

Mineral Industry Surveys

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SILICON IN DECEMBER 2022

Domestic production of silicon materials was 19,900 metric tons (t) in December 2022, 12% less than November 2022 production and 34% less than December 2021 production (table 1). Net shipments in December 2022 were withheld to avoid disclosing proprietary information. Total net shipments during 2022 were 249,000 t, 7% less than those during in 2021. Ending stocks in December were 21,600 t, 5% less than those in November 2022 and 59% more than those in December 2021.

On a contained weight basis, total ferrosilicon imports were 21,300 t in December 2022, more than double those in November 2022 and December 2021, respectively (fig.1, table 4). Total silicon metal imports, on a contained weight basis were 6,890 t in December 2022, 27% less than those in November 2022 and 37% less than those in December 2021.

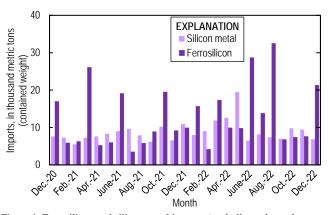


Figure 1. Ferrosilicon and silicon metal imports (excluding solar and semiconductor grades) from December 2020 through December 2022. Source: U.S. Census Bureau.

In December 2022, on a contained-weight basis in descending order of quantity, the leading destinations for silicon metal, more than 99.99% silicon trade category, were Vietnam, Japan, and Taiwan (table 3). In December 2022, on a contained-weight basis in descending order of quantity, leading import sources for ferrosilicon, 55%-80% grade, were Russia, Iceland, and Brazil and the leading import sources for silicon metal, 99.00%-

99.99% silicon trade category, were Brazil, Norway, and Canada and the (table 4).

Prices

The average U.S. spot price for silicon metal was 256.25 cents per pound in December 2022, 4% less than the average price in November 2022 and 46% less than the average price in December 2021. The average U.S. spot price for ferrosilicon, 75% grade, was 206.25 cents per pound, 10% less than the average price in November 2022 and 38% less than the average price in December 2021 (fig. 2). The average spot prices for ferrosilicon, 50% grade, were discontinued by CRU Group in April 2022 and no other published sources were available.

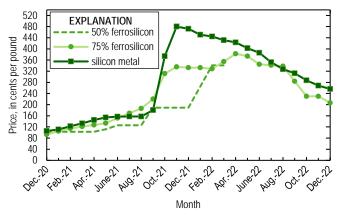


Figure 2. Average monthly spot prices for silicon metal and ferrosilicon 50% and 75% grades, contained silicon, from December 2020 through December 2022. The average spot prices for ferrosilicon, 50% grade, were discontinued by CRU Group in April 2022. Source: CRU Group and S&P Global Platts Metals Week.

Industry News

According to the China Nonferrous Metals Industry Association, China produced 811,000 t of polysilicon in 2022, a 66% increase compared with 2021 production (Argus Media group—Argus Metals International, 2023).

The China Securities Regulatory Commission approved the Guangzhou Futures Exchange (GFEX) to launch silicon futures contracts on December 22, 2022, and options contracts on December 23, 2022 for silicon metal grade 5-5-3, which is used as feedstock in metallurgical and polysilicon manufacturing, and silicon metal grade 4-2-1, which is used by the chemicals sector (Argus Media group—Argus Metals International, 2022). The GFEX was started in 2021 with a focus on products associated with green and sustainable development (China Daily, 2022). Believed to be the world's first industrial silicon futures contracts, the goal is to reduce price volatility of silicon metal which is used in the manufacture of semiconductor chips and solar panels (Jingjing, 2022).

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TABLE 1 PRODUCTION, SHIPMENTS, AND STOCKS OF SILICON ALLOYS AND METAL IN THE UNITED STATES $^{1,\,2,\,3}$

(Metric tons, gross weight)

	Gross	Gross Net	
	production ⁴	shipments	end of period
2021:			
January-December	W	269,000 ^r	13,600 ^r
December	30,300 ^r	24,200 ^r	13,600 ^r
2022:			
January	W	24,000 ^r	16,100 ^r
February	W	23,000 ^r	17,700 ^r
March	W	W	21,200 r
April	W	23,500 ^r	19,300 ^r
May	32,600 r	22,400 ^r	W
June	W	22,400 ^r	W
July	W	W	W
August	W	22,500 ^r	W
September	W	15,700 ^r	W
October	25,500	17,100 ^r	24,700 ^r
November	22,600 ^r	20,600 ^r	22,800 ^r
December	19,900	W	21,600
January-December	348,000	249,000	21,600

^rRevised. W Withheld to avoid disclosing company proprietary data.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes ferrosilicon, miscellaneous silicon alloys, and silicon metal, excluding semiconductor and solar grades, except where noted.

³Includes USGS estimates.

 $^{^4}$ Ferrosilicon production includes material consumed in the production of miscellaneous silicon alloys.

 ${\it TABLE~2}$ PRICES FOR FERROSILICON AND SILICON METAL IN DECEMBER 2022

		Low	Average	High	Average low, mid, and high
Ferrosilicon:					
50% ferrosilicon ¹	cents per pound of contained silicon	NA	XX	NA	NA
75% ferrosilicon ²	do.	180.00	206.25	255.00	XX
Silicon metal, 553 grade ³	cents per pound	250.00	256.25	265.00	XX

do. Ditto. NA Not available. XX Not applicable.

¹CRU Group transaction price, duty paid, f.o.b. Pittsburgh, producing plant or Chicago/Pittsburgh warehouse. Average price reported for price range.

²S&P Global Platts Metals Week, in U.S. warehouse, U.S. origin and imported material. Average price reported for all transactions during the month.

³S&P Global Platts Metals, duty paid, delivered Midwest, U.S. spot and imported 553 grade silicon metal (minimum 98.50% silicon). Average price reported for all transactions during the month.

TABLE 3 U.S. EXPORTS OF FERROSILICON AND SILICON METAL IN DECEMBER $2022^{1,\,2}$

(Metric tons, unless otherwise specified)

	Gross	Contained		Gross Contained		
Country or locality	weight	weight	Value	weight	weight	Value
Perrosilicon:						
More than 55% silicon: Brazil				40	24	\$62,4
Canada	989	593	\$1,570,000	8,750	5,250	15,200,0
Czechia		3/3	\$1,570,000	4	2	5,9
France				17	10	27,0
Germany	531	407	1,140,000	763	560	1,550,0
India				40	28	67,2
Israel	3	2	5,000	3	2	5,0
Mexico	142	85	221,000	1,920	1,150	3,100,0
Singapore				22	13	34,4
Thailand	5	3	7,500	14	8	21,8
United Arab Emirates				2	1	3,2
Total Total	1,670	1,090	2,940,000	11,600	7,050	20,100,0
Other ferrosilicon:	26	16	56 500	396	176	403,0
Belgium Brazil	36	10	56,500	390	176	831,0
Canada	21	11	54,300	1,430	280	1,900,0
China			54,500	20	10	50,0
Dominican Republic				63	9	78,
France				74	32	91,
Malaysia				15	7	10,
Mexico	27	14	72,200	1,820	654	4,460,
Turkey	40	18	64,000	120	54	251,
United Kingdom				97	48	406,
Other [3 countries and (or) localities]				28	10	101,
Total	125	58	247,000	4,360	1,430	8,590,
Total ferrosilicon	1,790	1,150	3,190,000	15,900	8,480	28,600,
Metal:						
More than 99.99% silicon:						
China	291	291	11,100,000	3,250	3,250	112,000,
Germany	201	201	7,590,000	5,030	5,030	161,000,
Japan Karaa Baruhlia of	961 104	961 104	38,700,000	11,200 832	11,200 832	492,000,0
Korea, Republic of Malaysia	93	93	3,150,000 3,190,000	2,550	2,550	33,300,0 108,000,0
Singapore	101	101	2,920,000	2,020	2,020	55,300,
Taiwan	304	304	9,660,000	4,680	4,680	104,000,
Thailand	(4)	(4)	12,100	234	234	9,460,
Turkey	16	16	576,000	948	948	32,800,
Vietnam	1,690	1,690	67,500,000	13,000	13,000	476,000,
Other [37 countries and (or) localities]	101	101	5,350,000	776	776	33,400,
Total	3,870	3,870	150,000,000	44,600	44,600	1,620,000,
99.00%–99.99% silicon:						
Australia	337	337	991,000	337	337	991,
Belgium				124	121	344,
Czechia				114	113	280,
France				50	50	70,
Germany	2	2	2.720	258	253	310,
Korea, Republic of	2		2,730	15 1	15 1	21,
Mexico				2	2	9,
Singapore Saint Maarten	2	2	2,580	2	2	3, 2,
Taiwan			2,360	5	5	6,
United Kingdom				75	75	165,
Total	341	341	997,000	984	974	2,200,
Other silicon:						
Belgium				192	186	355,
Canada	9	9	28,600	187	182	597,
China	30	30	40,200	146	142	193,
Germany				136	132	287,
Japan				5	5	7,
T D III 6	3	3	3,510	13	12	16,
Korea, Republic of		14	64,400	467	453	2,170,
Mexico	14					
Mexico Netherlands				309	300	
Mexico Netherlands South Africa	35	34	46,300	131	128	186,
Mexico Netherlands South Africa Trinidad and Tobago	35 (4)	34 (4)	46,300 3,400	131 30	128 29	186, 60,
Mexico Netherlands South Africa	35	34	46,300	131	128	371, 186, 60, 78, 4,320,

Source: U.S. Census Bureau.

¹ Otal Streon meta.

- Zero.

1 Presentation of monthly data is based on the quantities (gross weight) of the leading countries and (or) localities.

2 Data are rounded to no more than three significant digits; may not add to totals shown.

3 May include revisions to previously published data.

4 and then 14 unit

${\it TABLE~4}$ U.S. IMPORTS OF FERROSILICON AND SILICON METAL IN DECEMBER $2022^{1.2}$

(Metric tons, unless otherwise specified)

Ferrosition:		G	Contain		January–December ³		
Servestions:	Country or locality			Volue			Value
	<u> </u>	weight	weight	vaiue	weight	weight	value
Chins — — — 1.700 1.040 S22 India — — — — 21 19 Mesko — — — — 22 2 Norway — — — — 26 220 1 South Afteca 27 2.7 71,000 293 1.200 7.5 SSW-80% Silkion.ndher: — — — 2600 2000 63 SSW-80% Silkion.ndher: — — — — — 1.900 2.000 63 China 573 447 1.900,000 2.000 1.970 38 Chenda 1.529 943 3.460,000 1.520 9.73 4.8 Leclad 1.259 953 3.460,000 3.20 0.00 4.8 Malaysia 1.99 1.98 38,000 2.00 1.6 0.0 73 Noreacy 6.95 52		=					
Finne		- 			1.790	1.040	\$2,920,00
Mesico	France	36	29	\$166,000			1,930,00
Norway							57,80
South Africa 27							6,66
Total	Norway				276	210	1,350,00
SPN-80N silicon, other	•	27	27	71,100	293	224	1,030,00
Brail 1,230 930 2,170,000 26,900 20,200 8,33 43 China 576 580 3,110,000 22,000 19,700 58,8 Firance 223 177 113,000 1,500 19,700 58,8 Firance 232 177 113,000 1,500 1,500 58,8 Firance 187 188 89,900 1,320 975 4,6 4,6 1,6 6,607 4,550 3,0 4,6 6,607 4,550 3,0 3,0 8,0 6,600 1,500 3,0 3,0 3,0 3,0 1,600 1,500 3,0	Total	63	56	237,000	2,890	1,800	7,290,00
Cemada	55%-80% silicon, other:						
China 579 440 1,030,000 26,100 19,700 588, Sample Germany 187 1188 959,000 1,320 1975 4,4 Iceland 1,250 1933 3,400,00 8,30 6,90 35. Kazakhstan - - - - 6,070 4,550 30. Norway 695 527 3,520,000 5,600 4,000 23. Russia 20,800 15,800 45,900,000 88,600 67,400 38. Singapore 200 114 84 45,500 1,600 3,370 144 Other Decountries and fool localities 114 4 45,500 5,00 13,00 72,1 Singapore 20 119 81,200 5,00 13,00 13,00 72,1 Other Standiston, China - - - - - 14 160 - - - - - - - - <td>Brazil</td> <td>1,230</td> <td>930</td> <td>2,170,000</td> <td>26,900</td> <td>20,200</td> <td>63,800,00</td>	Brazil	1,230	930	2,170,000	26,900	20,200	63,800,00
France	Canada	767	550	3,110,000	12,200	8,730	47,400,00
Germany	China	579	440	1,030,000	26,100	19,700	58,000,00
Leeland	France	23	17	113,000	1,520	1,090	5,940,00
Malaysia 199 149 589,000 20,000 15,000 73,	Germany	187	138	959,000	1,320	975	4,450,00
Malaysis	Iceland	1,250	953	3,460,000	8,730	6,690	35,700,00
Norway	Kazakhstan	_			6,070	4,550	30,600,00
Paraguay	Malaysia	199	149	589,000	20,600	15,000	73,600,00
Russia 20,800	·	_			5,400		23,100,00
Singapore	Paraguay	250	183	745,000	1,480	1,070	4,090,00
Other Sountries and (or) localities 114 84 435,000 51,000 36,700 142,		_					359,000,00
Total	Singapore		149	817,000	200	149	817,00
S089086 ferrosiliton Third Thi							14,800,00
More than 90% ferrosilicon		26,200	19,900	62,800,000			721,000,00
China - - - 1 1 3.180 1 1 France 1 1 3.180 177 163 - Total 1 1 3.180 177 163 - Brazil 460 210 1.260,000 4,920 2.70 11. Canada 1,360 595 3,960,000 19,700 9,010 61. China - - - 2,650 1,220 6. Germany - - - 308 133 9 India 213 96 54,000 4,780 2.180 133 Norway 24 112 99,300 1,430 658 5. Slovakia - - - 93 34 5. Slovakia - - - 87 39 14 Total 2280 1,010 6,350,000 35,900 16 <t< td=""><td></td><td></td><td></td><td></td><td>3</td><td>3</td><td>3,57</td></t<>					3	3	3,57
France		_					
Magnesium ferrosilicon:		_					420,00
Magnesium ferrosilicon:		_ 1	1	3,180			3,18
Magnesium ferrosilicon:							4,53
Brazil		1	1	3,180	177	163	427,00
Canada 1,360 595 3,960,000 19,700 9,010 61,7 China 2,650 1,220 6. Germany 308 139 1. India 213 96 541,000 4,780 2,180 13. Norvay 24 12 90,300 1,430 658 5. Russia 87 39 44 1. 80vakia 1,450 658 3. Zambia 8422,000 1,450 658 3. Zambia 365 164 Other [1 country or locality] 355 164 Brazil 28 91 103 104 52 164 52	-	_					
China 2,50 1,220 6,60 Germany 2- 308 139 India 213 96 541,000 4,780 2,180 13,0 Norway 24 12 90,300 1,430 658 5, Russia 93 44 Slovakia 87 39 Thailand 220 98 492,000 1,450 658 3, Cambia 22,280 1,010 6,350,000 35,900 16,400 103, Other [1 country or locality] 208 91 1 Total 22,280 1,010 6,350,000 35,900 16,400 16,2 Brazil 208 91 1 Canada 66 207 1,340,000 </td <td></td> <td>_</td> <td></td> <td></td> <td></td> <td></td> <td>11,400,00</td>		_					11,400,00
Germany		1,360	595	3,960,000			61,800,00
India		_					6,370,00
Norway	·	_					499,00
Russia		_					13,000,00
Slovakia	•	_		90,300			5,250,00
Thailand		_					225,00
Cambia C		_					113,00
Other [I country or locality] — — — 53 24 Total 2,280 1,010 6,350,000 35,900 16,400 103,000 Other ferrosition: Brazil — — — 208 91 — Canada 686 207 1,340,000 8,080 2,600 15,6 China — — — 164 52 — France 47 21 83,300 47 21 — Germany 14 6 46,500 32 14 — — 67 30 — — 67 30 — — 67 30 — — 67 30 — — 67 30 — — 67 30 — — 67 30 — — 67 30 — — — 67 30 — — — 67 30 — —		_ 220		492,000			3,590,00
Total 2,280							319,00
Other ferrosilicon: Brazil 208 91 Canada 686 207 1,340,000 8,080 2,600 15,0 China 164 52 France 47 21 83,300 47 21 67 30 14 6 46,500 32 14 14 16 46,500 32 14 14 16 46,500 32 14 14 16 46,500 32 14 16 16 16 3 16 30 17 30 18 14 16 46,500 32 14 16 46,500 32 14 16 14 6 46,500 32 14 11 11,400 199 99 15 15 12 11 11,400 199 199 19 11 11 11 1,400 19 14 11							89,00
Brazil		2,280	1,010	6,350,000	35,900	16,400	103,000,00
Canada 686 207 1,340,000 8,080 2,600 15,1 China 164 52 France 47 21 83,300 47 21 Germany 14 6 46,500 32 14 India 67 30 67 30 85 43 67 30 67 30 67 30 67 30 85 43 85 43 85 43 85 43 80 11,400 199 99 <t< td=""><td></td><td>_</td><td></td><td></td><td>***</td><td></td><td>***</td></t<>		_			***		***
China 164 52 France 47 21 83,300 47 21 Germany 14 6 46,500 32 14 India 67 30 Norway 67 30 Paraguay 3 2 11,400 199 99 . Sbain 79 35 158,000 710 313 1. Spain 51 22 United Kingdom 6 3 Other [1 country or locality] 2 1 Total ferrosilicon 29,400 21,300 71,000,000 253,000 175,000 850,0 Metal: - 5 5 5 Canada - - 5 5		_					318,00
France 47 21 83,300 47 21 Germany 14 6 46,500 32 14 India 67 30 Norway 67 30 Paraguay 3 2 11,400 199 99 19 Slovakia 79 35 158,000 710 313 1, Spain 51 22 United Kingdom 6 3 Other [1 country or locality] 2 1 Total 830 271 1,640,000 9,650 3,280 18, Total ferrosilicon 29,400 21,300 71,000,000 253,000 175,000 850, Metal: 5 5 Canada 5 5 <td></td> <td>_</td> <td>207</td> <td>1,340,000</td> <td></td> <td></td> <td>15,000,00</td>		_	207	1,340,000			15,000,00
Germany		_					301,00
India		_					83,30
Norway		14	6	46,500			108,00
Paraguay 3		_					165,00
Slovakia 79 35 158,000 710 313 1,		_		11 400			210,00
Spain 51 22 United Kingdom 6 3 Other [1 country or locality] 2 1 Total 830 271 1,640,000 9,650 3,280 18. Total ferrosilicon 29,400 21,300 71,000,000 253,000 175,000 850,000 Metal: 23,000 175,000 850,000 Metal: 5 5 Brazil 112 112 401,000 1,780 1,780 5,000 Canada 5 5 China 3 3 1,620,000 372 372 15,000 Germany 80 80 80 4,550,000 751 751 55,000 Israel 20 20		_					587,00
United Kingdom 6 3 Other [1 country or locality] 2 1 Total 830 271 1,640,000 9,650 3,280 18, Total ferrosilicon 29,400 21,300 71,000,000 253,000 175,000 850,000 Metal: More than 99.99% silicon: Brazil 112 112 401,000 1,780 1,780 5,4 Canada 5 5 China 3 3 1,620,000 372 372 15,4 Germany 80 80 4,550,000 751 751 55,1 Israel 20 20 20 Japan 1 1 337,000 64 64 8, Norway 69 69 - Taiwan 45 45 6,070,000<		_		158,000			1,320,00
Other [1 country or locality] 2 1 Total 830 271 1,640,000 9,650 3,280 18, Total ferrosilicon 29,400 21,300 71,000,000 253,000 175,000 850,000 Metal: More than 99,99% silicon: Brazil 112 112 401,000 1,780 1,780 5,6 Canada 5 5 5 China 3 3 1,620,000 372 372 15,5 Germany 80 80 4,550,000 751 751 55, Israel 20 20 20 Japan 1 1 337,000 64 64 8, Norway 69 69 Taiwan 45 45 6,070,000 647 647 84, Turkey							98,50
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More than 99.99% silicon: 112 112 401,000 1,780 1,780 5,780 Canada 5 5 China 3 3 1,620,000 372 372 15,600 Germany 80 80 4,550,000 751 751 55,100 Israel 20 20 Japan 1 1 337,000 64 64 8,100 Norway 69 69 69 69 72 72 72 72 72 72 72 <td< td=""><td></td><td>29,400</td><td>21,300</td><td>/1,000,000</td><td>253,000</td><td>1/5,000</td><td>850,000,00</td></td<>		29,400	21,300	/1,000,000	253,000	1/5,000	850,000,00
Brazil 112 112 401,000 1,780 1,780 5,170 Canada 5 5 China 3 3 1,620,000 372 372 15,152 Germany 80 80 4,550,000 751 751 55,152 Israel 20 20 20 Japan 1 1 337,000 64 64 8,150 Norway 69 69 Taiwan 45 45 6,070,000 647 647 84,1 Turkey 19 19 19 Other [14 countries and (or) localities] 8 8 1,7 Total 243 243 13,000,000 3,810 3,810 173,000		_					
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Norway 69 69 1 69 69 69 69 84, Taiwan 45 45 6,070,000 647 647 84, Thailand 72 72 72 Turkey 19 19 19 Other [14 countries and (or) localities] 8 8 1, Total 243 243 13,000,000 3,810 3,810 173,1		_		227.000			70,90
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Thailand 72 72 72 Turkey 19 19 Other [14 countries and (or) localities] 8 8 1, Total 243 243 13,000,000 3,810 3,810 173,1	•	_					508,00
Turkey 19 19 Other [14 countries and (or) localities] 8 8 1, Total 243 243 13,000,000 3,810 3,810 173,4		_ 45	45	6,070,000			84,200,00
Other [14 countries and (or) localities] 8 8 1, Total 243 243 13,000,000 3,810 3,810 173,1			==				466,00
Total 243 243 13,000,000 3,810 3,810 173,	•						93,40
				12 000 000			1,410,00
99.00%-99.99% Silicon:		243	243	15,000,000	3,810	3,810	173,000,000
		=					4,690,000

See footnotes at end of table.

TABLE 4—Continued U.S. IMPORTS OF FERROSILICON AND SILICON METAL IN DECEMBER $2022^{1,2}\,$

(Metric tons, unless otherwise specified)

	Gross	Contained		Gross	January–December Contained	
Country or locality	weight	weight	Value	weight	weight	Value
Metal—Continued:						
99.00%–99.99% silicon:						
Brazil	1,340	1,330	\$5,350,000	14,100	13,900	\$55,900,000
Canada	386	383	2,490,000	7,320	7,280	26,400,000
Germany				780	776	1,990,000
Korea, Republic of				1,010	1,010	2,180,000
Malaysia				363	361	1,150,000
Norway	960	954	8,040,000	6,750	6,710	46,600,000
Slovakia				405	402	1,940,000
Thailand				2,510	2,490	13,400,000
Turkey				250	249	1,230,000
Other [10 countries and (or) localities]	142	141	519,000	425	423	1,340,000
Total	2,830	2,810	16,400,000	34,700	34,400	157,000,000
Other silicon:						
Australia	240	237	1,600,000	3,280	3,180	12,300,000
Belgium				299	279	567,000
Brazil	1,930	1,880	10,600,000	37,900	36,200	174,000,000
Canada	1,080	874	5,740,000	25,700	23,400	154,000,000
Laos				500	490	1,510,000
Malaysia				290	285	231,000
Netherlands	(4)	(4)	6,400	832	743	1,420,000
Norway	507	497	3,480,000	6,800	6,560	37,500,000
Slovakia				1,650	1,610	4,120,000
Thailand	360	355	1,070,000	4,620	4,390	15,100,000
Other [12 countries and (or) localities]	2	2	17,400	632	610	1,560,000
Total	4,120	3,840	22,600,000	82,500	77,800	402,000,000
Total silicon metal	7,190	6,890	52,000,000	121,000	116,000	732,000,000

⁻⁻ Zero.

Source: U.S. Census Bureau.

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 ¹Presentation of monthly data is based on the quantities (gross weight) of the leading countries and (or) localities.
 ²Data are rounded to no more than three significant digits; may not add to totals shown.
 ³May include revisions to previously published data.
 ⁴Less than ½ unit.