

## ZEOLITES (NATURAL)

(Data in metric tons unless otherwise noted)

**Domestic Production and Use:** In 2016, seven companies in the United States operated 10 zeolite mines and produced an estimated 80,000 tons of natural zeolites, a 7% increase from that of 2015. Two other companies might have also mined zeolites as part of development projects, but specific information on the status of these operations was not available. Chabazite was mined in Arizona, and clinoptilolite was mined in California, Idaho, New Mexico, Oregon, and Texas. New Mexico was estimated to be the leading natural zeolite-producing State, followed by Idaho, California, Texas, Oregon, and Arizona. The top three U.S. companies accounted for approximately 90% of total domestic production.

An estimated 78,900 tons of natural zeolites were consumed in the United States during 2016. Domestic uses were, in decreasing order by tonnage, animal feed, water purification, odor control, unclassified end uses, pet litter, fungicide or pesticide carrier, wastewater treatment, gas absorbent (and air filtration), oil and grease absorbent, fertilizer carrier, synthetic turf, soil amendment, and desiccant. Animal feed, water purification, odor control, pet litter, and fungicide or pesticide carrier applications accounted for 80% of the domestic sales tonnage.

<b>Salient Statistics—United States:</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016<sup>e</sup></b>
Production, mine	74,000	69,500	62,800	75,100	80,000
Sales, mill	70,500	68,300	62,500	73,200	79,000
Imports for consumption <sup>e</sup>	5	5	25	50	25
Exports <sup>e</sup>	750	200	200	200	100
Consumption, apparent <sup>e, 1</sup>	69,800	68,100	62,300	73,100	78,900
Price, range of value, dollars per metric ton <sup>2</sup>	50–800	50–800	110–440	110–950	110–950
Employment, mine and mill <sup>e, 3</sup>	110	105	95	100	110
Net import reliance <sup>4</sup> as a percentage of estimated 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 (2012–15):** Comprehensive trade data were not available for natural zeolite minerals because they were imported and exported under a generic U.S. Census Bureau Harmonized Tariff Schedule code that includes multiple mineral commodities. Nearly all imports and exports were synthetic zeolites.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–16</b>
Mineral substances not elsewhere specified or included	2530.90.8050	Free.

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

**Government Stockpile:** None.

**Events, Trends, and Issues:** During the past 20 years, the animal feed industry has seen the greatest increase in sales of natural zeolites. Sales for odor control, wastewater treatment, and water purification applications have also increased in the past 10 years, although expansion of these markets has not been as great as with animal feed. Sales for pet litter declined during the past 20 years as a result of competition from other products.

In 2016, the Wyoming State Geological Survey released a report concluding that Wyoming contains minable resources of natural zeolites. The agency confirmed previously explored occurrences, identified additional deposits, and published geologic descriptions and geochemical data for the outcrops studied during the investigation. Globally, the only natural zeolites producer in New Zealand completed construction of a processing plant that will allow the company to increase production to at least 100,000 tons per year. In July, a Canadian company began to process and sell zeolites from a deposit in British Columbia; the mining permit allows for the extraction of 50,000 tons of zeolites per year and expansion of the quarry as needed.

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

World reserves of natural zeolites have not been estimated. Deposits occur in many countries, but companies rarely, if ever, 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 <sup>e</sup>		Reserves <sup>5</sup>
	2015	2016	
United States	<sup>6</sup> 75,100	80,000	World reserves are not determined but are estimated to be large.
China	2,000,000	2,000,000	
Cuba	43,000	51,000	
Jordan	13,000	12,000	
Korea, Republic of	205,000	205,000	
New Zealand	<sup>6</sup> 65,000	80,000	
Turkey	70,000	60,000	
Other countries	<u>350,000</u>	<u>350,000</u>	
World total (rounded)	2,800,000	2,800,000	

**World Resources:** World resources have not been estimated for natural zeolites. An estimated 120 million tons of chabazite, clinoptilolite, erionite, mordenite, and phillipsite is present in near-surface deposits in the Basin and Range province in the United States.

**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 zeolite 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.

<sup>2</sup>Range of ex-works unit values for individual zeolite operations, based on data reported by U.S. producers. Unit values for most zeolite operations have varied from \$110 to \$220 per ton for the past 5 years. 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 office workers and development projects. Estimate 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.

<sup>6</sup>Reported figure.