

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 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 1) GSI, DMG, Rajasthan 2) and GMDC. Details of exploration carried out for quartz and other silica minerals during 2012-13 are given in Table - 3.

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	Inferred STD333	Reconnaissance STD334	Total B	
		STD121	STD122			STD221	STD222						
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

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Figures rounded off.

**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, 2012-13

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 Jaipur	N/v Buchara, Chotkiyon ki dhani, Teh-Kotputti	1:4000 1:10000	10.25 10	-	-	01	Exploration carried out for quartz & quartzite. Resources were not estimated.
QUARTZITE							
GSI Jammu & Kashmir Kathua	Banjat Bhund area	1:12,500 1:2000	- -	- -	- -	68 -	Reconnaissance stage investigation was carried out to delineate potential quartzite bands for industrial utilisation. Some portions of studied quartzite spectra roughly confirm to specifications in ceramic, refractory, and ferro silicon industries. A few samples from milky white & grey quartzite roughly confirms to the specification required for glass industry.
DMG, Rajasthan Jhunjhunu	N/v Baseri, Mchara, Nalpura, etc.	1:50,000 1:10,000 1:2000	150 10 1	- - -	- - -	- - -	Occurrence of white to creamish, brown, fine to medium grained felspathic quartzite were marked N/V Sihorian Ki Dhani, Dumoli, Khatipura, Muradpur & Manota P.F. which are suitable for use as masonry stone.
	Ratanshar (Mahakhar & Jhadaya Nagar)	1:4,000	1	-	-	-	Mapped area is comprising small hillock of earthy to brownish, fine grained, hard quartzite amidst field of village Jhadaya nagar. Quartzite hillock is about 40 m high & having 700 m length, 100 m width dimensions. Resources were not estimated.
SILICA SAND							
Gujarat Mineral Development Corporation, Bharuch	Amod, Maljipura, Bhuri Teh. Jhagadia	1:1000	-	-	-	-	Deposit extends across village Amod, Maljipura, Bhuri.

PRODUCTION, STOCKS & PRICES

QUARTZ

The production of quartz at 1041 thousand tonnes in 2012-13 increased by 33 percent as compared to the preceding year.

There were 283 reporting mines in 2012-13 as against 207 in preceding year. Besides, the production of quartz was also reported from 136 mines as an associated mineral as against 82 mines in preceding year. The share of public sector mines in the total output was about 1% during the year. The share of 8 principal producers was about 34% of the total output.

Andhra Pradesh continued to be the major producing state of quartz in the year 2012-13 also accounting for 59% of the total production followed by Rajasthan (16%), Gujarat (13%), Jharkhand (4%), West Bengal (3%), Tamil Nadu & Chhattishgarh (1% each)

and the remaining three percent production was contributed by Bihar, Odisha, Karnataka and Madhya Pradesh. About 54% of the production during the year 2012-13 was reported by 26 mines, including 4 associated mines having production above ten thousand tonnes. 27 mines including 4 associated mine having annual production between five thousand to ten thousand tonnes contributed about 19% of the total production. The remaining 27% was the contribution of 366 mines, including 128 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 537 thousand tonnes as against 275 thousand tonnes in the beginning of the year (Table- 8).

The average daily labour employed in quartz mines in 2012-13 was 3498 as against 2007 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
2012-13**

Name & address of producer	Location of mine	
	State	District
Shriram Mines & Minerals, Puskarana Stadium, Bikaner -334 001, Rajasthan	Rajasthan	Bikaner
Adibonia Subbarayadu, 20/1/2, Kondapeta, Rajivnagar, Dhone, Kurnool-518 222, Andhra Pradesh	Andhra Pradesh	Anantpur
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, Cuddapah, Mahabub- nagar, Rangareddy
P. V. Ramana Reddy, (Mine owner), C/C Shri R. Rammohan Reddy, Sondar Singh Lola, Dhone, Kurnool-518 222, Andhra Pradesh	Andhra Pradesh	Kurnool

(Contd.)

Table - 4 (Concl'd.)

Name & address of producer	Location of mine	
	State	District
B.S. Mining Company, Opp Jyoti Petrol Pump. Road No. 1 VKI Area, Jaipur-302 013, Rajasthan	Rajasthan	Tonk
AGI Glaspac (an SBU of HSIL Ltd.), Glass Factory Road, Motinagar, P.O. Sanath Nagar, Hyderabad- 500 018, Andhra Pradesh	Andhra Pradesh	Mahabub- nagar
Prakashbhai Bhulchand, Sindhi society, Post- Shehra, Dist.- Panchmahal, Gujarat	Gujarat	Kheda
M.A. Pocha, C/o Eagle STD, PCO, Shehra-Godhra Highway Road, Post- Shehra, Panchmahal, Gujarat	Gujarat	Panch- mahal

**Table – 5 : Production of Quartz, 2010-11 to 2012-13
(By States)**

(Qty in tonnes; value in ₹'000)

State	2010-11		2011-12		2012-13(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	497546	112108	782575	173890	1041133	259646
Andhra Pradesh	214626	40845	361566	73655	616053	144637
Bihar	-	-	-	-	8997	2555
Chhattisgarh	655	92	731	144	12100	4826
Gujarat	37540	4889	156248	27785	134521	20284
Jharkhand	61665	10196	109127	25461	37671	7528
Karnataka	10	3	-	-	6431	2085
Madhya Pradesh	1754	173	-	-	340	31
Maharashtra	10505	2363	5315	2658	10267	8508
Odisha	11414	5262	6241	2091	7138	3934
Rajasthan	133797	26046	114632	22485	163668	38123
Tamil Nadu	8674	18045	12631	14611	13689	17640
West Bengal	16906	4194	16084	5000	30258	9495

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**Table – 6 : Production of Quartz, 2011-12 & 2012-13
(By Sectors/States/Districts)**

(Qty in tonnes; value in ₹'000)

State/District	2011-12			2012-13 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	207(82)	782575	173890	283(136)	1041133	259646
Public Sector	3(1)	14453	14188	4(1)	14972	13069
Private Sector	204(81)	768122	159702	279(135)	1026161	246577
Andhra Pradesh	74(21)	361566	73655	107(33)	616053	144637
Adilabad	2	3032	455	2	2620	393
Anantapur	3	3979	1670	7	76068	16178
Chittoor	-	-	-	(1)	10	3
Cuddapah	4	6570	1310	1*	-	-
Guntur	-	-	-	1*	-	-
Krishna	-	-	-	1	880	484
Kurnool	7	67067	12650	6	187176	42030
Mahabubnagar	13(8)	128503	16279	22(14)	205827	42813
Medak	9	38969	9990	15	43938	12582
Nalgonda	4	247	54	8	13569	3967
Nellore	11(12)	19078	5629	14(16)	16621	4710
Nizamabad	1	8000	2200	1	5188	2672
Prakasam	6	5999	2208	10	3541	1644
Ranga Reddy	5(1)	30682	6588	8(2)	38212	9290
Srikakulam	-	-	-	1	20	5
Visakhapatnam	3	24532	8790	3	16792	5843
Vizianagaram	5	20948	4347	7	5591	2023
Warangal	1	3960	1485	-	-	-
Bihar	-	-	-	1	8997	2555
Nawada	-	-	-	1	8997	2555
Chhatisgarh	3	731	144	4	12100	4826
Jashpur	1	423	59	-	-	-
Mahasamund	2	308	85	4	12100	4826
Gujarat	12	156248	27785	18	134521	20284
Dahod	2	8336	1346	5	18255	2636
Kaira	1	33842	9137	1	24838	3726
Panchmahal	9	114070	17302	12	91428	13922
Jharkhand	10(3)	109127	25461	11(4)	37671	7528
Deoghar	1	1875	264	1	966	242
Dumka	1	4340	543	1	2246	371
Giridih	2	1685	669	2	1916	607
Hazaribagh	(1)	1039	235	(1)	2534	608
Jamtara	(1)	11319	1358	(1)	10306	1237
Latehar	5(1)	73919	18296	5(1)	16703	3622
Palamu	-	-	-	(1)	750	188
Singhbhum (East)	1	14950	4096	1	2250	653
Saraikela Kharswan	-	-	-	1*	-	-

(Contd.)

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Table - 6 (Concl'd.)

State/District	2011-12			2012-13 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
Karnataka	2	-	-	6	6431	2085
Chitradurga	-	-	-	1	4300	1290
Koppal	-	-	-	1*	600	154
Hassan	2*	-	-	2*	-	-
Raichur	-	-	-	1	1216	546
Tumkur	-	-	-	1	315	95
Madhya Pradesh	2	-	-	2(1)	340	31
Balaghat	1*	-	-	1*	-	-
Chattarpur	-	-	-	1*	-	-
Jabalpur	1*	-	-	(1)	340	31
Maharashtra	4	5315	2658	5	10267	8508
Bhandara	3	5315	2658	3	8083	6621
Chandrapur	1*	-	-	1	2076	1864
Nagpur	-	-	-	1	108	23
Odisha	2	6241	2091	2(1)	7138	3934
Jharsuguda	1*	-	-	-	-	-
Kalahandi	-	-	-	1*	5	2
Mayurbhanj	1	6241	2091	1(1)	7133	3932
Rajasthan	56(57)	114632	22485	63(96)	163668	38123
Ajmer	32(35)	57579	10899	36(53)	73663	18580
Bhilwara	5(20)	13362	2968	6(34)	16830	4399
Jaipur	3	40	8	4	2120	433
Rajsamand	2	3370	244	2(7)	5835	907
Sikar	8(1)	4175	816	10(2)	12120	2394
Sirohi	2(1)	133	19	-	-	-
Tonk	4	35973	7531	5	53100	11410
Tamil Nadu	38(1)	12631	14611	61(1)	13689	17640
Coimbatore	1	75	53	4	1389	1245
Dindigul	3	1416	850	6	609	236
Erode	5	55	25	11	900	905
Karur	6	111	63	18	2400	1934
Madurai	1	540	336	1	126	114
Namakkal	8	3615	7619	8	3769	7603
Salem	13	4271	889	9	1305	390
Tiruchirapalli	1	140	259	1	657	545
Thiruvarur	(1)	2408	4517	(1)	2089	3887
Tiruppur	-	-	-	1	395	751
Tuticorin	-	-	-	1*	-	-
Vellore	-	-	-	1	50	30
West Bengal	4	16084	5000	3	30258	9495
Bankura	1	3405	1022	1	8755	3109
Birbhum	1	3566	1426	1	10854	3404
Purulia	2	9113	2552	1	10649	2982

Figures in parentheses indicate no. of associated mines of quartz with asbestos, felspar, mica, laterite and quartzite.
 * Reported labour only.

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Table – 7 : Production of Quartz, 2011-12& 2012-13(P)
(By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
All Groups	207 (82)	283 (136)	782575	1041133	100.00	100.00	-	-
Up to 500	104 (44)	160 (75)	14310	26683	1.75	2.56	1.75	2.56
501-1000	19 (8)	27 (14)	20276	29844	2.59	2.87	4.34	5.43
1001-5000	47 (22)	51 (39)	166322	232532	21.25	22.33	25.59	27.76
5001-10000	19 (2)	23 (4)	154998	193761	19.90	18.61	45.49	46.37
10001 & above	18 (6)	22 (4)	426669	558313	54.51	53.63	100.00	100.00

Figures in parentheses indicate number of associated mines of quartz with asbestos, felspar, laterite, mica & quartzite.

Table – 8 : Mine-head Stocks of Quartz
2012-13(P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	274854	536516
Andhra Pradesh	134963	377283
Bihar	-	302
Chhattisgarh	294	4708
Gujarat	5267	5604
Jharkhand	6872	4547
Karnataka	12744	13428
Madhya Pradesh	9533	9588
Maharashtra	5934	6810
Odisha	10868	6853
Rajasthan	78592	95502
Tamil Nadu	8199	10290
Uttar Pradesh	1411	1279
West Bengal	177	322

During the year under review, there were 140 reporting mines as against 149 in the preceding year. Besides, the production of silica sand was also reported as an associated mineral by eight mines during the year. Eleven principal producers accounted for about 50% of the total production. The share of public sector in the total production was 3% in 2012-13 which was 2% in the preceding year.

Andhra Pradesh was the leading producing state accounting for 45% of the total production during the year followed by Gujarat(23%), Rajasthan (17%), Maharashtra (7%) and Jharkhand, Karnataka and Kerala (2% each). The remaining two percent of production was the contribution of Uttar Pradesh and Tamil Nadu.

About 63% of the total production of silica sand was contributed by 18 silica sand mines and two associated mines, each producing more than 50 thousand tonnes annually and about 34 % by 59 silica sand mines and three associated mines, each producing five thousand to fifty thousand tonnes. The remaining 3% of the output was contributed by 63 silica sand mines and three associated mines, each producing less than 5000 tonnes annually (Tables- 9 to 12).

Mine-head stocks of silica sand at the end of 2012-13 were 5,941 thousand tonnes as against of 5,438 thousand tonnes at the beginning of the year (Table-13).

The average daily employment of labour in 2012-13 was 2,053 as against 2,358 in the previous year. Domestic prices of silica sand are furnished in the General Review on 'Prices'.

SILICA SAND

The production of silica sand at 3,690 thousand tonnes in 2012-13 decreased by about 24% over the previous year due to decrease in market demand and non-availability of labour.

QUARTZ & OTHER SILICA MINERALS

**Table – 9 : Principal Producers of Silica Sand
2012-13**

Name & address of producer	Location of mine	
	State	District
Bhavani Minerals At & PO: Bhilod-393 135, Tehsil: Valia, Distt. Bharuch, Gujarat	Gujarat	Bharuch
Mohd. Sher Khan Khawaja Bagh, P.O. Sawa-312613, Distt. Chittorgarh, Rajasthan	Rajasthan	Chittorgarh
Kumaraswamy Silica Mines, Momidi P.O., Chillakur - Mandal, Distt. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
Alimiya.I.Saiyad 16,Vyapar Bhawan, P.O.Himmatnagar, Distt. Bharuch, Gujarat	Gujarat	Bharuch
Nishita Mines & Minerals, 6/160, East Street , Gudur, Distt. Nellore, Andhra Pradesh	Andhra Pradesh	Nellore
Balaji Mines & Minerals, 6/54-1, East Street, Distt. Nellore, Andhra Pradesh	Andhra	Nellore Pradesh

(Contd.)

Table - 9 (Concl.)

Name & address of producer	Location of mine	
	State	District
Bundi Silica Sand Supply Co. Kanhaiyalal Ghatiwala, Rishabh Bhavan, New Colony, Gumanpura, Distt. Kota – 324 007, Rajasthan	Rajasthan	Bundi
D. Sundra Rami Reddy P.O.- Chinthavaram, Distt. Nellore, Andhra Pradesh	Andhra Pradesh	Nellore
Southern Silica Mines, 7/105, Mitta Palem Street, Gudur, Distt. Nellore-524 101, Andhra Pradesh	Andhra Pradesh	Nellore
Om Gurudev Minerals, 6/55, East Street, Gudur, Distt. Nellore, Andhra Pradesh	Andhra Pradesh	Nellore
Maharashtra State Mining Corporation Ltd. 5,Abhyankar Nagar, Nagpur, Maharashtra	Maharashtra	Sindhudurg

**Table – 10 : Production of Silica Sand, 2010-11 to 2012-13
(By States)**

(Qty in tonnes; value in ₹'000)

State	2010-11		2011-12		2012-13(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	3380968	444684	4867667	714062	3690016	823828
Andhra Pradesh	1239896	82650	1582312	142157	1649138	235393
Gujarat	1247949	94933	1959203	154387	844789	72162
Jharkhand	97560	30733	113265	36724	81088	20971
Karnataka	43988	6384	37607	11053	70234	26143
Kerala	30975	26188	62683	83680	59502	89493
Maharashtra	256817	65828	236307	75652	243156	88953
Rajasthan	232788	74016	755074	169043	617677	238298
Tamil Nadu	8886	5466	4502	6518	10609	13182
Uttar Pradesh	167109	36486	65584	13118	42051	8322
West Bengal	55000	22000	51130	21730	71772	30911

QUARTZ & OTHER SILICA MINERALS

**Table – 11 : Production of Silica Sand, 2011-12 and 2012-13
(By Sectors/States/Districts)**

(Qty in tonnes; value in ₹'000)

State/District	2011-12			2012-13(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	149(6)	4867667	714062	140(8)	3690016	823828
Public Sector	6	109173	35414	4	93537	51200
Private Sector	143(6)	4758494	678648	136(8)	3596479	772628
Andhra Pradesh	65	1582312	142157	61	1649138	235393
Kurnool	9	35369	8523	6	42164	11449
Nellore	52	1521242	130924	49	1601010	223290
Prakasam	4	25701	2710	6	5964	654
Gujarat	16(1)	1959203	154387	17(1)	844789	72162
Bharuch	11(1)	1675086	137811	12(1)	721637	60132
Kachchh	1	133270	3598	1	63347	1432
Sabarkantha	1	3699	1202	1	15376	5813
Surat	1	90	11	1	60	7
Surendranagar	2	147058	11765	2	44369	4778
Jharkhand	1(1)	113265	36724	1(1)	81088	20971
Sahibganj	1(1)	113265	36724	1(1)	81088	20971
Karnataka	6	37607	11053	11	70234	26143
Udupi	4	30370	10330	11	70234	26143
Uttara Kannada	2	7237	723	-	-	-
Kerala	18	62683	83680	17	59502	89493
Alapuzha	18	62683	83680	17	59502	89493
Maharashtra	12	236307	75652	11	243156	88953
Kolhapur	1	950	105	1	5660	990
Ratnagiri	4	12571	2196	4	20443	4155
Sindhudurg	7	222786	73351	6	217053	83808
Rajasthan	16(4)	755074	169043	13(5)	617677	238298
Alwar	1	6053	968	1	4342	995
Bharatpur	-	-	-	1	10056	2514
Bikaner	(1)	12196	2500	(1)	49598	10985
Bundi	1	88630	39884	1	98867	44490
Chittorgarh	(1)	495991	90270	(1)	289190	103272
Jaipur	-	-	-	(1)	4758	857
Jaisalmer	1	11956	6576	1	10775	7004
Karauli	1	18315	4579	1	20438	5110
Sawai Madhopur	5	92297	20209	5	115625	58368
Sikar	5(2)	4060	1190	3(2)	14028	4703
Sirohi	1	19405	1941	-	-	-
Tonk	1	6171	926	-	-	-
Tamil Nadu	7	4502	6518	6	10609	13182
Kanchipuram	3	2977	4026	2	4213	4128
Nagapattinam	2	1525	2492	4	6396	9054
Villupuram	2	-	-	-	-	-
Uttar Pradesh	7	65584	13118	2	42051	8322
Allahabad	6	64619	12993	2	42051	8322
Chitrakut	1	965	125	-	-	-
West Bengal	1	51130	21730	1(1)	71772	30911
Bankura	1	51130	21730	1(1)	71772	30911

Figures in parentheses indicates number of associated mines with agate, ball clay, felspar, fireclay, kaolin & quartz.

QUARTZ & OTHER SILICA MINERALS

Table – 12 : Production of Silica Sand, 2011-12& 2012-13 (P)
(By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
All Groups	149(6)	140(8)	4867667	3690016	100.00	100.00	-	-
Up to 500	25(1)	23	4947	4051	0.10	0.11	0.10	0.11
501 to 1000	15	7	10258	5303	0.21	0.14	0.31	0.25
1001 to 3000	20(1)	14(1)	39069	27035	0.80	0.73	1.11	0.98
3001 to 5000	15	19(2)	62624	84147	1.29	2.28	2.40	3.26
5001 to 10000	21	17	154647	117183	3.18	3.18	5.58	6.44
10001 to 15000	12(1)	11	158482	137383	3.25	3.72	8.83	10.16
15001 to 25000	12	11(2)	248549	250470	5.11	6.79	13.94	16.95
25001 to 50000	11	20(1)	395090	737079	8.12	19.98	22.06	36.93
50001 and Above	18(3)	18(2)	3794001	2327365	77.94	63.07	100.00	100.00

Table – 13 : Mine-head Stocks of Silica Sand 2012-13 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	5438134	5941332
Andhra Pradesh	2379493	2383459
Gujarat	2185840	2700670
Jharkhand	52910	60773
Karnataka	59156	64115
Kerala	34453	25865
Maharashtra	132718	153199
Odisha	1749	656
Rajasthan	512623	446015
Tamil Nadu	1516	665
Uttar Pradesh	77676	105915

There were 31 reporting mines during the year as against 24 in the previous year. Besides, production of quartzite was reported by six associated mines in the current year and five associated mines in the previous year. During the year under review five principal producers accounted for about 57% 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 50% of total production which was followed by Maharashtra (14%), Chhattisgarh (11%), Jharkhand (8%), Odisha (7%), Bihar (6%), Karnataka (3%), Rajasthan (1%) and nominal production was also reported by West Bengal (Tables- 14 to 16).

Mine-head stocks of quartzite at the end of the year 2012-13 were 90 thousand tonnes as against 70 thousand tonnes at the beginning of the year (Table- 17).

The average daily employment of labour during the year under review was 773 as against 562 in 2011-12. Domestic prices of quartzite are furnished in the General Review on 'Prices'.

QUARTZITE

Production of quartzite at 365 thousand tonnes in 2012-13 increased by 34% as compared to that in the previous year mainly due to increase in mines reporting production in Andhra Pradesh and Chhattisgarh.

QUARTZ & OTHER SILICA MINERALS

Table – 14: Principal Producers of Quartzite, 2012-13

Name & address of producer	Location of mine	
	State	District
Dinesh Das & Son's Mines & Steel Pvt. Ltd Srikakulam, Post - Bahalda, Bahalda Road, Distt.- Mayurbhanj, Odisha.	Andhra Pradesh	Vizianagaram Srikakulam
K.Subramanya Raju, Vill.Totlalpalli, Post:- Alamanda, Distt.- Vizianagaram, Andhra Pradesh.	Andhra Pradesh	Vizianagaram
*Gahra Minerals, Habib Nagar,Teka Naka, Nagpur-440 017, Maharashtra.	Maharashtra	Bhandara
OCL India Ltd, At & Post- Rajgangpur, Distt.- Sundargarh, Odisha.	Chhattisgarh Odisha	Raigarh Jharsuguda
Bharat Mining Company, Post – Sunder Nagar, Distt.- Singhbhum (East), Jharkhand.	Jharkhand	Singhbhum (East)

* Producing as an associated mineral with quartz.

**Table – 15 : Production of Quartzite, 2010-11 to 2012-13
(By States)**

(Qty in tonnes; value in ₹'000)

State	2010-11		2011-12		2012-13(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	118117	45750	272141	139207	364894	206952
Andhra Pradesh	7717	4275	98955	44330	180485	73101
Bihar	62767	26855	35707	16895	21147	16393
Chhattisgarh	60	29	32626	36368	41861	45913
Jharkhand	24810	5458	44726	9840	30771	7316
Karnataka	11450	3607	10134	4155	10000	4380
Maharashtra	2455	614	37630	21111	50035	37302
Odisha	4608	3063	4715	3181	25806	21788
Rajasthan	4250	1849	7648	3327	4489	669
West Bengal	-	-	-	-	300	90

QUARTZ & OTHER SILICA MINERALS

**Table – 16 : Production of Quartzite, 2011-12 & 2012-13
(By Sectors/States/Districts)**

(Qty in tonnes; value in ₹'000)

State/District	2011-12			2012-13 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	24(5)	272141	139207	31(6)	364894	206952
Private Sector	24(5)	272141	139207	31(6)	364894	206952
Andhra Pradesh	10(1)	98955	44330	15(2)	180485	73101
Cuddapah	-	-	-	1	500	227
Srikakulam	1	1856	1151	3	20870	9789
Vizianagaram	9(1)	97099	43179	11(2)	159115	63085
Bihar	3	35707	16895	2	21147	16393
Munger	3	35707	16895	2	21147	16393
Chhattisgarh	4	32626	36368	6	41861	45913
Durg	2	1366	376	3	2224	1479
Raigarh	2	31260	35992	3	39637	44434
Jharkhand	2	44726	9840	2	30771	7316
Singhbhum (East)	2	44726	9840	2	30771	7316
Karnataka	1	10134	4155	1	10000	4380
Belgaum	1	10134	4155	1	10000	4380
Maharashtra	(3)	37630	21111	(4)	50035	37302
Bhandara	(2)	24809	12781	(3)	38013	26186
Chandrapur	(1)	12821	8330	(1)	12022	11116
Odisha	3(1)	4715	3181	3	25806	21788
Jharsuguda	1(1)	2209	1441	2	25122	21453
Mayurbhanj	2	2506	1740	1	684	335
Rajasthan	1	7648	3327	1	4489	669
Sawai Madhopur	1	7648	3327	1	4489	669
West Bengal	-	-	-	1	300	90
Bankura	-	-	-	1	300	90

Figures in parentheses indicates number of associated mines of quartz and kyanite.

**Table – 17: Mine-head Stocks of Quartzite
2012-13 (P)
(By States)**

(In tonnes)

State	At the beginning of the year	At the end of the year
India	69808	89651
Andhra Pradesh	20123	45966
Bihar	7939	10392
Chhattisgarh	19591	7890
Jharkhand	2174	2223
Karnataka	2463	1524
Maharashtra	4312	6096
Odisha	8459	10465
Rajasthan	4547	4847
West Bengal	200	248

SAND (OTHERS)

The production of sand (others) at 2,629 thousand tonnes in 2012-13 was almost at the same level as compared to that of previous year.

There were eleven reporting mines in 2012-13 same as in the previous year. The Singareni Collieries Co Ltd, having eight mines in Andhra Pradesh contributed 71% of the total production of sand (others). The remaining 29% of production was from three mines of Western Coal Fields Ltd, located in Chandrapur district of Maharashtra, and negligible 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 in nature and contract labour were employed by the producers.

Mine-head stocks at the end of 2012-13 were 441 thousand tonnes as against 430 thousand tonnes at the beginning of the year (Table-21).

QUARTZ & OTHER SILICA MINERALS

Table – 18 : Producers of Sand (Others), 2012-13

Name & address of producer	Location of mine	
	State	District
Singareni Collieries Co.Ltd, P.O. Kothagudam Collieries, Bhadrachalam Road, Station, S. C. Railway, Distt.- Khammam-507 101, Andhra Pradesh.	Andhra Pradesh	Adilabad Karimnagar
Western Coal fields Ltd, Office of the Sr Manager(Min) Nandgaon Inclines Mine, Lalpeth UG Sub-Area, Distt.- Chandrapur, Maharashtra.	Maharashtra	Chandrapur
*Cement Manufacturing Company Ltd, Lumshnong, PO-Khliehriat, Distt.- Jaintia Hills, Meghalaya-793 200.	Meghalaya	Jaintia Hills

*Associated mine with limestone.

**Table –19 : Production of Sand (Others), 2010-11 to 2012-13
(By States)**

(Qty in tonnes; value in ₹'000)

State	2010-11		2011-12		2012-13(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	2057119	109682	2625111	162965	2628935	186154
Andhra Pradesh	1673153	91014	2157012	134198	1871036	150235
Maharashtra	373746	17033	435159	23628	750877	34771
Meghalaya	10220	1635	32940	5139	7022	1148

**Table – 20 : Production of Sand (Others), 2011-12 & 2012-13
(By Sectors/States/Districts)**

(Qty in tonnes; value in ₹'000)

State/District	2011-12			2012-13(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	11(1)	2625111	162965	11(1)	2628935	186154
Public Sector	11	2592171	157827	11	2621913	185006
Private Sector	(1)	32940	5138	(1)	7022	1148
Andhra Pradesh	8	2157012	134198	8	1871036	150235
Adilabad	3	864037	71868	3	1004791	103134
Karimnagar	4	1292022	61989	4	860484	46688
Vizianagararam	1	953	341	1	5761	413
Maharashtra	3	435159	23628	3	750877	34771
Chandrapur	3	435159	23628	3	750877	34771
Meghalaya	(1)	32940	5139	(1)	7022	1148
Jaintia Hills	(1)	32940	5139	(1)	7022	1148

Figures in parenthesis indicates associated mines with limestone.

QUARTZ & OTHER SILICA MINERALS

Table – 21: Mine-head Stocks of Sand (Others), 2012-13 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	429794	440952
Andhra Pradesh	320892	359300
Maharashtra	108902	81652
Meghalaya	-	-

AGATE

The production of agate was 493 tonnes in 2012-13 as compared to 476 tonnes during the preceding year. There was only a single private sector mine of agate which was situated in Bharuch district of Gujarat (Tables- 22 to 24).

Mine-head stocks of agate at the end of the year 2012-13 was 56 tonnes as against 100 tonnes at the beginning of the year (Table- 25).

The average daily employment of labour was 9 in 2012-13 as against 13 in the previous year.

Table – 22 : Producer of Agate, 2012-13

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

Table – 23 : Production of Agate, 2010-11 to 2012-13
(By States)

(Qty in tonnes; value in ₹'000)

State	2010-11		2011-12		2012-13(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India/ Gujarat	19	10	476	238	493	247

Table – 24 : Production of Agate, 2011-12 & 2012-13
(By Sectors/States/Districts)

(Qty in tonnes; value in ₹'000)

State/District	2011-12			2012-13(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India/Private Sector	1	476	238	1	493	247
Gujarat/ Bharuch	1	476	238	1	493	247

QUARTZ & OTHER SILICA MINERALS

**Table – 25 : Mine-head Stocks of Agate
2012-13 (P)
(By States)**

(In tonnes)		
State	At the beginning of the year	At the end of the year
India/Gujarat	100	56

JASPER

No production of jasper was reported during 2010-11, 2011-12 and 2012-13. 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 Mahabubnagar district in Andhra Pradesh with crushing capacity of 45 tonnes and 1000 tonnes a month, respectively. Besides, Maharashtra Minerals Corp. Ltd having a 50000 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 fulcrum 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 2012-13 was 110,992.00 thousand sq m, 3,566.39 thousand sq m, 42.52 thousand tonnes and 1246.50 thousand tonnes, respectively and during 2013-14 have been 127,582 thousand sq m, 3191.19 thousand sq m, 30.27 thousand tonnes and 995.12 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

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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 143,000 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 compatability 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% SiO_2 , less than 0.55% Al_2O_3 and less than 0.2% Fe_2O_3 . 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.

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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

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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 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 127 thousand tonnes in 2011-12. 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, Distt.- Khammam, Andhra Pradesh.	9300
VBC Ferro Alloys Ltd, Medak, Andhra Pradesh.	19000
GMR Technologies & Ind. Ltd, Ravivalasa, Distt.- Srikakulam, Andhra Pradesh.	25000 (Total)
Akshay Ispat & Ferro Alloys Ltd, Namchi Distt.- South Sikkim, Sikkim.	6000
Hindustan Malleables & Forgings Ltd, Dhanbad, Jharkhand.	1800
Anjaney Ferro-alloys Ltd, Mihijam, Distt.- 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, Distt.- Pallakad, Kerala.	NA
Indian Metals & Ferro Alloys Ltd, Therubali, Distt.- Cuttack, Odisha.	53000
The Silical Metallurgic Ltd, Puducherry.	10560
Snam Alloys Ltd, Village Kariamamickam, Puducherry.	12000
V.S.K. Ferro-alloys Ltd, Thuthipet, Puducherry.	3000
Hindustan ferro-Alloys, Hamirpur, Uttar Pradesh.	3200

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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 (max)	50- 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 1.95 million tonnes in 2012-13. Major consuming industries were glass (33%), cement (31%), ferro-alloys (14%), foundry (7%), fertilizer and ceramic (5% each). Other industries such as iron & steel, alloy steel, insecticide, refractory, abrasive, etc. consumed the remaining 5%.

The consumption of quartzite was estimated around 292 thousand tonnes out of which iron and steel industry consumed about 54%, followed by refractory (17%), sponge iron (15%) and ferro-alloys (13%).

The estimated consumption of moulding sand in 2012-13 was 47,500 tonnes. Major consuming industries were foundry (88%), followed by mining machinery (9%) and iron & steel (3%).

The total ferro-silicon consumed by various industries in 2012-13 was estimated at 41,800 tonnes. Major consuming industries were iron & steel (86%), 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 worldwide in all types of electronic devices.

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**Table – 29 : Consumption of Quartz/Silica Sand, 2010-11 to 2012-13
(By Industries)**

(In tonnes)			
Industry	2010-11	2011-12(R)	2012-13(P)
All Industries	1560500	1873000	1945200
Alloy steel	14500(10)	14400(9)	14400(9)
Cement	326700(15)	355600(16)	608000(18)
Ceramic	86700(38)	87100(38)	88200(38)
Ferro-alloys	265400(40)	279100(44)	268000(44)
Fertilizer	105800(4)	105800(4)	105800(4)
Foundry	138100(33)	148100(32)	141400(32)
Glass	559800(54)	799400(54)	632300(54)
Iron & Steel	13500(1)	25100(3)	28600(3)
Others (Abrasive, asbestos, chemical, dry cell battery, electrical, paint, pesticide, refractory and rubber)	50000 (79)	58400(85)	58500(86)

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: Consumption of Quartzite, 2010-11 to 2012-13
(By Industries)**

(In tonnes)			
Industry	2010-11	2011-12(R)	2012-13(P)
All Industries	243500	255400	292500
Cement	5400(2)	1100(2)	++(2)
Ferro-alloys	34400(12)	40300(13)	39400(13)
Foundry	100(5)	100(5)	100(5)
Iron & steel	131100(25)	141000(29)	158200(29)
Pelletisation (Iron & steel)	++(1)	++(1)	++(1)
Refractory	27600(12)	28000(12)	49900(13)
Sponge iron	44900(2)	44900(2)	44900(2)

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 : Consumption of Moulding Sand, 2010-11 to 2012-13
(By Industries)**

(In tonnes)			
Industry	2010-11	2011-12(R)	2012-13(P)
All Industries	47500	47500	47500
Foundry	41700(14)	41700(14)	41700(14)
Iron & steel	1600(6)	1600(6)	1600(6)
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).

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**Table – 32 : Reported Consumption of Ferro-Silicon
2010-11 to 2012-13
(By Industries)**

(In tonnes)			
Industry	2010-11	2011-12(R)	2012-13(P)
All Industries	37400	41200	41800
Alloy steel	3300(8)	3300(8)	3300(8)
Foundry	2200(22)	2200(22)	2200(22)
Iron & steel	31700 (24)	35300(27)	35900(27)
Others (Electrode & Ferro-alloys)	200(4)	400(7)	400(7)

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, 2010-11 to 2012-13
(By Industries)**

(In tonnes)			
Industry	2010-11	2011-12(R)	2012-13(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), 2010 to 2012
(By Principal Countries)**

(In '000 tonnes)			
Country	2010	2011	2012
World: Total (rounded)	121000	138000	139000
Australia	5300	5600	5300
Belgium	1800	1800	1800
Canada	1171	1430	1590
Chile	1400	1240	1270
Czech Republic	1400	1350	1340
Egypt	-	1800	1800
Finland	-	2250	2400
France	5000	5000	6290
French Guiana	-	1500	1500
Gambia	-	-	1200
Germany	7000	7770	7500
India*	1800	1800	1900
Iran	1500	1500	1500
Italy	9800	19800	16400
Japan	3078	2900	3200
Latvia	-	1360	1360
Malaysia	-	-	1200
Mexico	-	2570	3590
Moldova	-	-	2970
Norway	1500	1200	1000
Poland	2730	2460	2570
South Africa	2910	2900	2600
Spain	5000	5000	5000
Turkey	4000	5000	7000
UK	3760	3760	3760
USA	30000	43700	50700
Other countries(rounded)	32000	14310	2260

Source: Mineral Commodity Summaries, 2013 & 2014.

* For India's production of silica minerals during 2010-11, 2011-12 and 2012-13, 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 233,275 tonnes in 2012-13 from 214,969 tonnes in the previous year. Out of total exports, quartz comprised 184,657 tonnes (79%) and quartzite 48,618 tonnes (21%). Exports were mainly to Bhutan (19%), Japan (15%), Bangladesh (14%) and UAE (10%). Exports of silica sand decreased considerably to 4,689 tonnes in 2012-13 from 10,020 tonnes in the previous year. Exports were mainly to Malaysia (19%), Japan (13%) and Singapore (12%) & Kenya (11%). Exports of sand (excluding metal bearing) decreased substantially to 7,342 tonnes in 2012-13 from 21,044 tonnes in the previous year. Exports were mainly to Nigeria (21%), Saudi Arabia (18%), Malaysia (13%) and Bangladesh (11%). Exports of agate (uncut) increased substantially to 786 tonnes in 2012-13 from 429 tonnes in the previous year. China (88%), Saudi Arabia (5%) and UK (3%) were the main buyers in 2012-13. Exports of agate (cut) decreased to 1,265 thousand carats in 2012-13 from 1,733 thousand carats in the previous year. China (34%), Hong Kong (31%) and USA (23%) were the main consumer of agate (cut) in 2012-13. Exports of flint decreased to 717 tonnes in 2012-13 from 968 tonnes in 2011-12. Exports were mainly to Ethiopia (50%), Sudan (27%) and Saudi Arabia (16%). Exports of silicon decreased substantially to 92 tonnes in 2012-13 from 247 tonnes in 2011-12. Ghana (23%), Bhutan (16%), Liberia (13%) and UAE (11%) were the main buyers in 2012-13 (Tables - 35 to 43).

Imports

Imports of quartz and quartzite (natural) were 1,652 tonnes in 2012-13 as compared to 578 tonnes in 2011-12. Out of the total imports in 2012-13, those of quartzite were 922 tonnes and mainly from Bangladesh (48%) and China (30%) while quartz imports were 730 tonnes mainly from Sri Lanka (34%), Bangladesh (24%) and Belgium (14%). Imports of silica sand decreased substantially to 54,379 tonnes in 2012-13 from 129,490 tonnes in the previous year. Egypt (42%), Saudi Arabia (27%) and Italy (9%) were the suppliers. Imports of sand (excluding metal bearing) was 12,785 tonnes and mainly from Nepal (91%). Imports of flint sharply increased to 28 tonnes in 2012-13 from mere one tonne in 2011-12. China and Italy were the main suppliers. Imports of agate (uncut) increased drastically to 52 tonnes in 2012-13 from 26 tonnes

in 2011-12. Imports were mainly from Tanzania (54%) and China (33%). Imports of agate (cut) decreased to only one thousand carats in 2012-13 from 5 thousand carats in 2011-12. Hong Kong was the only main supplier. Imports of silicon increased marginally to 36,882 tonnes in 2012-13 from 35,380 tonnes in previous year. Imports were mainly from China (87%), Australia (3%) and Vietnam (2%) (Tables - 44 to 52).

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	214969	1513889	233275	1608026
Japan	44852	549730	33982	430334
Bhutan	17860	74601	44297	144205
Malaysia	10554	99833	15700	126862
Bangladesh	30364	81498	31982	122475
Vietnam	15712	115936	12282	96103
UAE	25036	87153	22780	94430
Israel	8431	67567	7946	84861
Korea, Rep. of	2439	25089	4933	41304
Oman	5728	32504	6329	40460
Saudi Arabia	3304	17673	5994	36102
Other countries	50689	362305	47050	390890

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	35164	313122	48618	491494
Japan	9256	76265	6743	129013
Israel	4684	47467	6043	64859
Vietnam	3068	26668	4796	41693
Bangladesh	4359	16884	10033	41193
Malaysia	254	1634	1824	32807
Bhutan	-	-	4969	23500
Turkey	1371	14078	1929	20774
Oman	323	1133	1365	11225
Korea, Rep. of	587	7077	1362	11181
Bermuda	-	-	600	11032
Other countries	11262	121916	8954	104217

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	179805	1200767	184657	1116532
Japan	35596	473465	27239	301321
Bhutan	17860	74601	39328	120705
Malaysia	10300	98199	13876	94055
UAE	24521	85585	22319	92149
Bangladesh	26005	64613	21949	81282
Vietnam	12644	89267	7486	54410
Korea, Rep. of	1852	18012	3571	30123
Oman	5405	31371	4964	29235
Thailand	2531	21409	2969	28588
Saudi Arabia	2254	11252	4594	27993
Other countries	40837	232993	36362	256671

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	21044	377436	7342	455557
Iran	350	40936	426	252045
Saudi Arabia	5442	221211	1310	155823
Oman	626	3521	377	11992
Nigeria	4946	32752	1536	10472
Bangladesh	1030	5301	823	5583
Canada	236	1624	475	4801
Malaysia	-	-	919	4219
Kenya	363	2187	401	2344
Vietnam	++	2	147	1227
Japan	64	1173	55	1058
Other countries	7987	68729	873	5993

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	10020	80081	4689	43188
Malaysia	347	1495	907	12173
Japan	228	4958	601	5424
Kenya	633	4578	533	5409
Singapore	++	6	540	3643
Italy	989	7056	190	2116
Qatar	-	-	225	1860
Cameroon	-	-	307	1660
UAE	1171	4292	159	1560
Australia	96	1326	148	1378
USA	96	912	74	1017
Other countries	6460	55458	1005	6948

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	429	43262	786	96044
China	344	23380	690	38178
Saudi Arabia	2	2169	39	19102
USA	41	7159	14	18161
UK	2	294	23	3511
Italy	++	108	7	2662
Australia	++	302	1	2060
Canada	++	555	1	1735
Spain	++	129	1	1487
Netherlands	1	947	++	1394
Japan	++	808	5	1166
Other countries	39	7411	5	6588

QUARTZ & OTHER SILICA MINERALS

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

Country	2011-12		2012-13	
	Qty (‘000 carats)	Value (₹‘000)	Qty (‘000 carats)	Value (₹‘000)
All Countries	1733	111567	1265	70546
USA	293	31498	290	19304
Hong Kong	241	10254	386	18432
China	678	24245	424	18285
UK	38	3520	31	3041
Japan	18	2207	17	2003
France	47	5177	24	1807
Germany	87	7864	16	1338
Australia	28	2501	17	1153
Spain	3	1727	6	1102
Thailand	86	2326	16	728
Other countries	214	20248	38	3353

**Table – 43 : Exports of Silicon
(By Countries)**

Country	2011-12		2012-13	
	Qty (t)	Value (₹‘000)	Qty (t)	Value (₹‘000)
All Countries	247	23896	92	10420
UAE	16	2822	10	2137
Singapore	-	-	5	2008
China	48	5385	++	1162
Kenya	2	289	10	1097
Sri Lanka	-	-	5	848
Ghana	1	143	21	679
Liberia	-	-	12	549
Mexico	-	-	++	339
Nepal	126	6526	2	334
Bhutan	-	-	15	308
Other countries	54	8731	12	959

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹‘000)	Qty (t)	Value (₹‘000)
All Countries	968	2962	717	2883
Ethiopia	-	-	360	1816
Saudi Arabia	151	587	117	494
Sudan	-	-	197	302
UAE	-	-	40	265
Germany	-	-	3	6
Other countries	817	2375	-	-

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹‘000)	Qty (t)	Value (₹‘000)
All Countries	578	11065	1652	26982
China	54	1589	305	9374
Sri Lanka	450	6200	250	3867
Bangladesh	-	-	620	2077
Italy	17	675	52	2001
Germany	20	994	87	1868
Ecuador	-	-	41	1556
Belgium	8	224	101	1549
USA	11	598	19	1378
Thailand	-	-	59	1235
Japan	++	3	3	836
Other countries	18	782	115	1241

QUARTZ & OTHER SILICA MINERALS

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	72	2360	922	15167
China	54	1589	276	7772
Italy	17	675	52	2001
Bangladesh	-	-	445	1609
Ecuador	-	-	41	1556
Germany	-	-	51	920
Japan	++	3	3	836
Uzbekistan	-	-	26	209
South Africa	-	-	24	88
Switzerland	-	-	2	87
USA	-	-	++	46
Other countries	1	96	2	43

**Table – 46 : Imports of Quartz (Natural)
(By Countries)**

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	506	8702	730	11815
Sri Lanka	450	6200	250	3867
China	-	-	29	1602
Belgium	8	224	101	1549
USA	11	598	19	1332
Thailand	-	-	59	1235
Germany	20	994	36	949
Bangladesh	-	-	175	469
Kazakhstan	-	-	25	377
Spain	-	-	26	235
Netherlands	2	55	10	200
Other countries	15	631	-	-

**Table – 47 : Imports of Silica Sand
(By Countries)**

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	129490	598457	54379	579833
Saudi Arabia	4976	27298	14834	92964
Egypt	98783	197718	22738	91542
Italy	5124	65083	4640	65464
China	6244	109265	2199	62162
Chinese Taipei/ Taiwan	90	12311	633	60186
Germany	283	9059	1692	56061
USA	1105	30046	874	37006
Belgium	1127	19816	1197	21965
Vietnam	22	393	155	18982
Thailand	2932	31574	619	18438
Other countries	8804	95894	4798	55063

**Table – 48 : Imports of Sand
(Excl. Metal Bearing)
(By Countries)**

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	22811	53509	12785	42747
Nepal	21475	20920	11608	10480
Germany	652	20035	206	7010
China	28	391	307	5803
Chinese Taipei/ Taiwan	-	-	30	3818
Italy	-	-	44	3455
Belgium	215	2915	235	3342
USA	60	1331	93	2751
UAE	++	20	64	2279
Thailand	72	5034	118	2030
UK	19	773	20	798
Other countries	290	2090	60	981

**Table – 49 : Imports of Flint
(By Countries)**

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	1	98	28	1086
China	1	81	27	971
Italy	-	-	1	115
Other countries	++	17	-	-

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

Country	2011-12		2012-13	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	26	5376	52	17336
China	5	884	17	7990
Tanzania	12	662	28	5142
USA	++	2479	2	1813
Turkey	2	340	++	512
Madagascar	-	-	++	403
Belgium	-	-	4	396
Ireland	-	-	1	361
Brazil	5	648	++	242
Zimbabwe	-	-	++	194
Kenya	-	-	++	143
Other countries	2	363	++	140

QUARTZ & OTHER SILICA MINERALS

**Table – 51 : Imports of Agate: Cut
(By Countries)**

Country	2011-12		2012-13	
	Qty (‘000 Carats)	Value (₹‘000)	Qty (‘000 Carats)	Value (₹‘000)
All Countries	5	31093	1	10495
Hong Kong	-	-	1	8746
Tanzania	-	-	++	855
USA	++	107	++	612
China	5	30691	++	269
Australia	-	-	++	13
Other countries	++	295	-	-

**Table – 52 : Imports of Silicon
(By Countries)**

Country	2011-12		2012-13	
	Qty (t)	Value (₹‘000)	Qty (t)	Value (₹‘000)
All Countries	35380	4256979	36882	4536825
China	28880	3394760	31987	3827271
Australia	862	141788	1019	167678
Vietnam	2394	281721	867	106413
Korea, Rep. of	230	49452	522	61382
UK	194	26932	307	46922
Thailand	118	15204	337	45880
Chinese Taipei/Taiwan	166	26461	58	34918
South Africa	221	26346	240	25675
Germany	81	9098	134	18859
Saudi Arabia	96	11342	144	17662
Other countries	2138	273875	1267	184165

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.

