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GYPSUM

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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26 Gypsum

Gypsum ($CaSO_4.2H_2O$) is a hydrated calcium sulphate used widely in industry because of its special property of losing three-fourth of the combined water of crystallisation when moderately heated (calcined) to about 130ºC. Besides, calcined gypsum when cooled, finely ground and made plastic with water can be spread out, cast or moulded to any desired surface or form. On drying, it sets into a hard rock-like form. Selenite is a colourless, transparent, crystalline variety of gypsum, whereas alabaster is a fine grained, massive variety, white or shaded in colour. Silky and fibrous variety of gypsum is called satin spar. Anhydrite ($CaSO_4$) is a calcium sulphate mineral found associated with gypsum commonly as a massive or fibrous mineral.

Gypsum that occurs in nature is called mineral gypsum. In addition to mineral gypsum, seawater and some chemical and fertilizer plants are sources of by-product marine gypsum and by-product chemical gypsum, respectively. The later is obtained as by-product phospho-gypsum or fluoro-gypsum or boro-gypsum, depending upon the source. Phosphoric acid plants are important sources of by-product phospho-gypsum.

Marine gypsum is recovered from salt pans during production of common salt in coastal region, particularly in Gujarat and Tamil Nadu. The recovery of by-product gypsum and marine gypsum together is substantial and is comparable with the production of mineral gypsum.

Synthetic gypsum is recovered via flue gas desulphurisation at some coal fired electric power plants in western countries.

RESOURCES

As per UNFC system, the total resources of mineral gypsum in India as on 1.4.2010 were estimated at 1,286 million tonnes of which 39 million tonnes have been placed under 'reserves' and 1,247 million tonnes under 'remaining resources' category.

Of the total resources, fertilizer/pottery grade accounts for about 82% and cement/paint grade 12%. The unclassified and not-known grades together account for 5% resources. The remaining one percent of resources is shared by surgical plaster and soil reclamation grades. By States, Rajasthan alone accounts for 82% resources and Jammu & Kashmir 14% resources. The remaining 4% resources are in Tamil Nadu, Gujarat, Himachal Pradesh, Karnataka, Uttarakhand, Andhra Pradesh and Madhya Pradesh (Table-1).

EXPLORATION & DEVELOPMENT

No exploration was reported during the year 2012-13 by any agency.

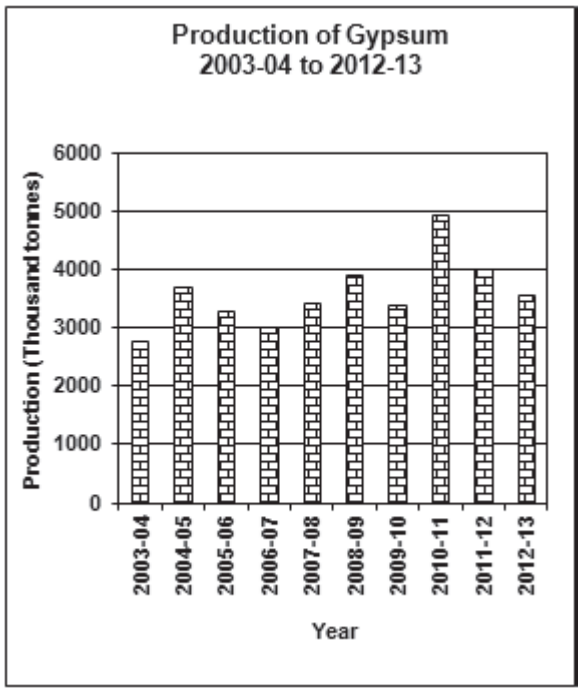

Table – 1 : Reserves/Resources of Gypsum as on 1.4.2010
(By Grades/States)

(In '000 tonnes)

Grade/State	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	**22494**	**239**	**16363**	**39096**	**8502**	**73651**	**17659**	**8455**	**710853**	**428272**	**10**	**1247402**	**1286498**
By Grades													
Surgical plaster	776	-	-	776	-	1039	82	-	-	3773	-	4894	5670
Fertilizer/Pottery	8097	81	276	8454	2196	9185	270	7680	703244	320454	-	1043029	1051483
Cement/Paint	9955	158	16087	26200	6120	63035	14677	532	2876	39366	10	126616	152816
Soil reclamation	-	-	-	-	185	392	2573	100	206	7939	-	11395	11395
Unclassified	-	-	-	-	-	-	56	78	2943	33548	-	36625	36625
Not-known	3666	-	-	3666	-	-	-	66	1585	23191	-	24842	28508
By States													
Andhra Pradesh	-	-	-	-	-	-	-	-	-	404	-	404	404
Gujarat	9	5	24	38	-	-	-	-	-	15138	-	15138	15176
Himachal Pradesh	-	-	-	-	-	-	1365	-	-	3081	-	4446	4446
Jammu & Kashmir	1664	153	442	2259	4784	9785	6570	7680	-	146694	-	175513	177772
Karnataka	-	-	-	-	-	-	-	-	-	3784	-	3784	3784
Madhya Pradesh	-	-	-	-	-	-	-	-	-	69	-	69	69
Rajasthan	20821	81	15834	36736	3405	63397	3105	750	710604	237550	-	1018811	1055547
Tamil Nadu	-	-	64	64	313	469	6584	25	249	19540	10	27190	27254
Uttarakhand	-	-	-	-	-	-	35	-	-	2012	-	2047	2047

Figures rounded off

PRODUCTION, STOCKS AND PRICES

Gypsum

The production of gypsum in 2012-13 at about 3.54 million tonnes decreased by 11% as compared to that in the previous year.

There were 33 reporting mines during the year as against 38 in the preceding year. Two principal producers together accounted for about 99% of the total production of gypsum in 2012-13. Five mines producing above 2 lakh tonnes annually contributed 70% of total production, 2 mines producing between one to two lakh tonnes contributed 9% of the total production, 3 mines producing between 50 thousand tonnes to 1 lakh tonnes contributed 7% of total production, 15 mines producing between 10 thousand to 50 thousand tonnes accounted for 13% of total production. Nominal production of gypsum was reported from 8 other mines, each producing below 10 thousand tonnes annually. Almost the entire production of gypsum was contributed by public sector and very nominal quantity of production was reported by private sector.

Rajasthan state continued to be the leading producer, contributing about 99% of the total output. Remaining 1% was contributed by Jammu & Kashmir (Tables - 3 to 6).

The mine-head stocks of gypsum at the end of the year 2012-13 was 2,00,015 tonnes as against 1,35,351 tonnes at the beginning of the year 2012-13 (Table - 7).

The average daily labour employed in gypsum mines during 2012-13 was 338 as against 334 in the previous year.

Domestic prices of gypsum are furnished in the General Review on 'Prices'.

Table – 3 : Principal Producers of Gypsum, 2012-13(P)

Name and address of producer	Location of mine	
	State	District
Rajasthan State Mines & Minerals Ltd, C 89-90, Janpath, Lal Kothi Scheme, Jaipur- 302 015, Rajasthan.	Rajasthan	Bikaner Sri Ganganagar Hanumangarh Jaisalmer Jalore Nagaur
FCI Aravali Gypsum & Minerals India Ltd, (formerly known as Fertilizer Corp. of India Ltd) Mangu Singh Rajvi Marg, Paota 'B' Road, Jodhpur-342 010, Rajasthan.	Rajasthan	Bikaner Sri Ganganagar Jaisalmer

Table – 4 : Production of Gypsum, 2010-11 to 2012-13(P)
(By States)

(Qty in tonnes; value in ₹ '000)

States	2010-11		2011-12		2012-13(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**4918170**	**1475454**	**3978806**	**1686042**	**3537755**	**1709725**
Gujarat	37	14	20	6	-	-
Jammu & Kashmir	38143	11443	29505	8852	41830	12599
Rajasthan	4879990	1463997	3937375	1674326	3495925	1697126
Tamil Nadu	-	-	11906	2858	-	-

Table – 5 : Production of Gypsum, 2011-12 & 2012-13(P) (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	**38**	**3978806**	**1686042**	**33**	**3537755**	**1709725**
Public sector	34	3962835	1681358	32	3537362	1709557
Private sector	4	15971	4684	1	393	168
Gujarat	**1**	**20**	**6**	-	-	-
Kuchchh	1	20	6	-	-	-
Jammu & Kashmir	**2**	**29505**	**8852**	**3**	**41830**	**12599**
Doda	1	6946	2084	1	393	168
Ramban	1	22559	6768	1	15008	4502
Baramula	-	-	-	1	26429	7929
Rajasthan	**33**	**3937375**	**1674326**	**30**	**3495925**	**1697126**
Barmer*	2*	-	-	2*	-	-
Bikaner	11	2562197	1054090	9	2196569	1028079
Sri Ganganagar	11	361588	169252	12	358553	169561
Hanumangarh	4	60845	27094	2	30324	14105
Jaisalmer	3	569908	237801	3	560876	321253
Jalore	1	33837	14381	1*	-	-
Nagaur	1	349000	171708	1	349603	164128
Tamil Nadu	**2**	**11906**	**2858**	-	-	-
Erode	1	3110	1213	-	-	-
Perambalur	1	8796	1645	-	-	-

(*): only labour reported

Table – 6 : Production of Gypsum, 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	**38**	**33**	**3978806**	**3537755**	**100.00**	**100.00**	–	–
Up to 10000	11	8	49038	19393	1.23	0.54	1.23	0.54
10001-50000	17	15	565503	461151	14.21	13.04	15.44	13.58
50001-100000	2	3	122928	250730	3.09	7.09	18.53	20.67
100001-200000	1	2	154585	323308	3.89	9.14	22.42	29.81
Above 200000	7	5	3086752	2483173	77.58	70.19	100.00	100.00

Table - 7: Mine-head Stocks of Gypsum, 2012-13(P) (By States)

(In tonnes)

State	At the beginning of the Year	At the end of the year
India	**135351**	**200015**
Gujarat	436	36
Jammu & Kashmir	3	5
Rajasthan	134430	199804
Tamil Nadu	482	170

Selenite

The production of Selenite was 7,577 tonnes in the year 2012-13 under review as against 13,047 tonnes during the previous year. The entire production of Selenite was reported by Rajasthan State Mines & Minerals Ltd (RSMML), a Public Sector Undertaking, operating 3 mines in Barmer & Bikaner districts of Rajasthan (Tables - 8 to 10).

The mine-head stocks of selenite at the end of the year 2012-13 was 345 tonnes (Table - 11).

Table – 8 : Producer of Selenite 2012-13(P)

Name & Address of Producer	Location of Mines	
	State	District
Rajasthan State Mines & Minerals Ltd, C 89-90, Janpath, Lal Kothi Scheme, Jaipur –302 015, Rajasthan	Rajasthan	Barmer & Bikaner

Table – 9 : Production of Selenite, 2010-11 to 2012-13(P) (By State)

(Qty in tonnes; value in ₹ '000)

State	2010-11		2011-12		2012-13(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**6736**	**5726**	**13047**	**16105**	**7577**	**9968**
Rajasthan	6736	5726	13047	16105	7577	9968

Table – 10 : Production of Selenite, 2011-12 and 2012-13(P) (By Sector/State/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	**3**	**13047**	**16105**	**3**	**7577**	**9968**
Public sector	3	13047	16105	3	7577	9968
Rajasthan	**3**	**13047**	**16105**	**3**	**7577**	**9968**
Barmer	2	3474	3995	2	1535	2049
Bikaner	1	9573	12110	1	6042	7919

Table - 11 : Mine-head Stocks of Selenite, 2012-13(P) (By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	-	**345**
Rajasthan	-	345

The average daily labour employed in Selenite mines during 2012-13 was 28 as against 36 in the previous year.

Domestic prices of selenite are furnished in the General Review on 'Prices'.

MINING AND MARKETING

Gypsum is mined out by opencast manual mining except in a few semi-mechanised mines in Rajasthan. In semi mechanised mines, Gypsum is excavated by backhoe excavator and directly loaded into trucks/dumpers. The trucks and dumpers loaded with gypsum are despatched directly to user industry or to railway siding for further loading into railway wagons for user industry. In some mines of Rajasthan, the excavated Gypsum is grinded before despatching to user or party. The deposits are found at shallow depths and scattered over large areas. Based on use of gypsum, the production is classified into different grades like Fertilizer grade, Cement grade, Plaster of Paris grade, Surgical grade, etc .

High grade gypsum is mostly mined in Bikaner and Jaisalmer districts of Rajasthan. Some gypsum mines in Bikaner district also produce crystalline variety i.e. selenite. Gypsum from Rajasthan is despatched to cement plants in India spread over Rajasthan, Gujarat, Madhya Pradesh, West Bengal, Uttar Pradesh, Bihar, Jharkhand, Chhattisgarh, Himachal Pradesh, etc. Besides, a substantial quantity, containing about 60-70% $CaSO_4.2H_2O$ is supplied to Punjab, Uttar Pradesh, Haryana, Delhi, etc. for reclaiming alkaline soil. A sizeable quantity of gypsum from mines in Barmer, Bikaner, Jaisalmer, Hanumangarh, Sri Ganganagar and Nagaur districts of Rajasthan is also supplied to the Plaster of Paris units in Rajasthan, Uttar Pradesh, Haryana, Maharashtra, West Bengal, Delhi, etc.

M/s Saint Gobain Gyproc India Ltd and Boral Gypsum India Pvt Ltd are among the market leaders in Plaster of Paris industries and specialise in dry construction techniques.

USES AND SPECIFICATIONS

Cement, fertilizer (ammonium sulphate) and Plaster of Paris are the three important industries in which gypsum is utilised. Gypsum of less purity in crushed form is utilised in portland cement manufacturing for controlling the setting time of portland cement (i.e. as a retarder to prevent quick set). It is added to the clinker just before final grinding to finished cement. Proportion of gypsum in cement industry is 4-5% of the cement produced. Both, mineral and by-product gypsum are used in cement manufacture. Calcined gypsum finds use in manufacturing Plaster of Paris. It is also used in manufacturing partition blocks, sheets and tiles, insulation boards for stucco and lattice works. Gypsum board is primarily used as a finish for walls and ceilings. It is also used as a binder in fast dry tennis court clay. Low grade gypsum is calcined and used as gypsum plaster after preparation of mortar. It is used for internal plastering and masonry work. Requirement of low-grade gypsum for use in building industry as per IS:12654-1989 (Reaffirmed 2010) is: $CaSO_4.2H_2O$ not less than 60%. In pottery, calcined gypsum is used for preparation of moulds in the production of sanitarywares. The used and discarded moulds are in turn again used as source of gypsum in cement and other industries. Low-grade gypsum is used in conditioning of alkaline soil and as a manure in agriculture mainly for correcting black alkali soils. BIS has prescribed IS:6046-1982 (First Revision; reaffirmed 2008) for gypsum for agricultural use.

Selenite, a crystalline variety is used to a limited extent for gypsum plate for petrological microscopes, known as Sensitive Tint. It is also used in the ceramic industry for making moulds, to manufacture surgical grade Plaster of Paris and also for producing white cement. Plaster of Paris industry requires high purity gypsum. Different grades of plaster of Paris are manufactured depending upon the period for setting. For surgical plaster, a minimum 96% $CaSO_4.2H_2O$ grade gypsum is required.

High-purity gypsum may be utilised for manufacturing of ammonium sulphate fertilizer. Ground pure white gypsum is also used as a filler in paper, paints and textile goods. Ground low grade gypsum is used in mine dusting, manufacture of black board chalks and as a filler in insecticides. Besides, gypsum is also used in other industries like pharmaceutical, textile and asbestos products.

Alabaster, a dense, massive, granular and translucent variety, is employed as ornamental stone in statuary and interior decoration.

BIS specification for by-product gypsum (IS:10170-1982, reaffirmed 2008) lays down a minimum 70% content of $CaSO_4.2H_2O$ and maximum limit of 0.75% Na, 1.0% F and 15% free moisture on dry basis. The material should pass through 2 mm sieve, but 50% of material should also pass through 0.25 mm (60 mesh) sieve. The specifications of by-product gypsum for use in plaster, blocks and boards, as per IS:12679-1989 (reaffirmed 2010), is given in Table-12. Besides, BIS has prescribed IS:1290-1973 (Second Revision; reaffirmed 2011) for mineral gypsum. Specifications of mineral gypsum for different industries are given in Table-13.

Table – 12 : Requirement of By-product Gypsum for Use in Plaster, Blocks and Boards (IS:12679 - 1989, Reaffirmed 2010)

Sl. No.	Characteristic	Requirement		
		Phospho-gypsum	Fluoro-gypsum	Marine-gypsum
1.	P_2O_5, % by mass, max	0.40	–	–
2.	F, % by mass, max	0.40	1.00	–
3.	Na_2O, % by mass, max	0.10	–	–
4.	K_2O, % by mass, max	0.20	–	–
5.	Organic matter, % by mass, max	0.15	–	–
6.	$CaSO_4.2H_2O$, % by mass, max	85.00	90.00*	85.00
7.	Cl as NaCl, % by mass, max	0.10	–	0.10
8.	pH of 10% aqueous suspension of gypsum, min	5.00	5.00	6.00

Note: ** Fluoro-gypsum shall be in anhydrous form (as $CaSO_4$).*

BY-PRODUCT GYPSUM

Phospho-gypsum

Phospho-gypsum is produced as a by-product during the manufacture of phosphoric acid by wet process. The quality & quantum of phospho-gypsum generation depends upon the quality of the phosphate rock, process route used to produce phosphoric acid, calcium sulphate generated either in di-hydrate ($CaSO_4.2H_2O$) or the hemi-hydrate ($CaSO_4.1/2\ H_2O$) form. Generally, about 4 to 6 tonnes of phospho-gypsum generates to recover one tonne of phosphoric acid. The principal producer of phospho-gypsum are given in Table-14. The estimated production of phospho gypsum in india is 6.28 million tonnes during 2012-13 (by assuming that 4.5 tonnes phospho-gypsum is generated in production of one tonne P_2O_5).

Presently, most of the phosphoric acid plants are disposing the phospho-gypsum within the plant premises in stack(s). Depending on the demand, the phosphoric acid units sell the phospho-gypsum for different applications. Phosphogypsum generated from phosphoric acid plants contains three types of impurities that are considered to be potentially harmful such as residual acidity, fluorine compounds, trace elements including radioactivity.

The purity of phospho-gypsum ranges from 77 to 98% $CaSO_4.2H_2O$. It contains about 0.2 to 0.7% total P_2O_5. Phospho-gypsum is mostly used in cement and fertilizer industries.

The environmental concerns associated with phospho-gypsum stacks include fluoride uptake, ground and surface water pollution if located nearby. Fluorine and phosphate contents in by-product gypsum are considered deleterious. The phosphate content affects setting properties of cement and fluorine content causes ring formation in kiln. Phospho-gypsum is radioactive due to the presence of naturally occurring uranium and radium in the phosphate ore. Phospho-gypsum contains about 1% P_2O_5, 1% F and 10 to 30 times more radon; none is desirable. These entities along with radon that were a scare in the 1980s resulted in a 1989 EPA (Environment Protection Agency, USA) ruling that phospho-gypsum is unsuitable for sale as common gypsum.

Fluoro-gypsum

Fluoro-gypsum is obtained as by-product during the manufacture of aluminium fluoride and hydrofluoric acid using fluorite. Important units producing aluminium fluoride were Navin Fluorine International Ltd, Udhana-Navsari Road, Surat district, Gujarat; Tanfac Industries Ltd, SIPCOT Industrial Complex, Cuddalore, Tamil Nadu; Maya Rasayan Ltd, Mumbai; Aegies Chemical Ltd Dombivali, Thane, Maharashtra, etc. which may recover fluoro-gypsum in their chemical plants.

Boro-gypsum

By-product boro-gypsum is obtained at a plant which refines calcium borates (colemanite and ulexite) to produce borax and boric acid. Borax Morarjee Ltd, Ambarnath, Thane district, Maharashtra is one of the main company engaged in refining of borates and were reporting production

Table – 13 : Specifications of Mineral Gypsum in Different Industries

Constituent	Surgical plaster	Ammonium sulphate fertilizer	Pottery	Cement	Reclamation of soil	Extender in paints
Free water	1.0% (max)	–	1.0% (max)	–	–	0.5% (max) when heated for 2 hr. at 45°C
CO_2	1.0% (max)	–	3.0% (max)	–	–	–
SiO_2 & other insoluble matter	0.7% (max)	6.0% (max)	6.0% (max)	–	–	–
Iron & aluminium oxide	0.1% (max)	1.5% (max)	1.0% (max)	–	–	–
MgO	0.5% (max)	1.0% (max)	1.5% (max)	3.0 (max)	–	–
$CaSO_4.2H_2O$	96.0% (min)	85-90% (min)	85.0% (min)	70-75% (80-85% for export quality cement)	70% (min)	75% (min)
NaCl	0.01% (max)	0.003% (max)	0.1% (max)	0.5% (max)	–	–
Na_2O	–	–	–	–	0.75% (max) (Na)	–
Fineness	–	–	–	–	Residue on 2 mm sieve : Nil & on 0.25 mm sieve : 50% (max)	Residue on 240 mesh B.S. test sieve : 0.5%
Oil absorption	–	–	–	–	–	Within 5% of the approved sample
Colour	–	–	–	–	–	Close match to the approved sample
Lead & its compounds (calculated as metallic lead)	–	–	–	–	–	0.5% (max) when lead-free gypsum is required.
Physical form	–	–	–	–	–	In the form of dry powder.
Microscopic form	–	–	–	–	–	Material should match entirely with the characteristics of gypsum crystals.

Table – 14 : Principal Producers of Phospho-gypsum

State	Unit
Andhra Pradesh	Coromandel International Ltd, Visakhapatnam.
Gujarat	(i) Gujarat State Fertilizers and Chemicals Ltd, Fertilizernagar, Vadodara district. (ii) Hindalco Industries Ltd, P.O. - Dahej.
Kerala	(i) Fertilizers & Chemicals Travancore Ltd, Udyogmandal, Ernakulam district. (ii) Fertilizers & Chemicals Travancore Ltd, Ambalamedu, Ernakulam district.
Maharashtra	Rashtriya Chemicals & Fertilizers, Chembur, Mumbai.
Odisha	(i) Paradeep Phosphates Ltd. (ii) IFFCO, Paradeep, district Jagatsinghpur.
Tamil Nadu	(i) Southern Petrochemical Industries Corporation Ltd, Thoothukudi. (ii) Coromandel International Ltd, Ennore, Thiruvallur. (iii) Sterlite Industries (India) Ltd, Thoothukudi.
West Bengal	Tata Chemicals Ltd, Haldia.

of by-product boro-gypsum, in the past. However, detailed information on production of boro-gypsum is not available. National Peroxide Ltd, Kalyan, Maharashtra is producing sodium perborate; information on production of boro-gypsum, if any at this plant is not available. As a thumb rule, for one tonne production of boric acid, about 2 tonnes of boro-gypsum is produced.

Marine Gypsum

Marine gypsum is obtained as a by-product during the production of common salt by solar evaporation. The total production of marine gypsum as per the Salt Commissioner, Jaipur, was 166,665 tonnes in 2011-12 and 260,712 tonnes in 2012-13, reported from Gujarat and Tamil Nadu. Marine gypsum recovered from Gujarat, earlier, showed 89.72-92.62% $CaSO_4.2H_2O$, 0.48 to 2.08% NaCl, 0.57% $MgCl_2$, 3.42% $MgSO_4$ and 3.48 to 7.65% insolubles. No recent test results are available.

CONSUMPTION

About 8.67 million tonnes gypsum in all forms was consumed in organised sector in 2012-13 as against 8.87 million tonnes in 2011-12. A substantial quantity of mineral gypsum as well as phospho-gypsum was used in agricultural sector for conditioning of alkaline soil. The respective share of natural gypsum, by-product gypsum and marine gypsum in total consumption during 2012-13 was about 60%, 34%, and 6%. Consumption of Gypsum in Plaster of Paris moulds was neglible. Almost entire quantity of natural gypsum in 2012-13 was consumed in the manufacture of cement (99%). The remaining nominal consumption was in Plaster of Paris, asbestos products, ceramic, fertilizer, refractories, textile, pharmaceutical, paint and chemical industries. The entire quantity of marine gypsum and gypsum moulds was consumed in cement and ceramic industries, respectively. By-product gypsum was also almost entirely consumed for manufacture of cement and meagre consumption was in ceramic and fertilizer industries in 2012-13 (Table - 15).

INDUSTRY

Saint-Gobain Gyproc India (formerly India Gypsum Ltd) has been a pioneer in introducing light weight interior construction practices and manufactures an extensive range of Gypsum boards and plasters systems and solutions for partitions, wall panels, ceilings and internal wall linings. SGGI have three manufacturing plants located at Jind (Haryana), Wada (near Mumbai) and Bengaluru, producing light weight construction solution, gypsum plaster boards and other accessories. Saint-Gobain places great emphasis on developing its businesses and strengthening its presence in the Indian market. This combined with its investment in manufacturing activities to fuel growth, makes it

Table- 15: Consumption of Gypsum, 2010-11 to 2012-13
(By Industries & Categorywise)

(In tonnes)

Category	Industry	2010-11	2011-12(R)	2012-13(P)
All Industries :	**Grand Total**	**8215800**	**8868800**	**8667300**
Natural-Gypsum :	**Total**	**4503300**	**5177800**	**5199000**
	Asbestos products	700(4)	700(4)	700(4)
	Cement	4484200(71)	5138600(78)	5159200(79)
	Ceramic	400(1)	400(1)	400(1)
	Fertilizer	100(1)	100(1)	100(1)
	Paint	++(2)	++(2)	++(2)
	Pharmaceutical	900(2)	900(2)	900(2)
	Plaster of Paris	17000(4)	37100(4)	37700(5)
	Refractories	++(1)	++(1)	++(1)
	Textile	++(1)	++(1)	++(1)
By-Product-Gypsum :	**Total**	**3356600**	**3227700**	**2982600**
	Cement	3355900(72)	3227100(74)	2981800(74)
	Ceramic	600(1)	600(1)	600(1)
	Fertilizer	100(1)	++(1)	200(1)
Marine-Gypsum :	**Total**	**353000**	**460400**	**482800**
	Cement	353000(15)	460400(16)	482800(17)
Gypsum-Moulds :	**Total**	**2900**	**2900**	**2900**
	Ceramic	2900(5)	2900(5)	2900(5)

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).*

possible to bring in advanced technological competency in providing state–of–the-art products to their customers.

Boral Gypsum India Pvt Ltd (BGI) is also among the market leader in designing, manufacturing and supplying gypsum board, standard and technical metal systems for ceilings and partition, an aesthetic range of ceiling tiles, with jointing compounds and complete accessories. BGI uses mineral gypsum, sedimentary rock extracted from mines as well as synthetic Gypsum, produce from by-products of energy generation or industrial waste. The mineral gypsum is mostly supplied from different mines of Rajasthan State Mines & Minerals Ltd and FCI Aravali Gypsum & Minerals India Ltd, located mainly in Rajasthan.

In the year 2008-09, Rashtriya Chemicals and Fertilizers Ltd (RCF) formed a Joint Venture Company with Fertilizers and Chemicals Travancore Limited (FACT) by incorporating FACT-RCF Building Products Ltd (FRBL) to set up a Rapidwall project at Kochi. Both RCF and FACT have 50:50 equity holding in the Company. The plant was commissioned in June 2012 and started its operation. The plant was set up to utilise by-product gypsum generated to produce load bearing wall panels, wall plaster and wall putty through Rapidwall technology provided by Rapid Building Systems Pty Ltd ,Australia, a world leader in making large size load bearing building panels from Gypsum. The JV has obtained BMTPC Certification for the Gypwall panels.

FRBL, Kochi, manufactures PREFAB GYPWALL which is a revolutionary low cost load bearing prefabricated walling system with broad construction application. Glass fibre reinforced gypsum (GFRG) wall a new composite wall product is made of gypsum plaster reinforced with glass fibre. GFRG Wall panel is suitable for use in residential, commercial and industrial building construction. FRBL also manufactures gypsum based silky wall plaster/shine wall putty, a unique light weight material and is an advanced substitute to the conventional cement and sand plastering. FRBL plaster reduces plastering/finishing time by

60% providing smooth shrinkage crack free walls and ceilings. The plaster can be applied directly over brick /stone masonary or concrete surfaces, does not require water curing and is ready to be painted in less than 48 hours.

WORLD REVIEW

The world reserves of gypsum are large. The total reported production of gypsum in 2012 was about 147.1 million tonnes as against 143.6 million tonnes in 2011. China was the largest producer accounting for 25%, followed by Iran (10%), USA & Thailand (7% each), Iraq & Mexico (6% each), Spain (4%), and Australia, Brazil, Canada, France, India & Russia (2% each) (Tables - 16 & 17).

Table – 16 : World Reserve of Gypsum (By Principal Countries)

(In '000 tonnes)

Country	Reserve
World: Total (Rounded)	**Large**
Brazil	230000
Canada	450000
India*	69000
Poland	55000
USA	700000
Other countries	NA

Source: *Mineral Commodity Summaries, 2014*
** India's resources have been placed at 1286 million tonnes.*

Table – 17 : World Production of Gypsum (By Principal Countries)

(In '000 tonnes)

Country	2010	2011	2012
World: Total	**137800**	**143600**	**147100**
Algeria	1610	1800	2000
Argentina	1346	1350(e)	1350(e)
Australia	3268	3294	3013(e)
Austria@	872	815	792
Brazil	2638	3229	3000(e)
Canada@	2717	2555	2550
Chile	758	918	799
China(e)	37000	37000	37000
Egypt@(e)	1668	2138	2193
France@	2066	2452	2500(e)
Germany@	1822	2021	1949
India#	4925	3202	3529
Iran	11914	14657	14000(e)
Iraq	8277	11350	9424
Italy(e)	1600	1600	1600
Mexico	6478	6464	9456
Poland	1398	1226	1228
Pakistan	854	885	1260
Russia(e)	2900	3000(e)	3100(e)
Spain	6990	7826	6600(e)
Thailand@	10709	11608	10734
Turkey	2851	991	1000(e)
UK (e)	1700	1700	1700
USA	8840	8900	9900(e)
Other countries	12599	12619	16423

Source: *World Mineral Production, 2008-2012.*
@ *Including Anhydrite, # Including Selenite.*
Note: *India's production of gypsum and selenite during 2010-11, 2011-12 and 2012-13 was 4,925 thousand tonnes, 3,992 thousand tonnes and 3,545 thousand tonnes, respectively.*

FOREIGN TRADE

Exports

Exports of gypsum and plaster at 44,142 tonnes in 2012-13 decreased by 15% from 51,732 tonnes in the preceding year. During the same period, export of alabaster was negligible against one tonne in the previous year. Gypsum & plaster were exported in bulk to neighbouring countries, mainly, Nepal (62%) and Bangladesh (34%) (Tables - 18 & 19).

Imports

Imports of gypsum & plaster at 30,39,607 tonnes in 2012-13 was substantially increased by 9% from 27,76,177 tonnes in 2011-12. Imports of alabaster considerably decreased to 751 tonnes in 2012-13 from 1,138 tonnes in 2011-12. Gypsum was imported mainly from Thailand (30%), Oman (42%), Pakistan (15%), Iran (12%) and USA (6%). Alabaster was imported from Spain (97%) and USA (3%). (Tables - 20 & 21).

Table – 18: Exports of Gypsum & Plaster (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**51732**	**78485**	**44142**	**100926**
Nepal	43645	36473	27445	51983
Bangladesh	5633	8281	14811	23283
Tanzania	110	1514	246	4854
Kenya	363	4076	299	4028
Sri Lanka	140	1500	351	3160
Turkey	20	936	300	2776
South Africa	243	1812	64	1924
UK	21	1156	50	1736
Singapore	11	346	43	1708
Netherlands	208	2688	21	1551
Other countries	1338	19703	512	3923

Table – 19: Exports of Alabaster (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1**	**49**	-	-
USA	1	49	-	-

Table – 20: Imports of Gypsum & Plaster (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**2776177**	**3979046**	**3039607**	**4755312**
Oman	589703	846513	1285814	1793080
Thailand	1217598	1682179	918655	1527119
Pakistan	351450	528509	441556	636294
Iran	452759	594900	358320	567360
USA	1547	45427	17507	85964
China	6401	45364	2964	38333
Turkey	24	512	1097	22350
Saudi Arabia	164	1028	2292	20157
Germany	1043	10929	1694	9688
Afghanistan	25721	36472	5176	6930
Other countries	129767	187213	4532	48037

Table – 21 : Imports of Alabaster (By Countries)

Country	2011-12		2012-13	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1138**	**21525**	**751**	**15685**
Spain	1089	20463	729	15278
USA	-	-	22	407
Other countries	49	1062	-	-

FUTURE OUTLOOK

India's domestic resources of gypsum are large enough to meet increased demand. The apparent domestic demand of gypsum was estimated at 5.66 million tonnes by 2011-12 and 8.71 million tonnes by 2016-17 at 9% growth rate as per the Report of the Working Group for 12th Plan, Planning Commission of India. The apparent consumption of Gypsum, Anhydrite, Marine gypsum and plaster during 2012-13 (P) was about 6.54 million tonnes.

India's main focus is the creation of more infrastructure with a view to infuse momentum in its economy and participation in its industrial development. As per the Working Group report, the activities will keep the cement industry growing and accordingly, the consumption of gypsum will also increase, . Further, as per the report, steps would be necessary to find out suitable mining technology to exploit, deep-seated gypsum resources in Bhadvasi deposit, Nagaur district Rajasthan. State-of-the-art-technology needs to be adopted for the exploitation of deep-seated gypsum.

Production of gypsum wallboard in India is negligible. Its light weight and other special characteristics like attractive partition material could facilitate its utility in high rise building constructions. In view of the environmental problem arising from huge accumulation of phospho-gypsum at different fertilizer plants, possibilities of finding other plausible means for its utilisation has become a necessary. Low-grade gypsum being cheaper should be utilised more as a soil conditioner in the reclamation of alkaline soils.