

## NICKEL

(Data in metric tons of contained nickel unless otherwise noted)

**Domestic Production and Use:** In 2021, the underground Eagle Mine in Michigan produced approximately 18,000 tons of nickel in concentrate, which was exported to smelters in Canada and overseas. A company in Missouri recovered metals, including nickel, from mine tailings as part of the Superfund Redevelopment Initiative. Nickel in crystalline sulfate was produced as a byproduct of smelting and refining platinum-group-metal ores mined in Montana.

In the United States, the leading uses for primary nickel are alloys and steels, electroplating, and other uses including catalysts and chemicals. Stainless and alloy steel and nickel-containing alloys typically account for more than 85% of domestic consumption.

<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	22,100	17,600	13,500	16,700	18,000
Refinery, byproduct	W	W	W	W	W
Imports:					
Ores and concentrates	64	3	4	95	24
Primary	150,000	144,000	119,000	105,000	110,000
Secondary	38,100	45,100	37,700	31,800	35,000
Exports:					
Ores and concentrates	20,000	18,000	14,300	13,400	15,000
Primary	11,000	9,780	12,800	11,300	10,000
Secondary	51,500	59,400	47,800	34,100	29,000
Consumption:					
Reported, primary	105,000	107,000	105,000	<sup>e</sup> 84,000	82,000
Reported, secondary, purchased scrap	133,000	123,000	111,000	<sup>e</sup> 99,000	110,000
Apparent, primary <sup>1</sup>	140,000	136,000	106,000	94,100	100,000
Apparent, total <sup>2</sup>	273,000	259,000	217,000	<sup>e</sup> 190,000	210,000
Price, average annual, London Metal Exchange (LME), cash:					
Dollars per metric ton	10,403	13,114	13,903	13,772	18,000
Dollars per pound	4.719	5.948	6.306	6.25	8.3
Stocks, yearend:					
Consumer	14,600	16,300	13,400	13,000	13,000
LME U.S. warehouses	3,780	2,268	1,974	1,734	1,500
Net import reliance <sup>3</sup> as a percentage of total apparent consumption	51	52	49	49	48

**Recycling:** Nickel in alloyed form was recovered from the processing of nickel-containing waste, including flue dust, grinding swarf, mill scale, and shot blast generated during the manufacturing of stainless steel; filter cakes, plating solutions, spent catalysts, spent pickle liquor, sludges, and all types of spent nickel-containing batteries. Nickel-containing alloys and stainless-steel scrap were also melted and used to produce new alloys and stainless steel. The U.S. Department of Energy's ReCell Center continued to investigate methods to more effectively recover raw materials, including nickel, from recycled batteries. In 2021, recycled nickel in all forms accounted for approximately 52% of apparent consumption.

**Import Sources (2017–20):** Nickel contained in ferronickel, metal, oxides, and salt: Canada, 43%; Norway, 10%; Finland, 9%; Australia, 8%; and other, 30%. Nickel-containing scrap, including nickel content of stainless-steel scrap: Canada, 37%; Mexico, 26%; United Kingdom, 9%; and other, 28%.

<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>
	Nickel ores and concentrates, nickel content	2604.00.0040	Free.
	Ferronickel	7202.60.0000	Free.
	Unwrought nickel, not alloyed	7502.10.0000	Free.
	Nickel waste and scrap	7503.00.0000	Free.
	Nickel powders	7504.00.0010	Free.
	Nickel flakes	7504.00.0050	Free.

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**Depletion Allowance:** 22% (domestic), 14% (foreign).

**Government Stockpile:**<sup>4</sup> The U.S. Department of Energy is holding nickel ingot contaminated by low-level radioactivity at Paducah, KY, and shredded nickel scrap at Oak Ridge, TN. See Lithium for statistics on lithium-nickel-cobalt-aluminum oxide.

<b>Material</b>	<b>Inventory as of 9–30–21</b>	<b>FY 2021</b>		<b>FY 2022</b>	
		<b>Potential acquisitions</b>	<b>Potential disposals</b>	<b>Potential acquisitions</b>	<b>Potential disposals</b>
Nickel alloys, gross weight	790	—	—	—	—

**Events, Trends, and Issues:** On November 9, 2021, a proposed revised U.S. critical minerals list was published in the Federal Register (86 FR 62199). The new list contained 50 individual mineral commodities; proposed changes were the addition of nickel and zinc and the removal of helium, potash, rhenium, strontium, and uranium, which were included in the 2018 critical minerals list.

In 2021, the annual average LME cash price was estimated to have increased by 30% compared with that in 2020, which was attributed to expectations of increased use of nickel in electric vehicle batteries and continued strong demand for stainless steel.

Mine production in Indonesia increased by an estimated 30%, which was facilitated by the ongoing commissioning of integrated nickel pig iron and stainless-steel projects. The country's first hydrometallurgical plant began operation in May on Obi Island. It was among several similar projects in the country that were designed to produce intermediate nickel products to be used as feed material at battery-grade nickel sulfate plants.

**World Mine Production and Reserves:** Reserves for Australia, Canada, Russia, and the United States were revised based on new information from company and (or) Government reports.

	<b>Mine production</b>		<b>Reserves<sup>5</sup></b>
	<b>2020</b>	<b>2021<sup>e</sup></b>	
United States	16,700	18,000	<sup>6</sup> 340,000
Australia	169,000	160,000	<sup>7</sup> 21,000,000
Brazil	77,100	100,000	16,000,000
Canada	167,000	130,000	2,000,000
China	120,000	120,000	2,800,000
Indonesia	771,000	1,000,000	21,000,000
New Caledonia <sup>8</sup>	200,000	190,000	NA
Philippines	334,000	370,000	4,800,000
Russia	283,000	250,000	7,500,000
Other countries	<u>373,000</u>	<u>410,000</u>	<u>20,000,000</u>
World total (rounded)	2,510,000	2,700,000	>95,000,000

**World Resources:**<sup>5</sup> Identified land-based resources averaging approximately 0.5% nickel or greater contain at least 300 million tons of nickel, with about 60% in laterites and 40% in sulfide deposits. Extensive nickel resources also are found in manganese crusts and nodules on the ocean floor.

**Substitutes:** Low-nickel, duplex, or ultrahigh-chromium stainless steels have been substituted for austenitic grades in construction. Nickel-free specialty steels are sometimes used in place of stainless steel in the power-generating and petrochemical industries. Titanium alloys can substitute for nickel metal or nickel-base alloys in corrosive chemical environments.

<sup>e</sup>Estimated. NA Not available. W Withheld to avoid disclosing company proprietary data. — Zero.

<sup>1</sup>Defined as primary imports – primary exports + adjustments for industry stock changes, excluding secondary consumer stocks.

<sup>2</sup>Defined as apparent primary consumption + reported secondary consumption.

<sup>3</sup>Defined as imports - exports + adjustments for consumer stock changes.

<sup>4</sup>See Appendix B for definitions.<sup>5</sup>See Appendix C for resource and reserve definitions and information concerning data sources.

<sup>6</sup>Includes reserve data for three projects. An additional three domestic projects have defined resources but have not yet defined reserves.

<sup>7</sup>For Australia, Joint Ore Reserves Committee-compliant or equivalent reserves were 8.3 million tons.

<sup>8</sup>Overseas Territory of France.