019</u></b>	<b><u>2020</u></b>	<b><u>2021<sup>e</sup></u></b>
Production, mine	82,400	86,100	87,800	86,700	87,000
Sales, mill	81,300	80,500	77,100	75,300	76,000
Imports for consumption <sup>e</sup>	<1,000	<1,000	<1,000	<1,000	<1,000
Exports <sup>e</sup>	<1,000	<1,000	<1,000	<1,000	<1,000
Consumption, apparent <sup>1</sup>	81,300	80,500	77,100	75,300	76,000
Price, range of value, dollars per ton <sup>2</sup>	100–300	<sup>e</sup> 50–300	<sup>e</sup> 50–300	<sup>e</sup> 50–300	50–300
Employment, mine and mill, number <sup>e, 3</sup>	110	110	120	120	120
Net import reliance <sup>4</sup> as a percentage of apparent consumption	E	E	E	E	E

**Recycling:** Zeolites used for desiccation, gas absorbance, wastewater cleanup, and water purification may be reused after reprocessing of the spent zeolites. Information about the quantity of recycled natural zeolites was unavailable.

**Import Sources (2017–20):** Comprehensive trade data were not available for natural zeolite minerals because they were imported and exported under generic Harmonized Tariff Schedule of the United States and Schedule B codes, respectively, that include multiple mineral commodities or under codes for finished products. Nearly all imports and exports were thought to be synthetic zeolites.

<b><u>Tariff:</u></b>	<b><u>Item</u></b>	<b><u>Number</u></b>	<b><u>Normal Trade Relations</u></b> <b><u>12–31–21</u></b>
	Mineral substances not elsewhere specified or included	2530.90.8050	Free.

**Depletion Allowance:** 14% (domestic and foreign).

**Government Stockpile:** None.

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**Events, Trends, and Issues:** Prior to the 1990s, annual output of natural zeolites in the United States was less than 15,000 tons. Production rose more than sixfold from 1990 through 2021 owing predominantly to increases in sales for animal feed applications, although sales for odor control and water purification also increased significantly. In contrast, sales for pet litter declined substantially during this period as a result of competition from other products.

**World Mine Production and Reserves:** Many countries either do not report production of natural zeolites or production is reported with a 2- to 3-year lag time. End uses for natural zeolites in countries that mine large tonnages of zeolite minerals typically include low-value, high-volume construction applications, such as dimension stone, lightweight aggregate, and pozzolanic cement. As a result, production data for some countries may not accurately indicate the quantities of natural zeolites used in the high-value applications that are reflected in the U.S. data.

World reserves of natural zeolites have not been estimated. Deposits occur in many countries, but companies rarely publish reserves data. Further complicating estimates of reserves is the fact that much of the reported world production includes altered volcanic tuffs with low to moderate concentrations of zeolites that are typically used in high-volume construction applications. Some deposits should, therefore, be excluded from reserves estimates because it is the rock itself and not its zeolite content that makes the deposit valuable.

	Mine production		Reserves <sup>5</sup>
	2020	2021 <sup>e</sup>	
United States	86,700	87,000	Two of the leading companies in the United States reported combined reserves of 80 million tons in 2021; total U.S. reserves likely are substantially larger. World data are unavailable, but reserves are estimated to be large.
China	<sup>e</sup> 52,000	52,000	
Cuba	<sup>e</sup> 53,000	53,000	
Georgia	135,000	140,000	
Hungary	<sup>e</sup> 29,000	29,000	
Indonesia	<sup>e</sup> 130,000	130,000	
Jordan	711,000	710,000	
Korea, Republic of	131,000	130,000	
New Zealand	<sup>e</sup> 100,000	100,000	
Russia	<sup>e</sup> 35,000	35,000	
Slovakia	<sup>e</sup> 117,000	120,000	
Turkey	<sup>e</sup> 73,000	50,000	
Other countries	<u>5,450</u>	<u>5,500</u>	
World total (rounded)	1,660,000	1,600,000	

**World Resources:**<sup>5</sup> Recent estimates for domestic and global resources of natural zeolites are not available. Resources of chabazite and clinoptilolite in the United States are sufficient to satisfy foreseeable domestic demand.

**Substitutes:** For pet litter, zeolites compete with other mineral-based litters, such as those manufactured using bentonite, diatomite, fuller's earth, and sepiolite; organic litters made from shredded corn stalks and paper, straw, and wood shavings; and litters made using silica gel. Diatomite, perlite, pumice, vermiculite, and volcanic tuff compete with natural zeolites as lightweight aggregate. Zeolite desiccants compete against such products as magnesium perchlorate and silica gel. Zeolites compete with bentonite, gypsum, montmorillonite, peat, perlite, silica sand, and vermiculite in various soil amendment applications. Activated carbon, diatomite, or silica sand may substitute for zeolites in water-purification applications. As an oil absorbent, zeolites compete mainly with bentonite, diatomite, fuller's earth, sepiolite, and a variety of polymer and natural organic products. In animal feed, zeolites compete with bentonite, diatomite, fuller's earth, kaolin, silica, and talc as anticaking and flow-control agents.

<sup>e</sup>Estimated. E Net exporter.

<sup>1</sup>Defined as mill sales + imports – exports. Information about industry stocks was unavailable.

<sup>2</sup>Range of ex-works mine and mill unit values for individual natural zeolite operations, based on data reported by U.S. producers and U.S. Geological Survey estimates. Average unit values per ton for the past 5 years were \$140 in 2017, and an estimated \$125 in 2018, 2019, 2020, and 2021. Prices vary with the percentage of zeolite present in the product, the chemical and physical properties of the zeolite mineral(s), particle size, surface modification and (or) activation, and end use.

<sup>3</sup>Excludes administration and office staff. Estimates based on data from the Mine Safety and Health Administration.

<sup>4</sup>Defined as imports – exports.

<sup>5</sup>See Appendix C for resource and reserve definitions and information concerning data sources.