

QUARTZ & OTHER SILICA MINERALS



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QUARTZ & OTHER SILICA MINERALS

(FINAL RELEASE)

**GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES**

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42 Quartz & Other Silica Minerals

The term 'quartz' is often referred to as a synonym for silica. Silica (SiO_2) is one of the ubiquitous materials in the earth's crust. Quartz, quartz crystals, quartzite, silica sand, sand (others) and moulding sand are all coined together in one generic name 'silica minerals'. This is because all these commodities are essentially crystalline silicon dioxide (SiO_2) with variations mostly related to their crystalline structure and presence of minor or trace impurities. Silica occurs in several forms giving rise to different varieties.

Crystalline Varieties

The important varieties of crystalline quartz are vein quartz (massive crystalline quartz); milky quartz (white, translucent to opaque); ferruginous quartz (containing brown limonite and red haematite and almost opaque); aventurine quartz (containing glistening flakes of mica or haematite); cat's eye (opalescent greenish quartz with fibrous structure); rock crystal (clear, colourless, well-crystallised transparent quartz); amethyst (clear-purple or violet-blue), transparent quartz; rose quartz; smoky quartz; etc. Occurrences of massive crystalline quartz in veins or pegmatites have been recorded in almost all the states.

Clastic or Granular Varieties

These varieties include sand consisting largely of unconsolidated quartzose grains (0.06 mm to 2 mm diameter), gravel consisting largely of unconsolidated coarse quartzose grains or pebbles (2 mm to 8 mm in diameter), sandstone and quartzite. The occurrences are reported from Andhra Pradesh, Bihar, Delhi, Haryana, Karnataka, Kerala, Madhya Pradesh, Rajasthan, Tamil Nadu, Uttar Pradesh, etc. The silica sand from Naini area in Allahabad district, Uttar Pradesh is of a very high quality.

Cryptocrystalline Varieties

This group includes chalcedony, agate, jasper, onyx, flint and chert. These varieties appear non-crystalline (amorphous) in hand specimens, but under microscope show double refraction which reveals their concealed crystalline nature. These varieties are reported from Gujarat, Uttar Pradesh, Tamil Nadu, Andhra Pradesh, Maharashtra, Madhya Pradesh, Karnataka and Punjab. The most important occurrences of agate are in Ratnapur, Rajpipla area and

further west between Tapi and Narmada rivers in Bharuch district, Gujarat, where it is found as pebbles in varying sizes associated with clay washed down by the river flow. Other occurrences of economic importance are reported from Amravati, Aurangabad, Buldhana, Chandrapur, Nashik and Pune districts in Maharashtra; beds of Krishna and Godavari rivers in Andhra Pradesh; Dumka district in Jharkhand; Dhar, Mandasaur, Sihore and Shahdol districts in Madhya Pradesh; and Kachchh district in Gujarat.

RESOURCES

As per the UNFC system as on 1.4.2010, the total resources of quartz and silica sand in the country are estimated at 3,499 million tonnes out of which 12% i.e. 429 million tonnes are placed under reserves category while 88% i.e. 3,070 million tonnes are placed under remaining resources category. Resources by grades reflect foundry & moulding grade as 19%, glass grade 14%, ceramic & pottery grade 11% and ferro-silicon grade as 5%. The unclassified, others, sodium silicate and not-known grades account for about 51% of the total resources. Haryana alone accounts for about 52% resources, followed by Rajasthan (9.5%), Tamil Nadu (6.5%), Andhra Pradesh (6%), Maharashtra (5%), Jharkhand (4.5%) and Karnataka and Gujarat (3% each) (Table - 1).

The total resources of quartzite in the country as per the UNFC system as on 1.4.2010 (Provisional) are estimated as 1,251 million tonnes of which reserves are about 87 million tonnes and remaining resources are 1,165 million tonnes. Bulk resources of about 50% are located in Haryana followed by Bihar (22%), Maharashtra (7%), Punjab (6.5%), Odisha (5%) and Jharkhand (3%). Resources of refractory grade are 37%, ceramic & pottery grade 18% and BF grade 5%. The remaining 40% resources are of low, unclassified, others and not-known grades (Table - 2).

EXPLORATION & DEVELOPMENT

Exploration for quartz and silica minerals was conducted by DMG, Rajasthan. Details of exploration carried out for quartz and other silica minerals during 2011-12 are given in Table - 3.

QUARTZ & OTHER SILICA MINERALS

Table – 1 : Reserves/Resources of Quartz & Silica Sand as on 1.04.2010
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources						Total resources (A+B)			
	Proved STD111	Probable		Total A	Feasibility STD221	Pre-feasibility		Measured STD331	Indicated STD332	Interred STD333		Reconnaissance		Total B
		STD121	STD122			STD221	STD222					STD334	STD334	
All India: Total	272,972	35,079	121,173	429,223	185,399	322,454	321,760	58,683	259,116	1,907,994	14,402	3,069,808	3,499,031	
By Grades														
Glass	103,129	15,139	40,524	158,792	46,785	23,815	51,528	2,176	8,707	175,356	5,922	314,289	473,082	
Ferro-silicon	4,889	96	6,479	11,464	9,022	16,023	20,409	98	65,126	57,175	-	167,853	179,317	
Sodium silicate	1,622	38	1,594	3,254	533	1,490	5,143	-	146	31,245	11	38,568	41,822	
Ceramic and Pottery	96,746	1,554	32,111	130,411	12,935	23,781	59,764	7,328	12,826	148,729	-	265,362	395,773	
Foundry and Moulding	46,285	15,999	20,891	83,175	58,339	36,249	116,140	16,984	38,301	302,462	7,672	576,148	659,323	
Abrasive	2,405	7	13	2,425	-	249	1,861	-	10	3,508	-	5,628	8,053	
Others	10,844	116	11,398	22,358	38,280	62,210	14,649	116	25	862,023	220	977,523	999,881	
Unclassified	4,600	353	2,828	7,781	11,869	154,593	33,209	31,982	39,669	190,442	17	461,781	469,562	
Not-known	2,453	1,778	5,333	9,564	7,634	4,045	19,058	-	94,307	137,053	560	262,657	272,220	
By States														
Andhra Pradesh	33,590	3,320	35,772	72,683	16,664	6,242	25,109	5,404	10,965	65,867	6,099	136,349	209,031	
Assam	-	-	-	-	-	-	-	-	-	1,790	-	1,790	1,790	
Bihar	-	-	2,121	2,121	-	-	-	-	-	24,652	-	24,652	26,773	
Chhattisgarh	141	-	46	187	385	-	620	56	-	191	7,672	8,924	9,111	
Goa	-	-	-	-	-	20	1,736	-	-	18,248	-	20,004	20,004	
Gujarat	16,042	684	19,256	35,982	17,133	5,110	11,774	2,144	2,999	25,629	-	64,789	100,771	
Haryana	-	46	8,317	8,363	35,553	252,759	182,478	27,837	39,767	1,264,473	-	1,802,868	1,811,231	
Himachal Pradesh	1	-	7	8	99	-	-	-	-	2,928	-	3,027	3,035	
Jammu & Kashmir	-	-	-	-	-	-	-	-	-	3,110	-	3,110	3,110	
Jharkhand	563	4	8,671	9,238	2	989	3,299	518	1,026	141,342	107	147,283	156,521	
Karnataka	8,677	3,809	2,375	14,861	12,402	4,970	8,276	205	100	49,508	525	75,987	90,848	
Kerala	-	38	-	38	404	1,959	3,354	14,611	30,241	77,528	-	128,096	128,135	
Madhya Pradesh	144	11	14	169	51	-	86	47	316	2,191	-	2,692	2,861	
Maharashtra	12,356	2,085	10,884	25,326	29,372	15,172	48,391	-	355	58,374	-	151,663	176,989	
Meghalaya	-	-	-	-	-	-	-	-	177	6,906	-	7,083	7,083	
Odisha	438	69	860	1,367	1,161	1,503	2,599	90	63,385	3,836	-	72,573	73,940	
Punjab	-	-	-	-	-	-	-	-	-	3,927	-	3,927	3,927	
Rajasthan	132,135	10,472	27,757	170,364	40,583	13,344	23,433	3,202	7,658	73,883	-	162,104	332,468	
Tamil Nadu	60,063	9	93	60,166	29,644	4,892	7,523	3,387	95,837	27,150	-	168,432	228,598	
Tripura	-	-	-	-	-	-	-	225	-	264	-	490	490	
Uttar Pradesh	8,042	14,530	3,977	26,549	1,946	15,482	3,071	957	6,290	51,590	-	79,337	105,886	
West Bengal	779	-	1,022	1,801	-	11	11	-	-	4,607	-	4,629	6,430	

Figures rounded off.

QUARTZ & OTHER SILICA MINERALS

**Table – 2 : Reserves/Resources of Quartzite as on 1.4.2010
(By Grades/States)**

(In '000 tonnes)

Grades/States	Reserves				Remaining resources					Total resources (A+B)			
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332		Inferred STD333	Reconnaissance STD334	Total (B)
		STD121	STD122			STD221	STD222						
All India : Total	59004	1647	25948	86599	33217	105018	147686	93116	113611	669453	2548	1164649	1251248
By Grades													
Refractory Grade-I	52958	268	21894	75120	4549	626	11470	829	1067	239474	1730	259745	334865
Refractory Grade-II	1520	406	485	2411	146	461	-	3183	21490	97836	-	123116	125527
Ceramic / Pottery	558	9	1015	1582	16195	35826	72771	-	3599	90702	-	219093	220675
Low	985	-	1000	1985	468	3863	18	37	-	8460	-	12846	14831
Ferro-silicon	-	-	-	-	169	692	3034	-	376	-	523	4794	4794
B.F.	242	-	1258	1500	-	606	809	197	275	62822	295	65004	66504
Others	1079	907	210	2196	9488	757	2025	588	-	3012	-	15870	18066
Unclassified	163	-	86	249	2203	55769	55479	67347	55674	133095	-	369567	369816
Not-known	1500	58	-	1558	-	6418	2080	20935	31130	34053	-	94616	96174
By States													
Andhra Pradesh	2114	406	2131	4651	548	1009	7481	-	4390	5209	295	18932	23583
Arunachal Pradesh	-	-	-	-	-	-	-	-	-	5270	-	5270	5270
Bihar	-	32	-	32	146	461	20054	5287	22822	227531	-	276301	276333
Chhattisgarh	1404	-	1267	2671	3086	3926	2195	-	-	14706	-	23913	26584
Haryana	-	-	-	-	15702	89742	112365	86951	85333	231887	-	621980	621980
Himachal Pradesh	25	-	16	41	16	-	-	-	-	-	-	16	57
Jammu & Kashmir	1500	58	-	1558	-	-	-	-	-	-	-	-	1558
Jharkhand	1079	-	174	1253	-	-	-	197	275	38869	-	39341	40594
Karnataka	390	-	1011	1401	-	-	190	-	-	-	1730	1920	3321
Madhya Pradesh	-	-	-	-	-	-	-	-	-	832	-	832	832
Maharashtra	48700	-	19480	68180	9516	28	1639	-	-	11353	-	22536	90716
Odisha	3629	1151	1783	6563	4204	9834	3744	681	-	34851	523	53837	60400
Punjab	-	-	-	-	-	-	-	-	116	81796	-	81912	81912
Rajasthan	163	-	86	249	-	18	18	-	-	706	-	742	991
Sikkim	-	-	-	-	-	-	-	-	675	16444	-	17119	17119

Figures rounded off.

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Table – 3 : Details of Exploration Activities for Quartz, Quartzite & Silica sand, 2011-12

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
QUARTZ							
DMG, Rajasthan Pali	N/v Dholi Dungari-Khenwal Kana -Kolar Teh-Raipur	1:50000 1:10000 1:2000	150 10 2	-	-	40	Exploration carried out for quartz & feldspar, etc. Resources were not estimated.
Sirohi	Teh-Sheoganj	1:10000 1:2000	10 1	-	-	-	Exploration carried out for quartz & feldspar, etc. Resources were not estimated.
SILICA SAND							
DMG, Rajasthan Dausa	Girota, Sandhera Ghumna	1:50000 1:10000	100 15	-	-	20	About 35,250 tonnes resources of silica sand were estimated. Silica sand occurs as pale brown to off white coloured & was mapped in 40-50 x 6x10 m N/v Girota and 60-80 x 10-20 m N/v Sandhera.
Silica Sand (Colloidal) Karauli	N/V Jhakhoka, Lawanch, Orich, Ranipura	1:50000 1:10000 1:2000	50 10 1.0	-	-	04	Occurrences of silica sand were observed at N/v Orich having dimension of 100 m x 20-40 m x 8-16 m (avg-12 m). Resources of colloidal silica sand were estimated at 0.09 million tonnes.

PRODUCTION, STOCKS & PRICES

QUARTZ

The production of quartz at 520 thousand tonnes in 2011-12 increased by 5% as compared to the preceding year. There were 153 reporting mines in 2011-12 as against 100 in preceding year. Besides, the production of quartz was also reported from 72 mines as an associated mineral as against 56 mines in preceding year. The share of public sector mines, in the total output was about 3% during the year. The share of 10 principal producers was about 46% of the total output.

Andhra Pradesh continued to be the major producing state of quartz in the year 2011-12 also accounting for 46% of the total production followed by Rajasthan (18%), Jharkhand (17%), Gujarat and Maharashtra (6% each), West Bengal and Tamil Nadu (3% each) and the remaining one

percent production was contributed by Odisha, Chhasttisgarh and Madhya Pradesh. About 54% of the production during the year 2011-12 was reported by 17 mines including 6 associated mines having production above ten thousand tonnes. Fourteen mines including one associated mine having annual production between five thousand to ten thousand tonnes contributed about 19% of the total production. The remaining was the contribution of 195 mines including 65 associated mines having annual production below five thousand tonnes (Tables-4 to 7).

The mine-head stocks of quartz at the end of the year were 359 thousand tonnes as against 346 thousand tonnes in the beginning of the year (Table-8).

The average daily labour employed in quartz mines in 2011-12 was 1611 as against 1,075 in the previous year. Domestic prices of quartz are furnished in the General Review on 'Prices'.

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**Table – 4 : Principal Producers of Quartz
2011-12**

Name & address of producer	Location of mine	
	State	District
Sibelco India Minerals Pvt. Ltd. (Formerly Vijaya Gimpex Mining (P) Ltd.) No.8-2-293/K/311-312, Sriman Chambers, Kamalapuri Colony, Phase-3, Hyderabad-500 073, Andhra Pradesh.	Andhra Pradesh	Anantapur, Mahboobnagar
P. V. Ramana Reddy C/O R. Ramamahan Reddy Sondar Singh Colony, Dhone, Kurnool-518 222, Andhra Pradesh.	Andhra Pradesh	Kurnool
Shree B.S. Mining Company Opp Jyoti Petrol Pump Road No. 1, VKI Area, Jaipur-302 013, Rajasthan.	Rajasthan	Tonk
Dolphin Feldspar Private Ltd. 6-3-1239/2/A, Kotis Court, 4th Floor Rajbhavan Road, Somajiguda-500 082, Hyderabad, Andhra Pradesh.	Andhra Pradesh	Mahboobnagar
Abdul Gaffar Rangoonwala Gahra Mineral Habib Nagar, Teka Naka, Nagpur - 440 017, Maharashtra.	Maharashtra	Bhandara, Chandrapur

(Contd.)

Table - 4 (Concl'd.)

Name & address of producer	Location of mine	
	State	District
B. Ram Reddy H.No. 2-26, Nirdavelly, Keshampet-509 408, Mahboobnagar, Andhra Pradesh.	Andhra Pradesh	Mahboobnagar
Sandeep Kumar Kanodia Main Road, P.O. Chandwa, Latehar- 829 203, Jharkhand	Jharkhand	Latehar
Dilip Singh P. Solanki C/O L. H. Pandya Patthar Talvadi, Near H.Mandir, Godhra, Panchmahal-389 001, Gujarat.	Gujarat	Panchmahal
Renuka pati 99, Konark complex, Masjid Road, Golmuri, Jamshedpur-831 003, Singhbhum (East), Jharkhand.	Jharkhand	Singhbhum (East)
K. Subramanya Raju Lotlapalli Alamanda RS & PO Jami (Mandal) Vizianagaram-535 240, Andhra Pradesh.	Andhra Pradesh	Vizianagaram

**Table – 5 : Production of Quartz, 2009-10 to 2011-12
(By States)**

(Qty in tonnes; value in ₹'000)

State	2009-10		2010-11		2011-12(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	512320	94043	497546	112108	520146	117074
Andhra Pradesh	182040	29642	214626	40845	239325	44895
Chhattisgarh	384	54	655	92	731	144
Gujarat	69597	7048	37540	4889	33061	4548
Jharkhand	68331	13420	61665	10196	87221	16393
Karnataka	275	108	10	3	-	-
Madhya Pradesh	-	-	1754	173	435	43
Maharashtra	12650	2761	10505	2363	30694	10557
Odisha	1570	257	11414	5262	6241	2088
Rajasthan	154698	29471	133797	26046	91953	18911
Tamil Nadu	6952	7898	8674	18045	14423	14653
West Bengal	15823	3384	16906	4194	16062	4842

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**Table – 6 : Production of Quartz, 2010-11 & 2011-12
(By Sectors/States/Districts)**

(Qty in tonnes; value in ₹'000)

State/District	2010-11			2011-12(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	100(56)	497546	112108	153(72)	520146	117074
Public Sector	2(2)	12264	18264	4(1)	14430	14177
Private Sector	98(54)	485282	93844	149(71)	505716	102897
Andhra Pradesh	32(14)	214626	40845	39(17)	239325	44895
Adilabad	-	-	-	1	200	30
Anantpur	2	67	10	1	3970	1667
Cuddapah	-	-	-	3	6495	1299
Khammam	2	48	7	-	-	-
Krishna	2	193	29	-	-	-
Kurnool	5	34877	6860	6	51767	7184
Mahaboobnagar	7(5)	105229	17708	6(7)	106031	17120
Medak	4	32229	6080	5	26141	5766
Nalgonda	1	2500	465	1	113	20
Nellore	2(8)	16276	3441	8(10)	12347	2976
Ranga Reddy	3(1)	5134	810	3	9145	1755
Visakhapatnam	1	7799	3361	2	6588	2415
Vizianagaram	3	10274	2074	3	16528	4663
Chhattisgarh	1	655	92	3	731	144
Jashpur	1	655	92	1	423	59
Mahasmand	-	-	-	2	308	85
Gujarat	5	37540	4889	5	33061	4548
Dahod	-	-	-	1	450	203
Panchmahal	5	37540	4889	4	32611	4345
Jharkhand	9(3)	61665	10196	9(3)	87221	16393
Deoghar	1	1925	289	1	1875	265
Dumka	1	5807	900	1	3766	485
Giridih	-	-	-	1	36	9
Hazaribagh	(1)	785	124	(1)	1039	235
Jamtara	(1)	6370	764	(1)	11319	1358
Latehar	4(1)	45878	7961	5(1)	54236	9946
Ranchi	1*	-	-	-	-	-
Saraikala-Kharsawan	1*	-	-	-	-	-
Singhbhum (East)	1	900	158	1	14950	4095
Karnataka	(1)	10	3	1*	-	-
Bengaluru	(1)	10	3	-	-	-
Hassan	-	-	-	1*	-	-

(Contd.)

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Table - 6 (Concl.d.)

State/District	2010-11			2011-12(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
Madhya Pradesh	2(1)	1754	173	2	435	43
Balaghat	1(1)	1424	142	1	-	-
Chhatarpur	1	330	31	1	435	43
Maharashtra	4(1)	10505	2363	4(1)	30694	10557
Bhandara	3(1)	10369	2344	3	19726	7834
Chandrapur	1	136	19	1	10502	2625
Nagpur	-	-	-	(1)	466	98
Odisha	1	11414	5262	1	6241	2088
Mayurbhanj	1	11414	5262	1	6241	2088
Rajasthan	32(35)	133797	26046	47(50)	91953	18911
Ajmer	15(21)	36783	6448	25(31)	39546	7954
Alwar	1	132	67	-	-	-
Bhilwara	1(14)	4869	910	4(17)	10916	2632
Bundi	-	-	-	(1)	252	29
Chittorgarh	2	166	42	-	-	-
Jaipur	1	5545	832	3	40	8
Rajasamand	2	1723	121	3	2697	278
Sikar	3	1521	152	7(1)	3401	642
Sirohi	2	1396	227	2	129	19
Tonk	4	81662	17247	3	34972	7349
Udaipur	1*	-	-	-	-	-
Tamil Nadu	11(1)	8674	18045	38(1)	14423	14653
Coimbatore	-	-	-	1	40	28
Dindugul	3	142	39	4	617	309
Erode	-	-	-	4	55	25
Karur	1	448	90	9	46	39
Madurai	2	2830	1615	1	540	336
Nammakal	1	3616	13271	5	3457	7585
Salem	4*	-	-	13	7120	1555
Tiruchirapalli	-	-	-	1	140	259
Tiruvarur	(1)	1638	3030	(1)	2408	4517
West Bengal	3	16906	4194	4	16062	4842
Bankura	1	8650	1920	1	3405	876
Birbhum	1	1256	314	1	3566	1425
Purulia	1	7000	1960	2	9091	2541

Figures in parentheses indicate no. of associated mines of quartz with asbestos, chinaclay, felspar, manganese ore, mica & silica sand.

* Reported labour only and/or production of felspar.

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**Table – 7 : Production of Quartz, 2010-11 & 2011-12(P)
(By Frequency Groups)**

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
All Groups	100 (56)	154 (72)	497544	520146	100.00	100.00	-	-
Up to 500	46 (24)	86 (39)	7935	13495	1.59	2.59	1.59	2.59
501-1000	9 (9)	15 (12)	12675	19759	2.55	3.80	4.14	6.39
1001-5000	23 (16)	29(14)	76090	103919	15.29	19.98	19.43	26.37
5001-10000	15(4)	13(1)	134695	101323	27.07	19.48	46.50	45.85
10001 & above	7 (3)	11(6)	266149	281650	53.50	54.15	100.00	100.00

Figures in parentheses indicate number of associated mines of quartz with asbestos, chinaclay, felspar, manganese ore, mica & silica sand.

**Table – 8 : Mine-head Stocks of Quartz
2011-12(P)
(By States)**

(In tonnes)

State	At the beginning of the year	At the end of the year
India	345738	359336
Andhra Pradesh	207074	118117
Chhattisgarh	114	77
Gujarat	3980	4898
Jharkhand	3584	6813
Karnataka	13812	119665
Madhya Pradesh	9311	9532
Maharashtra	2649	5620
Odisha	2928	10869
Rajasthan	96819	73770
Tamil Nadu	2605	8519
Uttar Pradesh	2565	1279
West Bengal	297	177

SILICA SAND

The production of silica sand at 4,335 thousand tonnes in 2011-12 increased by about 28 % over the previous year due to increase in demand from cement plants. Gujarat, the major producing state, reported increase of about 41% in comparison with the previous year.

During the year under review, there were 132 reporting mines as against 122 in the preceding year. Besides, the production of silica sand was also reported as an associated mineral by six mines during the year. Ten principal producers accounted for about 67% of the total production. The share of public sector in the total production was 4% in 2011-12 which was same in the preceding year.

Gujarat was the leading producing state accounted for 41% of the total production during the year, followed by Andhra Pradesh (29%), Rajasthan (16%), Maharashtra (7%), Jharkhand (3%), Kerala and Uttar Pradesh (1% each). The remaining two percent production was the contribution of Karnataka and Tamil Nadu.

About 77% of the total production of silica sand was contributed by 14 silica sand mines and three associated mines, each producing more than 50 thousand tonnes annually. About 21 % was contributed by 52 silica sand mines and one associated mine, each producing five thousand to fifty thousand tonnes. The remaining 2% output was contributed by 66 silica sand mines and two associated mines, each producing less than 5000 tonnes annually (Tables - 9 to 12).

Mine-head stocks of silica sand at the end of 2011-12 were 5,359 thousand tonnes as against of 5,007 thousand tonnes in the beginning of the year (Table-13).

The average daily employment of labour in 2011-12 was 1,995 as against 2,191 in the previous year. Domestic prices of silica sand are furnished in the General Review on 'Prices'.

QUARTZ & OTHER SILICA MINERALS

**Table – 9 : Principal Producers of Silica Sand
2011-12**

Name & address of producer	Location of mine	
	State	District
Bhavani Minerals At & PO: Bhilod-393 135, Tehsil: Valia, Dist. Bharuch, Gujarat.	Gujarat	Bharuch
Mohd. Sher Khan Pathan S/o Gulbaz Khan Vill. Banesti, PO. Sawa, Dist. Chittorgarh, Rajasthan	Rajasthan	Chittorgarh
Kumaraswamy Silica Mines, Momidi P.O., Chillakur - Mandal, Dist. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
Alimiya.I.Saiyad 16, Samruddhi Complex Himmatnagar-383 001, Dist. Sabarkantha, Gujarat.	Gujarat	Bharuch
D. Sundra Rami Reddy P.O.- Chinthavaram, Dist. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore

Table - 9 (Concl.)

Name & address of producer	Location of mine	
	State	District
Bundi Silica Sand Supply Co. Kanhaiyalal Ghatiwala, Rishabh Bhavan, New Colony, Gumanpura, Dist. Kota – 324 007, Rajasthan.	Rajasthan	Bundi
Y. Pitchi Reddy 7/26-3A,Chevurivari Thota Post- Kavali, Dist. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
Maharashtra State Mining Corporation Ltd. 5,Abhyankar Nagar, Nagpur, Maharashtra.	Maharashtra	Sindhudurg
N.N.Ankleshwara Vill. Amod, Dist. Bharuch, Gujarat.	Gujarat	Bharuch
Sanghi Industries Ltd Post. Sanghipuram, Dist. Kachchh, Gujarat-370 511.	Gujarat	Kachchh

(Contd.)

**Table – 10 : Production of Silica Sand, 2009-10 to 2011-12
(By States)**

(Qty in tonnes; value in ₹'000)

State	2009-10		2010-11		2011-12(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	2545988	408559	3380968	444684	4334925	689115
Andhra Pradesh	958934	64205	1239896	82650	1270309	98804
Gujarat	465530	40569	1247949	94933	1757376	144790
Jharkhand	91597	32818	97560	30733	112140	36493
Karnataka	109468	15206	43988	6384	33937	8469
Kerala	33988	20220	30975	26188	58732	78838
Maharashtra	271517	90831	256817	65828	281043	96396
Odisha	2800	700	-	-	-	-
Rajasthan	418311	103878	232788	74016	707160	185176
Tamil Nadu	10476	5688	8886	5466	4502	6517
Uttar Pradesh	183367	34444	167109	36486	58596	11971
West Bengal	-	-	55000	22000	51130	21661

QUARTZ & OTHER SILICA MINERALS

**Table – 11 : Production of Silica Sand, 2010-11 and 2011-12
(By Sectors/States/Districts)**

(Qty in tonnes; value in ₹'000)

State/District	2010-11			2011-12(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	122(4)	3380968	444684	132(6)	4334925	689115
Public Sector	7	141032	33504	5	153873	56530
Private Sector	115(4)	3239936	411180	127(6)	4181052	632585
Andhra Pradesh	45(1)	1239896	82650	54	1270309	98804
Kurnool	5(1)	4048	650	9	32128	6489
Nellore	40	1235848	82000	45	1238181	92315
Gujarat	16(1)	1247949	94933	13(1)	1757376	144790
Bharuch	12(1)	1029285	77158	10(1)	1675086	137668
Kachchh	1	194754	15191	1	78501	5925
Sabarkantha	1	4675	1519	1	3699	1186
Surat	1	105	13	1	90	11
Surendranagar	1	19130	1052	-	-	-
Jharkhand	1(1)	97560	30733	1(1)	112140	36493
Sahibganj	1(1)	97560	30733	1(1)	112140	36493
Karnataka	16	43988	6384	6	33937	8469
Haveri	4	3567	393	-	-	-
Udupi	8	18760	3716	4	26700	7745
Uttara Kannada	4	21661	2275	2	7237	724
Kerala	8	30975	26188	17	58732	78838
Alappuzha	8	30975	26188	17	58732	78838
Maharashtra	13	256817	65828	12	281043	96396
Kolhapur	-	-	-	1	950	105
Ratnagiri	5	27222	5818	4	12607	2205
Sindhudurg	8	229595	60010	7	267486	94086
Rajasthan	8(1)	232788	74016	16(4)	707160	185176
Alwar	1	6023	1325	1	6053	1004
Bharatpur	2	4960	843	-	-	-
Bikaner	-	-	-	(1)	12196	2495
Bundi	1	99235	34732	1	88630	34730
Chittorgarh	1(1)	108869	33205	(1)	449780	112168
Jaisalmer	1	6066	2002	1	11956	6576
Karauli	1	2645	661	1	18315	4579
Sawai Madhopur	1	4990	1248	5	92297	20190
Sikar	-	-	-	5(2)	2357	567
Sirohi	-	-	-	1	19405	1941
Tonk	-	-	-	1	6171	926
Tamil Nadu	6	8886	5466	7	4502	6517
Kanchipuram	3	3574	3658	3	2977	4026
Nagapattinam	-	-	-	2	1525	2491
Villupuram	3	5312	1808	2	-	-
Uttar Pradesh	8	167109	36486	5	58596	11971
Allahabad	6	126040	22994	4	57631	11874
Chitrakut	2	41069	13492	1	965	97
West Bengal	1	55000	22000	1	51130	21661
Bankura	1	55000	22000	1	51130	21661

Figures in parentheses indicate number of associated mines with agate, kaolin & quartz.

QUARTZ & OTHER SILICA MINERALS

Table – 12 : Production of Silica Sand, 2010-11 & 2011-12 (P)
(By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
All Groups	122(4)	132(6)	3380968	4334925	100.00	100.00	-	-
Up to 500	18(1)	23(1)	3906	4560	0.13	0.11	0.13	0.11
501 to 1000	6	14(1)	5256	10550	0.15	0.24	0.28	0.35
1001 to 3000	22	17	41587	30461	1.23	0.70	1.51	1.05
3001 to 5000	10	12	41674	48843	1.23	1.13	2.74	2.18
5001 to 10000	18	20	121233	141532	3.58	3.26	6.32	5.44
10001 to 15000	6	8(1)	72712	113847	2.15	2.63	8.47	8.07
15001 to 25000	10	13	185796	267126	5.49	6.16	13.96	14.23
25001 to 50000	20(1)	11	743042	390497	21.98	9.01	35.94	23.24
50001 and Above	12(2)	14(3)	2165762	3327509	64.06	76.76	100.00	100.00

Table – 13 : Mine-head Stocks of Silica Sand 2011-12 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	5006757	5359336
Andhra Pradesh	2243909	2320521
Gujarat	2202382	2185840
Jharkhand	34880	45626
Karnataka	55495	59050
Kerala	21402	33427
Maharashtra	179419	135229
Odisha	1226	1749
Rajasthan	185411	503702
Tamil Nadu	46	1516
Uttar Pradesh	82587	72676

additional mines reporting production in Chhattisgarh and Jharkhand.

There were 15 reporting mines during the year as against 13 in the previous year. Besides, production of quartzite was reported by two associated mines in the current year and one associated mine in the previous year. During the year under review five principal producers accounted for about 73% of the total production. Entire output of quartzite was reported from mines operated in the private sector.

Andhra Pradesh was the leading producing state during the year under review contributing about 34% of total production followed by Jharkhand (25%), Bihar (20%), Chhattisgarh (9%), Karnataka (6%), Rajasthan (4%), Odisha and Maharashtra (1% each) (Tables-14 to 16).

Mine-head stocks of quartzite at the end of the year 2011-12 were 50 thousand tonnes as against 28 thousand tonnes in the beginning of the year (Table -17).

QUARTZITE

Production of quartzite at 181 thousand tonnes in 2011-12 increased by 53% as compared to that in the previous year mainly due to

The average daily employment of labour during the year under review was 453 as against 226 in 2010-11. Domestic prices of quartzite are furnished in the General Review on 'Prices'.

QUARTZ & OTHER SILICA MINERALS

Table – 14: Principal Producers of Quartzite, 2011-12

Name & address of producer	Location of mine	
	State	District
Dinesh Das & Son's Mines & Steel Pvt. Ltd. Srikakulam Post - Bahalda, Bahald Road, Dist - Mayurbhanj, Odisha.	Andhra Pradesh	Vizianagaram Srikakulam
Bharat Mining Company, Post - Sunder Nagar, Dist - Singhbhum East, Jharkhand.	Jharkhand	Singhbhum East
Douglas Dias No.26, D'Costa Mansion, Main Road, Bistupur, Dist - Singhbhum East, Jharkhand	Jharkhand	Singhbhum East
OCL India Ltd. At & Post- Rajgangpur, Dist - Sundargarh, Odisha.	Chhattisgarh Odisha	Raigarh Jharsuguda
Khalsa Stone Works, Albert Road, Jamalpur, Dist - Munger, Bihar.	Bihar	Munger

**Table – 15 : Production of Quartzite, 2009-10 to 2011-12
(By States)**

(Qty in tonnes; value in ₹ '000)

State	2009-10		2010-11		2011-12 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	112652	37377	118117	45750	181065	91790
Andhra Pradesh	122	18	7717	4275	61599	39531
Bihar	56394	20855	62767	26855	36024	16632
Chhattisgarh	50	8	60	29	16086	18422
Jharkhand	10737	2147	24810	5458	44726	10992
Karnataka	7437	2054	11450	3607	10434	2902
Maharashtra	2481	620	2455	614	1944	588
Odisha	29886	11093	4608	3063	3064	1860
Rajasthan	5545	582	4250	1849	7188	863

QUARTZ & OTHER SILICA MINERALS

**Table – 16 : Production of Quartzite, 2010-11 & 2011-12
(By Sectors/States/Districts)**

(Qty in tonnes; value in ₹'000)

State/District	2010-11			2011-12 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	13(1)	118117	45750	15(2)	181065	91790
Private Sector	13(1)	118117	45750	15(2)	181065	91790
Andhra Pradesh	4	7717	4275	3	61599	39531
Cuddapah	2	83	12	-	-	-
Srikakulam	1	2218	1284	1	1840	745
Vizianagaram	1	5416	2979	2	59759	38786
Bihar	3	62767	26855	3	36024	16632
Munger	3	62767	26855	3	36024	16632
Chhattisgarh	1	60	29	3	16086	18422
Durg	-	-	-	1	150	72
Raigarh	-	-	-	2	15936	18350
Rajnandgaon	1	60	29	-	-	-
Jharkhand	1	24810	5458	2	44726	10992
Singhbhum (East)	1	24810	5458	2	44726	10992
Karnataka	1	11450	3607	1	10434	2902
Belgaum	1	11450	3607	1	10434	2902
Maharashtra	(1)	2455	614	(1)	1944	588
Bhandara	(1)	2455	614	(1)	1944	588
Odisha	2	4608	3063	2(1)	3064	1860
Jharsuguda	1	4590	3061	1(1)	2209	1441
Mayurbhanj	1	18	2	1	855	419
Rajasthan	1	4250	1849	1	7188	863
Sawai Madhopur	1	4250	1849	1	7188	863

**Table – 17: Mine-head Stocks of Quartzite
2011-12 (P)
(By States)**

(In tonnes)

State	At the beginning of the year	At the end of the year
India	27649	49885
Andhra Pradesh	10169	5333
Bihar	4239	7939
Chhattisgarh	612	19576
Jharkhand	1821	2174
Karnataka	2100	2193
Maharashtra	100	40
Odisha	4131	7883
Rajasthan	4477	4547
West Bengal	-	200

SAND (OTHERS)

The production of sand (others) at 2,625 thousand tonnes in 2011-12 increased by 28% as compared to that in the previous year.

There were ten reporting mines in 2011-12 as against fourteen in the previous year. The Singareni Collieries Co Ltd., having seven mines in Andhra Pradesh contributed 82% production of sand (others). 17% production was from three mines of Western Coal Fields Ltd., located in Chandrapur district of Maharashtra. The remaining one percent was reported as an associated mineral by a private sector mine of limestone located in Jaintia Hills district of Meghalaya (Tables -18 to 20).

All mines were captive engaging contract labours.

Mine-head stocks at the end of 2011-12 were 430 thousand tonnes as against 222 thousand tonnes in the beginning of the year (Table -21).

QUARTZ & OTHER SILICA MINERALS

Table – 18 : Producers of Sand (Others), 2011-12

Name & address of producer	Location of mine	
	State	District
Singareni Collieries Co.Ltd, P.O. Kothagudam Collieries, Bhadrachalam Road, Station, S. C. Railway, Dist- Khammam-507 101, Andhra Pradesh.	Andhra Pradesh	Adilabad Karimnagar
Western Coalfields Ltd, Sasti Colliery, P.O.- Sasti, Dist- Chandrapur, Maharashtra.	Maharashtra	Chandrapur
Cement Manufacturing Company Ltd, Lumshnong, P.O.- Khliehriat, Dist- Jaintia Hills, Meghalaya-793 200.	Meghalaya	Jaintia Hills

**Table –19 : Production of Sand (Others), 2009-10 to 2011-12
(By States)**

(Qty in tonnes; value in ₹'000)

State	2009-10		2010-11		2011-12 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	2159405	101399	2057119	109682	2625329	162809
Andhra Pradesh	1763495	75083	1673153	91014	2156059	133823
Maharashtra	395910	26316	373746	17033	435159	23649
Meghalaya	-	-	10220	1635	34111	5337

**Table – 20 : Production of Sand (Others), 2010-11 & 2011-12
(By Sectors/States/Districts)**

(Qty in tonnes; value in ₹'000)

State/District	2010-11			2011-12 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	14(1)	2057119	109682	10(1)	2625329	162809
Public Sector	14	2046899	108047	10	2591218	157472
Private Sector	(1)	10220	1635	(1)	34111	5337
Andhra Pradesh	11	1673153	91014	7	2156059	133823
Adilabad	4	736667	46068	3	864037	71796
Karimnagar	6	936468	44940	4	1292022	62027
Vizianagaram	1	18	6	-	-	-
Maharashtra	3	373746	17033	3	435159	23649
Chandrapur	3	373746	17033	3	435159	23649
Meghalaya	(1)	10220	1635	(1)	34111	5337
Jaintia Hills	(1)	10220	1635	(1)	34111	5337

QUARTZ & OTHER SILICA MINERALS

Table – 21: Mine-head Stocks of Sand (Others), 2011-12 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	221835	429794
Andhra Pradesh	142937	320892
Maharashtra	68678	108902
Meghalaya	10220	-

AGATE

The production of agate was 476 tonnes in 2011-12 as compared to 19 tonnes during the preceding year. There was only a single private sector mine of agate which was situated in district Bharuch of Gujarat (Tables - 22 to 24).

Mine-head stocks of agate at the end of 2011-12 were 100 tonnes as against 25 tonnes at the beginning of the year (Table - 25).

The average daily employment of labour was 13 in 2011-12 as against 12 in the previous year.

Table – 22 : Producer of Agate 2011-12

Name & address of producer	Location of mine	
	State	District
Almiya I. Saiyad, 16, Vyapar Bhawan, Himmatnagar, Gujarat.	Gujarat	Bharuch

Table – 23 : Production of Agate, 2009-10 to 2011-12
(By States)

(Qty in tonnes; value in ₹'000)

State	2009-10		2010-11		2011-12(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India/Gujarat	11	6	19	10	476	238

Table – 24 : Production of Agate, 2010-11 & 2011-12
(By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2010-11			2011-12(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India/Private Sector	1	19	10	1	476	238
Gujarat/Bharuch	1	19	10	1	476	238

QUARTZ & OTHER SILICA MINERALS

**Table – 25 : Mine-head Stocks of Agate
2011-12 (P)
(By States)**

(In tonnes)		
State	At the beginning of the year	At the end of the year
India/Gujarat	25	100

JASPER

No production of jasper was reported during 2009-10, 2010-11 and 2011-12. The only mine which reported production in 2008-09 wound up its operation due to lack of demand.

MINING

Mining for silica minerals is carried out by manual opencast method. Quartz produced in the form of lump along with other associated minerals is invariably hammered to pieces and manually sorted before it is despatched to the consuming industries. It is sometimes crushed and marketed. Glass sand is generally screened and washed to remove all the deleterious constituents for its use in glass industry.

APMDC owns two crushing plants located at Mahaboobnagar district in Andhra Pradesh with crushing capacity of 45 tonnes and 1,000 tonnes a month, respectively. Besides, Maharashtra Minerals Corp. Ltd has a 50,000-tonnes per year beneficiation plant at Phondaghat in Sindhudurg district. The plant has advanced technology in washing both by water and chemicals and further grading it in required fractions.

HEALTH HAZARDS

Respirable silica is still a cause of major concern to miners and consumers since many minerals especially, industrial sand and gravel contain crystalline silica. There is a potential threat of workers getting subjected to "silicosis"

in quartz, silica sand and gravel mines. Occupational safety measures & regulations to monitor the levels of crystalline silica in these mines are mandatory. In the USA, the Occupational Safety and Health Administration (OSHA) listed "crystalline silica" as one of their top five priorities for formulation of necessary rules. The OSHA, on the basis of significant information put out by International Agency for Research on Evaluation of Cancer, has declared that any material containing more than 0.1% crystalline silica should indicate its carcinogenic hazard.

USES

Quartz, quartzite and silica sand are used in various industries like glass, refractory, foundry, ceramic, cosmetic, electrical, abrasives, paints, etc. The primary use of silica is in the manufacture of virtually all types of glasswares, ceramics and ceramic glazes. Other major uses are in metallurgy, (where silica is used as a refractory, foundry mould, fluxes and as a source of silicon for the production of silicon metal and ferro-silicon and other ferro-alloys), silicon carbide manufacture, chemical & construction sectors and as a natural abrasive. Known for its piezoelectric properties, high quality quartz crystal is used in electronic devices, multiple telephone lines, depth-sounding devices, range finders, chronometers, etc.

Sand is also used as a fireproofing material, for sandstowing in mines, soundproofing material and as a filler. Silica sand is also used to maintain or increase the permeability of oil and gas-bearing formations; its application as a filler in acid proof cements, putty, paints, epoxy & polyester resins is inevitable. Besides, it is widely used in horticulture, as a filtration medium, and for ornamental purposes as well. Silica flour is used as a filler in plastic and rubber products.

Flint and chert are used in abrasives and tube-mill lining. Besides, chert is used in crushed form as aggregate for concrete and road surfacing. Rounded pebbles of chalcedony are used as balls in ball mill for finer crushing and grinding felspar, calcite and barytes. The different cryptocrystalline varieties of transparent and translucent chalcedony are valued as semiprecious stones and are carved out into a variety of ornaments and used for making different ornamental wares or articles of decoration. Agate pieces after cutting and polishing are sold as semiprecious stones. Big pieces are used in making mortars and pestles for laboratory use. Agate cut into requisite shapes is also used as fulcra of scientific balances and in making edges, planes and bearings of precision instruments.

INDUSTRY & SPECIFICATIONS

In India, quartz, quartzite and silica sand are used mainly in glass, foundry, ferro-alloys and refractory industries and also as building materials. According to its suitability for different purposes, it may be named as building sand, paving sand, moulding or foundry sand, refractory sand or furnace sand, filter sand, glass sand and grinding & polishing sand.

Glass

Main use of silica minerals is in the manufacture of different types of glasses, i.e. glass containers, bottles, amber glass containers, clear flint glass, vacuum bottles and other glasswares. Most of the glass demand in India currently comes from container glass, which accounts for 50% of the country's glass consumption by value. It is reported that a large fraction of the requirement of flat glass, container glass, glass fibre and glass tablewares is being produced by about 100 large-scale producers. Most of them are located in Gujarat, Mumbai, Kolkata, Bengaluru and

Hyderabad. There are more than 600 medium and small cottage-scale industries. The production of glass sheet, toughened glass, fibre glass and glass bottles during 2011-12 was 106,144.07 thousand sq m, 2678.26 thousand sq m, 42.67 thousand tonnes and 1271.92 thousand tonnes, respectively and during 2012-13 (up to Nov. 12) have been 73,043 thousand sq m, 2231.39 thousand sq m, 29.36 thousand tonnes and 879.73 thousand tonnes, respectively.

The natural silica sand is the preferred material in glass industry, but in some cases where the glass plants are located far away from silica deposits, crushed quartz is also used. For use in glass industry, the silica sand must be uniform in chemical composition, size and shape of grains. Uniform grain size promotes even melting in the glass tank. The sand should not be coarser than 20 or 30 mesh and finer than 100 to 120 mesh. As a general rule, the grains should be angular rather than rounded, because angular grains melt more readily than the rounded ones.

For glass manufacturing, the silica sand should be fairly free from contaminations of clay materials, pebbles, etc. Silica sand usually contains iron oxide, calcium oxide, potassium oxide and sodium oxide in small amounts. Iron is the most objectionable impurity because it imparts colouration to the glass. The common permissible limits of iron oxide in silica sand for use in the manufacture of different types of glass are as follows:

Glass type	Fe ₂ O ₃ %
Optical glass	0.005-0.008
Flint or soda-lime glass	0.02-0.05
Plate glass	0.1-0.2
White bottles or window glass	0.2-0.5
Dark bottle glass	0.5-0.7

QUARTZ & OTHER SILICA MINERALS

BIS has laid down specifications for glass making sands vide IS:488-1980 (Second Revision, Reaffirmed 2008).

Chromium compounds, alumina, lime and magnesia are the other deleterious impurities. Chromium compounds are undesirable because these compounds impart more colouration to the glass than iron. Alumina tends to decrease transparency and makes the batch more difficult to melt. The maximum quantity of alumina permissible in sand is 1.5 percent. The maximum permissible limit for lime and magnesia is about 0.05% and for alkalies, it is 0.01% or less.

Ceramic

Ceramic industry comprises ceramic tiles, sanitaryware and crockeryware items. These products are manufactured both in large and small-scale sectors. In organised sector, there were 16 units for ceramic tiles with an installed capacity of 2.1 million tonnes per year, 16 units for potteryware with 43,000 tpy installed capacity and 7 units for sanitaryware with 1,43,000 tpy capacity in the country.

In the small-scale sector, there were over 210 units of sanitaryware with capacity of 53,000 tpy and over 1400 plants of potteryware with a capacity of 3 lakh tpy (Table - 26).

Ceramic whiteware contains about 40% silica, besides other constituents except for bone china in which it is not used at all. The silica serves to provide whiteness, renders the ceramic body to dry easily and provides compatibility between the body and the glass to prevent crazing or peeling. Main source of silica for this application is silica sand. In addition, silica flour is used in formulation of ceramic body for enamels and frits. Silica flour produced by fine grinding of quartzite, sandstone or lump quartz is used in enamels. The silica flour normally contains more than 97.5% SiO₂, less than 0.55% Al₂O₃ and less than 0.2% Fe₂O₃. Purity and small particle size (BS mesh-200) are fundamentally important for silica in manufacture of ceramics. BIS has prescribed the specifications of quartz for ceramic industry vide IS: 11464-2011 (First Revision).

Table – 26 : Ceramic Industry

Industry	Unit	2011-12		2012-13(e)	
		No. of Units	Production	No. of Units	Production
Ceramic Tiles	million sq m	16 + 200 SSI Units	450.00	16 +200 SSI Units	513.00
Potteryware	million tonnes	16 + 1400 SSI Units	85.40	16 + 1400 SSI Units	92.23
Sanitaryware	million tonnes	7 + 210 SSI Units	0.53	7 + 210 SSI Units	0.58

Source: Ministry of Commerce & Industry, Department of Industrial Policy & Promotion, Annual Report, 2012-13.

Foundry

The Indian foundry industry is the largest in the world. This industry is well established in the country and is spread across a wide spectrum consisting of large, medium, small and tiny sector. A special feature of domestic foundry industry is its geographical clustering i.e. Coimbatore cluster is famous for pump sets castings, Kolhapur and Belgaum

cluster for automotive castings, Rajkot cluster for diesel engine castings and Batala and Jalandhar cluster for machinery parts and agriculture implements.

A large number of foundries in both ferrous and non-ferrous sectors are functioning in the organised sector in the country. Most of the foundry units use moulding sand having 40 to 65 A.F.S. (American Foundrymen's Society) numbers.

QUARTZ & OTHER SILICA MINERALS

Silica sand is used in both foundry cores and moulds because of its resistance to thermal shock. Silica content of 85% is used in iron casting. In steel foundries, silica content should be at least 95%. BIS has laid down specifications of high silica sand for use in foundries vide IS: 1987-2002 (Second Revision, Reaffirmed 2007).

Natural moulding sand contains variable amount of clay which acts as a bond between the sand grains. These sands, therefore, possess strength, plasticity and refractoriness to varying extent depending upon the clay minerals present. When it contains more clay, it is blended with river sand, which is relatively clay-free so as to get the optimum properties desired in the sand mixture.

Washed grains shall be mostly sub-angular to rounded shape. As far as possible, the sand shall be free from gravel. As per IS:3343-1965 (Reaffirmed 2008), natural moulding sand for use in foundries shall be of three main grades, namely, A, B and C with respect to clay content.

Grade	Clay (%)
A	5 to 10
B	10 to 15
C	15 to 20

Refractoriness of the natural moulding sand based on sintering temperature range should be as follows:

Grade A - 1350 to 1450 °C

Grade B - 1200 to 1350 °C

Grade C - 1100 to 1200 °C

Washed sand grains are required to be sub-angular to rounded shape.

Silica flour is particularly used in the steel foundry in dressing for moulds and cores and also as essential ingredient in the moulding sand mixtures. It is also used to obtain elevated temperature strength, high density and resistance to metal penetration in cores. Silica flour is produced by crushing, washing and grading high-grade quartz/quartzite rocks or white silica sand or other deposits sufficiently pure to get the desired material. BIS has laid down

specifications of silica flour for use in foundries vide IS: 3339-1975 (Reaffirmed 2008).

Refractory

Quartz and quartzite are used in the manufacture of refractory silica bricks. However, recently these bricks are being replaced by basic linings of magnesite, dolomite or natural types such as bauxite, etc. in LD basic oxygen and electric furnaces. Silica reacts readily with basic slag and is therefore unsuitable in the basic steel making process. Nevertheless, silica bricks continue to be used in coke ovens, ceramic kilns, glass tank crowns and as blast furnace chequers in some steel mills. Silica bricks have excellent load resistance capacity at high temperature. For the manufacture of refractory bricks, silica mineral should be free from aluminosilicates (felspar, mica, etc.) as they adversely affect refractoriness of the bricks. Silica rock (raw material) should be hard, having high bulk density and low porosity.

Fluxes

Massive quartz, quartzite, sandstone and unconsolidated sands are the main sources of silica that get used as flux in smelting base metal ores where iron and basic oxides are slagged as silicates. Silica is also used to balance the lime and silica ratio of the blast furnace mix. The silica content for this purpose must be as high as 90% with minor amounts of impurities like iron and alumina up to 1.5% maximum. BIS has laid down IS: 13676-1993(Reaffirmed 2008) for quartzite for iron making in blast furnace.

Ferro-silicon and Other Alloys

Ferro-silicon contains about 75-90% silicon and minor amounts of iron, carbon, etc. It is estimated that for the manufacture of one tonne ferro-silicon of 70-75% grade, about 1.78 tonnes quartz is required besides other raw materials like coke, iron scrap, etc. Quartz is the major source of silica in the manufacture of ferro-silicon. Occasionally, quartzite is also used. However, use of quartzite is restricted as it contains higher alumina and iron and more likely that it would break down in the furnace. Lump silica in the size range from 3/4 to 5 inches are generally preferred. Ferro-silicon is produced by smelting a mixture of quartz, metallic iron (steel scrap and turnings) and a reducing agent like coke, charcoal or wood chips.

QUARTZ & OTHER SILICA MINERALS

Quartz suitable for ferro-silicon production should have more than 98% SiO₂, less than 0.4% Al₂O₃ and not more than 0.2% each of Fe₂O₃, CaO and MgO. Phosphorus or arsenic should not be present in quartz. If Al₂O₃ is more than the prescribed limit, it affects reduction in the electric furnace. Alkali has a tendency to promote a sticky slag which contaminates the products. If higher iron (more than 0.3%) is present in quartz, the fusion in the furnace takes place at lower temperature and affects reduction process. Another important factor is that quartz should have good thermal stability

at 1200°C or more. BIS has laid down IS: 13054-1991(Reaffirmed 2008) for use of quartz/quartzite for production of ferro-alloys.

As per Indian Ferro Alloys Producers' Association, 35 units having a capacity of 205,750 tpy were established for the production of ferro-silicon. However, presently only 20 units are in operation with a total capacity of 145 thousand tpy. The production of ferro-silicon was estimated at around 117 thousand tonnes in 2010-11. List of principal producers of ferro-silicon is furnished in Table - 27.

Table – 27 : Principal Producers of Ferro-silicon

Name of the plant	Installed capacity (tpy)
Ferro Alloys Corp. Ltd, (Ferro Alloys Division), Vizianagaram, Andhra Pradesh.	72500 (Total)
Navbharat Ferro-alloys Ltd, Paloncha, Dist- Khammam, Andhra Pradesh.	9300
VBC Ferro Alloys Ltd, Medak, Andhra Pradesh.	19000
GMR Technologies & Ind. Ltd, Ravivalasa, Dist- Srikakulam, Andhra Pradesh.	25000 (Total)
Akshay Ispat & Ferro Alloys Ltd, Namchi Dist- South Sikkim, Sikkim.	6000
Hindustan Malleables & Forgings Ltd, Dhanbad, Jharkhand.	1800
Anjaney Ferro-alloys Ltd, Mihijam, Dist- Dumka, Jharkhand.	NA

(Contd.)

(Table -27 Concltd.)

Name of the plant	Installed capacity (tpy)
Sandur Manganese & Iron Ore Ltd, Vyasankere, Bellary, Karnataka. (closed)	24000
Sri Laxmi Electro Smelters (Pvt.) Ltd, Erumathala, Aluva, Kerala.	NA
Indsil Electrosmelts Ltd, Pallabhari, Dist- Pallakad, Kerala.	NA
Indian Metals & Ferro Alloys Ltd, Therubali, Dist- Cuttack, Odisha.	53000
The Silical Metallurgic Ltd, Puducherry.	10560
Snam Alloys Ltd, Village Kariamanickam, Puducherry.	12000
V.S.K. Ferro-alloys Ltd, Thuthipet, Puducherry.	3000
Hindustan ferro-Alloys, Hamirpur, Uttar Pradesh.	3200

QUARTZ & OTHER SILICA MINERALS

Silico-manganese, a combination of 60-70% manganese, 10-20% silicon and 20% carbon, substitutes low carbon ferro-manganese in steel industry. The production of silico-manganese including medium and low carbon silico-manganese estimated at 1,478 thousand tonnes in 2011-12. The details of silicon ferro-alloys are also discussed in the review on 'Ferro-Alloys'.

Silicon Metal

A high purity quartz containing about 99.80% SiO₂, without any other contaminant, is

used in the production of silicon metal. The production of silicon metal is similar to that for ferro-silicon except that no iron is added. The alumina and iron contents are specified to be below 0.1% each with calcium and phosphorus contents each restricted to 0.005 percent. For production of one tonne of silicon metal, about 2.6 tonnes silica is consumed. Specifications of silica minerals to be used in different industries are given in Table - 28.

Table – 28 : BIS Specifications of Silica Minerals for various Industries

Industry	Mineral consumed	BIS No.	Physical specifications	Grade	Chemical Specifications						Remarks	
					SiO ₂ (%)	Al ₂ O ₃ (%)	Fe ₂ O ₃ (%)	CaO (%)	MgO (%)	TiO ₂ (%)		P (%)
Glass	Silica sand	IS: 488 1980 (Second Revision; Reaffirmed 2008)	-	Special Gr.	99	0.020 (min)	-	-	-	0.10	-	For manufacturing high-grade colourless glass, viz, crystal glass, tableware and decoratedware.
				Gr. I	98.0 (min)	0.04 (max)	-	-	-	0.10 (max)	-	For manufacturing decolourised glassware, viz, containerware, lampware, etc.
				Gr. II	97.5 (min)	0.07 (max)	-	-	-	0.10 (max)	-	For manufacturing glassware where slight tint is permissible.
				Gr. III	97 (max)	0.2 (max)	-	-	-	-	-	For manufacturing of decolourised and some coloured glasses.
Foundry	Silica flour	IS:3339 1975 (First Revision; Reaffirmed 2008)	-	-	98.0 (min)	-	-	-	-	-	-	100% silica flour should pass through 150-micron I.S. sieve and atleast 95% through 75-micron sieve. The fusion temperature should be >1700 °C.
Iron (BF)	Quartzite	IS:13676 -1993 (Reaffirmed 2008)	Lumpy, Hard, Non-friable of size -150 to +10 mm	-	96-98	2.4	-	-	-	-	-	After prescribed thermal stability test on -25+19 mm material, +19 mm fraction should be more than 55% and -5 mm fraction should be less than 5%.

(Contd.)

QUARTZ & OTHER SILICA MINERALS

(Table -28 Concl.d.)

Industry	Mineral consumed	BIS No.	Physical specifications	Grade	Chemical Specifications							Remarks
					SiO ₂ (%)	Al ₂ O ₃ (%)	Fe ₂ O ₃ (%)	CaO (%)	MgO (%)	TiO ₂ (%)	P (%)	
	Banded Hematite Quartzite	-do-	-do-	-	48-50	1.0	50- (max)52 (Fe)	-	-	-	-	After prescribed tumbling test on +5 mm material, +5 mm fraction should be more than 90%.

Note: In addition, BIS has prescribed following specifications: - silica for paint industry (IS : 67 - 1998; Second Revision; Reaffirmed 2002), High-silica sand for use in foundries (IS : 1987-2002; Second Revision), Quartz quartzite for production of ferro-alloys (IS : 13054-1991; Reaffirmed 2003).

CONSUMPTION

The consumption of quartz and silica sand was estimated at 1.72 million tonnes in 2011-12. Major consuming industries were glass (40%), cement (20%), ferro-alloys (15%), foundry (9%), fertilizer (6%) and ceramic (5%). Other industries such as iron & steel, alloy steel, insecticide, refractory, abrasive, etc. consumed the remaining 5%.

The consumption of quartzite was estimated around 200 thousand tonnes out of which iron and steel industry consumed about 68%, followed by ferro-alloys (16%), refractory (14%) and cement (3%).

The estimated consumption of moulding sand in 2011-12 was 64,800 tonnes. Major consuming industries were foundry (64%), followed by iron & steel (29%) and mining machinery (6%).

The total ferro-silicon consumed by various industries in 2011-12 was estimated at 43,100 tonnes. Major consuming industries were iron & steel (87%), alloy steel (8%) and foundry (5%). Besides, reported consumption of ferro-silico-magnesium was 13 tonnes in foundry industry in 2011-12 (Tables - 29 to 33).

POLICY

Foreign Trade Policy (FTP) for 2009-2014 and the amended Export and Import Policy

incorporated in the FTP freely allows the import of quartz and quartzite lumps and powder as also silica sand and quartz sands under headings 2505 and 2506. However, the exports of silica sands and quartz sands under heading 2505 are restricted and permitted under licence. The export of river sand to Maldives is permitted, subject to 'No Objection Certificate' by CAPEXCIL within the annual ceiling of 1,185,455 tonnes for 2011-12.

SUBSTITUTION

In order to reduce the potential threat of "silicosis," a variety of materials are used as substitutes for silica. Basic and neutral refractories (including magnesite, mag-chrome, dolomite and high alumina bricks) have replaced silica in a large number of applications. Chromite, olivine and zircon are alternatives to foundry sands. Garnet and to a lesser extent, olivine are used in sand blasting to avoid the risk of silicosis. Wollastonite is more favoured than free silicon for use in the ceramic industry, again due to the risk of silicosis. In electronic industry, replacement of natural quartz crystal by cultured quartz crystal is increasing steadily. It has been estimated that about 10 billion quartz crystals and oscillators per year are manufactured and installed world wide in all types of electronic devices.

QUARTZ & OTHER SILICA MINERALS

**Table – 29 : Reported Consumption of Quartz/Silica Sand, 2009-10 to 2011-12
(By Industries)**

(In tonnes)			
Industry	2009-10	2010-11(R)	2011-12(P)
All Industries	1451500	1560500	1723100
Alloy steel	14500(10)	14500(10)	15300(11)
Cement	278100(14)	326700(15)	349800(11)
Ceramic	76300(38)	86700(38)	87100(37)
Ferro-alloys	208300(35)	265400(40)	258300(37)
Fertilizer	105800(4)	105800(4)	105800(4)
Foundry	136400(33)	138100(33)	148100(31)
Glass	569900(52)	559800(54)	685600(50)
Iron & steel	13500(1)	13500(1)	22800(2)
Others (Abrasive, asbestos, chemical, dry cell battery, electrical, paint, pesticide, refractory and rubber)	48700(75)	50000(79)	50300(81)

Figures rounded off.

Figures in parentheses denote the number of units in organised sector reporting consumption.*

*(*Includes actual reported consumption and/or estimates made wherever required).*

**Table – 30: Reported Consumption of Quartzite, 2009-10 to 2011-12
(By Industries)**

(In tonnes)			
Industry	2009-10	2010-11(R)	2011-12(P)
All Industries	278600	198700	200300
Cement	1100(2)	5400(2)	5400(2)
Ferro-alloys	45300(12)	34400(12)	31900(12)
Foundry	800(5)	100(5)	100(5)
Iron & steel	173700(22)	131100(25)	135200(26)
Pelletisation (Iron & steel)	2400(1)	-(1)	-(1)
Refractory	55200(13)	27600(12)	27600(12)
Sponge iron	100(1)	100(1)	100(1)

Figures rounded off.

Figures in parentheses denote the number of units in organised sector reporting consumption.*

*(*Includes actual reported consumption and/or estimates made wherever required).*

**Table – 31 : Reported Consumption of Moulding Sand, 2009-10 to 2011-12
(By Industries)**

(In tonnes)			
Industry	2009-10	2010-11(R)	2011-12(P)
All Industries	66000	64800	64800
Foundry	41700(14)	41700(14)	41700(14)
Iron & steel	20100(6)	18900(6)	18900(4)
Mining machinery	4100(3)	4100(3)	4100(3)
Others (Sugar & textile)	100(7)	100(7)	100(7)

Figures rounded off.

Figures in parentheses denote the number of units in the organised sector reporting consumption.*

(includes reported companies and/or estimates, whenever required).*

QUARTZ & OTHER SILICA MINERALS

**Table – 32 : Reported Consumption of Ferro-Silicon
2009-10 to 2011-12
(By Industries)**

(In tonnes)			
Industry	2009-10	2010-11(R)	2011-12 (P)
All Industries	41900	38800	43100
Alloy steel	4100(7)	3300(8)	3300(8)
Foundry	2200(21)	2200(21)	2200(21)
Iron & steel	35600 (17)	33100(22)	37300(24)
Others (Electrode, Ferro-alloys	++	200(5)	300(6)

Figures rounded off.

Figures in parentheses denote no of units in organised sector reporting* consumption.

(*Includes actual reported consumption and/or estimates made wherever required).

**Table – 33 : Reported Consumption of
Ferro-Silicon-Magnesium, 2009-10 to 2011-12
(By Industries)**

(In tonnes)			
Industry	2009-10	2010-11(R)	2011-12 (P)
All Industries	13	13	13
Foundry	13 (2)	13 (2)	13 (2)

Figures rounded off.

Figures in parenthesis denote the number of units in organised sector reporting* consumption.

(*Includes actual reported consumption and/or estimates made wherever required).

WORLD REVIEW

Basically, silica is abundant in the earth's crust. Sand and gravel reserves of the world are large. Quartz-rich sand and sandstone are the main sources of industrial silica sand which occurs throughout the world. Reserves of natural quartz crystal suitable for electronics or optical use in the world are limited. The world's dependence on these reserves will continue to decline because of the increased usage of cultured quartz crystal as an alternate material. Electronic applications accounted for the most industrial uses of quartz crystal, followed by optical application.

All quartz crystals used for electronics were cultured. The world production of industrial silica sand and gravel by principal countries is given in Table - 34.

**Table – 34: World Production of
Sand and Gravel (Industrial), 2009 to 2011
(By Principal Countries)**

(In '000 tonnes)			
Country	2009	2010	2011
World: Total (rounded)	112000	121000	138000
Australia	5300	5300	5600
Austria	1500	-	-
Belgium	1800	1800	1800
Brazil	1500	-	-
Canada	2000	1171	1430
Chile	600	1400	1240
Czech Republic	1900	1400	1350
Egypt	-	-	1800
Finland	-	-	2250
France	5000	5000	5000
French Guyana	-	-	1500
Gambia	1400	-	-
Germany	6500	7000	7700
Hungary	300	-	-
India*	1700	1800	1800
Iran	2000	1500	1500
Italy	14000	9800	19800
Japan	4500	3078	2900
Korea Rep of	2000	-	-
Latavia	-	-	1360
Mexico	2800	2480	2570
Norway	1500	1500	1200
Poland	5300	2730	2460
Slovakia	2000	-	-
South Africa	2900	2910	2900
Spain	5000	5000	5000
Turkey	1200	4000	5000
UK	5600	3760	3760
USA	27400	30000	43700
Other countries (rounded)	6300	29371	14310

Source: Mineral Commodity Summaries, 2012 & 2013.

* For India's production of silica minerals during 2008-09, 2009-10 and 2010-11, Tables-5, 10, 15, and 19 of this Review may be referred. Besides, sand is also produced as a minor mineral for use in building construction applications.

FOREIGN TRADE

Exports

Exports of quartz and quartzite (natural) increased marginally to 214,969 tonnes in 2011-12 from 211,253 tonnes in the previous year. Out of total exports, quartz comprised 179,805 tonnes (84%) and quartzite 35,164 tonnes (16%). Exports were mainly to Japan (21%), Bangladesh (14%) and UAE(12%). Exports of silica sand decreased marginally to 10,020 tonnes in 2011-12 from 12,451 tonnes in 2010-11. Exports were mainly to China (30%), UAE (12%) and Italy (10%). Exports of sand (excluding metal bearing) increased marginally to 21,044 tonnes in 2011-12 from 18,218 tonnes in the previous year. Exports were mainly to Saudi Arabia (26%), Nigeria (24%) and UAE (10%). Exports of agate (uncut) increased substantially to 429,123 tonnes in 2011-12 from 34,453 tonnes in the previous year. China (80%), USA (10%) and Hong Kong (5%) were the main buyers in 2011-12. Exports of agate (cut) also increased substantially to 1,733 thousand carats in 2011-12 from 725 thousand carats in the previous year. Exports of flint decreased substantially to 968 tonnes in 2011-12 from 1,688 tonnes in 2010-11. Exports of silicon increased marginally to 247 tonnes in 2011-12 from 201 tonnes in the previous year. Exports were mainly to Nepal, China, Italy and UAE (Tables - 35 to 42).

Imports

Imports of quartz and quartzite (natural) were 578 tonnes in 2011-12 as compared to 496 tonnes in 2010-11. Out of the total imports in 2011-12, those of quartz were 506 tonnes and mainly from Sri Lanka, Germany, USA and UK while quartzite imports were decreased marginally to 72 tonnes as compared to 84 tonnes in the preceding year. The imports were mainly from China and Italy. Imports of silica sand increased substantially to 129,490 tonnes in 2011-12 from 93,741 tonnes in the previous year. Egypt, China, Italy, Jordan and Bhutan were the main suppliers. Imports of sand (excluding metal bearing) was 22,811 thousand tonnes in 2011-12. Imports were mainly from Nepal, Germany and Belgium. Imports of flint sharply decreased to 1 tonne in 2011-12 as compared to 25 tonnes in the previous year. China

was the main supplier. Imports of agate (uncut) increased substantially to 25,877 tonnes in 2011-12 as compared to 637 tonnes in 2010-11. Imports were mainly from Tanzania, China and Brazil. Imports of agate (cut) were 5,000 carat in 2011-12, mainly from China. Imports of silicon were 35,380 tonnes as compared to 32,055 tonnes in 2010-11, mostly from China (Tables - 43 to 51).

Table – 35 : Exports of Quartz And Quartzite (Natural) : Total (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	211253	1209795	214969	1513889
Japan	50114	439977	44852	549730
Vietnam	24505	179849	15712	115936
Malaysia	8747	73501	10554	99833
UAE	27203	77745	25036	87153
Bangladesh	26368	63744	30364	81498
Bhutan	21227	27931	17860	74601
Israel	6969	37105	8431	67567
Italy	8158	58133	4645	41473
Germany	4822	38832	3424	33190
Oman	3172	15650	5728	32504
Other countries	29968	197328	48363	330404

Table – 36 : Exports of Quartzite (Natural) (By Countries)

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	37962	285800	35164	313122
Japan	7277	47230	9256	76265
Israel	2784	21823	4684	47467
Vietnam	9579	78092	3068	26668
Italy	5646	43079	2513	26420
Germany	1257	12398	1896	20010
Bangladesh	2158	5472	4359	16884
USA	159	4993	246	15335
Spain	680	9398	1677	14095
Turkey	-	-	1371	14078
Korea Rep. of	336	3280	587	7077
Other countries	8086	60035	5507	48823

QUARTZ & OTHER SILICA MINERALS

**Table – 37 : Exports of Quartz (Natural)
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	173291	923995	179805	1200767
Japan	42837	392747	35596	473465
Malaysia	8575	72611	10300	98199
Vietnam	14926	101757	12644	89267
UAE	26861	75178	24521	85585
Bhutan	20629	27309	17860	74601
Bangladesh	24210	58272	26005	64613
Oman	2761	13778	5405	31371
Thailand	2543	19170	2531	21409
Nigeria	685	3832	3694	20652
Israel	4185	15282	3747	20100
Other countries	25079	144059	37502	221505

**Table – 39 : Exports of Sand
(Excl. Metal Bearing)
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	18218	208067	21044	377436
Saudi Arabia	6369	109374	5442	221211
UAE	606	2380	2127	45493
Iran	1	142	350	40936
Nigeria	398	2192	4946	32752
Bangladesh	25	1998	1030	5301
Nepal	69	288	1283	4280
Djibouti	178	737	838	4008
Oman	1152	6907	626	3521
Bhutan	-	-	1357	2824
Indonesia	24	2149	938	2824
Other countries	9396	81900	2107	14286

**Table –38 : Exports of Silica Sand
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	12451	162239	10020	80081
China	1	3	2970	27537
UK	807	12641	528	7909
Italy	54	218	989	7056
Japan	4921	92519	228	4958
Kenya	619	3933	633	4578
UAE	597	4015	1171	4292
France	757	3764	641	3397
Thailand	280	3571	40	2027
Nigeria	80	347	320	1854
Tanzania	67	232	353	1794
Other countries	4268	40996	2147	14679

**Table – 40 : Exports of Agate (Uncut)
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	34453	14511	429123	43262
China	2019	3395	343840	23380
USA	1644	3765	40895	7159
Hong Kong	21547	1696	22450	2824
Saudi Arabia	-	-	2200	2169
Netherlands	-	-	835	947
Chinese Taipei/ Taiwan	100	296	10	937
Japan	130	332	267	808
Turkey	-	-	13567	664
Canada	20	44	86	555
Austria	-	-	249	548
Other countries	8993	4983	4724	3271

QUARTZ & OTHER SILICA MINERALS

**Table – 41 : Exports of Agate: (Cut)
(By Countries)**

Country	2010-11		2011-12	
	Qty (‘000 carats)	Value (₹‘000)	Qty (‘000 carats)	Value (₹‘000)
All Countries	725	55396	1733	111567
USA	181	10147	293	31498
China	156	4057	678	24245
Hong Kong	153	23424	241	10254
Germany	66	4840	87	7864
Saudi Arabia	5	369	59	7548
Italy	53	4866	107	7457
France	62	2941	47	5177
UK	5	375	38	3520
Australia	2	698	28	2501
Thailand	++	42	86	2326
Other countries	42	3637	69	9177

**Table – 42 : Exports of Flint
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹‘000)	Qty (t)	Value (₹‘000)
All Countries	1688	6320	968	2962
Djibouti	1064	4034	787	2249
Saudi Arabia	233	895	151	587
Lebanon	-	-	30	126
Other countries	391	1391	-	-

**Table – 43 : Imports of Quartz and Quartzite (Natural) : Total
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹‘000)	Qty (t)	Value (₹‘000)
All Countries	496	8699	578	11065
Sri Lanka	225	2932	450	6200
China	++	17	54	1589
Germany	21	1576	20	994
Italy	42	1230	17	675
USA	10	510	11	598
UK	54	1111	10	478
Belgium	3	128	8	224
Chinese Taipen/Taiwan	-	-	5	153
Korea Rep. of	-	-	1	65
Netherlands	-	-	2	55
Other countries	141	1195	++	34

QUARTZ & OTHER SILICA MINERALS

**Table – 44 : Imports of Quartzite (Natural)
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	84	2510	72	2363
China	-	-	54	1589
Italy	34	1186	17	675
Korea Rep. of	-	-	1	65
Nepal	-	-	++	20
Rwanda	-	-	++	11
Japan	-	-	++	3
Other countries	50	1324	-	-

**Table – 45 : Imports of Quartz (Natural)
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	412	6189	506	8702
Sri Lanka	175	2285	450	6200
Germany	21	899	20	994
USA	10	510	11	598
UK	54	1111	10	478
Belgium	3	128	8	224
Chinese Taipei/ Taiwan	-	-	5	153
Netherlands	-	-	2	55
Other countries	149	1256	-	-

**Table – 46 : Imports of Silica Sand
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	93741	413702	129490	598457
Egypt	50178	91860	98783	197718
China	2468	37903	6244	109265
Italy	3120	43291	5124	65083
Thailand	336	4622	2932	31574
USA	506	17043	1105	30046
Bhutan	3729	32763	3548	28999
Saudi Arabia	2938	20383	4976	27298
Belgium	458	11705	1127	19816
Chinese Taipei/ Taiwan	116	6264	90	12311
Norway	2124	34404	482	11923
Other countries	27768	113464	5079	64424

**Table – 47 : Imports of Sand
(Excl. Metal Bearing)
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	22379	28609	22811	53509
Nepal	19744	17562	21475	20920
Germany	4	377	652	20035
Thailand	-	-	72	5034
Belgium	594	7372	215	2915
USA	-	-	60	1331
UK	-	-	19	773
Spain	-	-	23	510
China	15	1089	28	391
Myanmar	-	-	100	254
Unspecified	-	-	42	1211
Other countries	2022	2209	125	135

**Table – 48 : Imports of Flint
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	25	202	1	98
China	25	202	1	80
Indonesia	-	-	++	18

**Table – 49 : Imports of Agate: Uncut
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	637	15193	25877	5376
USA	8	286	114	2479
China	594	13692	4729	884
Tanzania	-	-	12350	662
Brazil	13	216	4560	648
Turkey	-	-	2477	340
Germany	-	-	1620	180
Korea Rep. of	-	-	14	95
Hong Kong	-	-	12	87
Indonesia	-	-	1	++
Other countries	22	999	++	1

QUARTZ & OTHER SILICA MINERALS

**Table – 50 : Imports of Agate: Cut
(By Countries)**

Country	2010-11		2011-12	
	Qty (‘000 Carats)	Value (₹‘000)	Qty (‘000 Carats)	Value (₹‘000)
All Countries	3	16464	5	31093
China	2	327	5	30691
Korea Rep. of	-	-	++	220
USA	++	15422	++	107
Germany	-	-	++	74
Other countries	1	715	++	1

**Table – 51 : Imports of Silicon
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹‘000)	Qty (t)	Value (₹‘000)
All Countries	32055	3523172	35380	4256979
China	28375	3087166	28880	3394760
Vietnam	1558	175100	2394	281721
Australia	333	46201	862	141788
Korea Rep. of	20	2860	230	49452
USA	76	10051	332	43965
UK	92	10264	194	26932
Chinese Taipei/Taiwan	4	9014	166	26461
South Africa	100	8618	221	26346
Hong Kong	127	14107	209	25556
Spain	-	-	245	24801
Other countries	1370	159791	1647	215197

FUTURE OUTLOOK

According to its suitability for different purposes, it may be named as building sand, paving sand, moulding or foundry sand, refractory sand or furnace sand and glass sand etc. However, the main use of silica minerals is in manufacture of different types of glasses, natural silica sand being the preferred material in the glass industry. In India, quartz, quartzite and silica sand are used mainly in glass, foundry, ferro-alloys, refractory industries and also as building materials.

The demand for quartz, silica sand, moulding sand and quartzite is increasing over the years to cater to the requirement of ferro-silicon, silico-manganese, silico-chrome, silica refractories, glass

and for moulding and casting purposes. The requirements of these products are linked up directly with iron and steel industry including alloy steel production. Further, setting up foundries and enhancing their capacities are also linked with metallurgical industry.

As per the report of the Sub-Group on 12th Plan, Planning Commission of India, the domestic demand of quartz and silica minerals was estimated at 3.15 million tonnes by 2011-12 and at 4.85 million tonnes by 2016-17 at 9% growth rate.

The total resources of quartz and other silica minerals are 4,750 million tonnes as on 1.4.2010. There are very good prospects of increasing the production and also the export of quartz and silica minerals to the neighbouring countries.