

ASBESTOS



# Indian Minerals Yearbook 2012

(Part- III : Mineral Reviews)

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**ASBESTOS**

**(FINAL RELEASE)**

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

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## 2 Asbestos

Asbestos is a group of six naturally occurring fibrous silicate minerals. The physical properties, besides fibrous character, such as, fineness, flexibility, tensile strength & length of fibres, infusibility, low heat conductivity and high resistance to electricity & sound as also to corrosion by acids, make asbestos commercially important. Commercial asbestos is classified into two main mineralogical groups: serpentine asbestos or chrysotile asbestos and amphibole asbestos. The latter includes asbestos minerals, such as, tremolite, actinolite, anthophyllite, amosite and crocidolite. Commercially, chrysotile asbestos is far superior in physical properties and hence more valuable than amphibole asbestos.

India's asbestos requirement is mainly met through imports from Russia, Kazakhstan, Brazil and Canada.

### RESOURCES

As per the UNFC system, the total resources of asbestos in the country as on 1.4.2010 are placed at 22.17 million tonnes (Table-1). Of these, 2.5 million tonnes are reserves and 19.6 million tonnes are remaining resources. Out of the total resources, Rajasthan accounts for 13.6 million tonnes (61%) and Karnataka 8.28 million tonnes (37%). The remaining two percent resources are estimated in Jharkhand, Andhra Pradesh, Odisha and Uttarakhand.

Table-2 summarises the mineralogical varieties of asbestos occurring in various parts of the country.

### PRODUCTION, STOCKS & PRICES

The production of asbestos at 280 tonnes in 2011-12 increased by about 4% as compared to that in the previous year. There were 5 reporting mines in both the years. However, production of asbestos was reported by three mines in Andhra Pradesh. Two asbestos mines in Rajasthan reported production of associated minerals only. In 2011-12, the entire production of 280 tonnes was of chrysotile variety of asbestos and was produced by three mines in Cuddapah district of Andhra Pradesh.

The entire production of asbestos was from private sector in both the years. Padma Minerals (P) Ltd contributed above 75% of the chrysotile variety. The remaining production was reported by Baba Minerals Corporation (Tables-3 to 5).

The mine-head stocks of asbestos at the beginning of the year were 8 tonnes and 19 tonnes at the end of the year (Table - 6).

The average daily employment of labour strength was 39 in 2011-12 as against 57 in the preceding year. Prices of asbestos are furnished in the General Review on 'Prices'.

**Table – 2 : Occurrences of Asbestos in India**

State	District	Mineralogical variety
Andhra Pradesh	Cuddapah	Chrysotile
Jharkhand	Singhbhum	Chrysotile, tremolite, chrysotile mixed with other minerals
Karnataka	Chickmagalur Hassan Mandya Mysore Shimoga	Amosite Anthophyllite Mixed amphibole minerals Chrysotile Amosite
Rajasthan	Ajmer Bhilwara Dungarpur Pali Rajsamand Udaipur	Mixed amphibole minerals -do- -do- Tremolite, chrysotile mixed with other amphibole minerals Tremolite, actinolite and mixed amphibole minerals Chrysotile, tremolite and mixed amphibole minerals
Uttarakhand	Chamoli	Others

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

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						
<b>All India : Total</b>	<b>1700152</b>	<b>4588</b>	<b>806101</b>	<b>2510841</b>	<b>109641</b>	<b>3072849</b>	<b>3257941</b>	<b>100687</b>	<b>2527918</b>	<b>10528926</b>	<b>57800</b>	<b>19655762</b>	<b>22166603</b>
<b>By Grades</b>													
Chrysotile	5754	-	9028	14782	856	3117	9191	2885	17619	41992	-	75660	90442
Amosite	-	-	-	-	-	-	-	-	3987	4459680	-	4463667	4463667
Tremolite	-	-	-	-	-	94768	116516	-	2426700	1562125	-	4200109	4200109
Chrysotile mixed with others	-	-	-	-	-	3871	18309	-	-	336	-	22516	22516
Mixed Amphibole	1634775	4588	770739	2410102	108785	2638007	2975117	87802	42101	4121718	-	9973530	12383632
Actinolite	-	-	-	-	-	-	-	-	311	34000	-	34311	34311
Anthophyllite	-	-	-	-	-	-	-	-	-	20000	-	20000	20000
Others	-	-	-	-	-	332459	99675	-	-	-	-	432134	432134
Not-known	59623	-	26334	85957	-	627	39133	-	-	279574	57800	377134	463091
Unclassified	-	-	-	-	-	-	-	10000	37200	9500	-	56700	56700
<b>By States</b>													
Andhra Pradesh	5754	-	9028	14782	856	3117	9191	-	1500	27085	-	41749	56531
Jharkhand	-	-	-	-	-	3871	18309	2885	5769	124059	-	154893	154893
Karnataka	-	-	-	-	-	-	-	-	2441037	5841420	-	8282457	8282457
Odisha	-	-	-	-	-	-	-	10000	37200	9500	-	56700	56700
Rajasthan	1694398	4588	797073	2496059	108785	3065861	3230441	87802	42101	4526861	57800	11119651	13615710
Uttarakhand	-	-	-	-	-	-	-	-	311	-	-	311	311

Figures rounded off.

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**Table – 3 : Principal Producers of Asbestos, 2011-12**

Name & address of producer	Location of mine	
	State	District
Padma Minerals (P) Ltd, 1/5A, Ambikapalli Road, Pulivendla, Cuddapah Distt. Cuddapah – 516 390 Andhra Pradesh.	Andhra Pradesh	Cuddapah
Baba Minerals Corporation, 1/125 Krishnappa Nagar, Near Rly. Station, Cuddapah Distt. Cuddapah Andhra Pradesh.	Andhra Pradesh	Cuddapah

**Table – 4 : Production of Asbestos, 2009-10 to 2011-12  
(By States)**

(Qty in tonnes; value in ₹ '000)

State	2009-10		2010-11		2011-12(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India</b>	<b>243</b>	<b>12268</b>	<b>268</b>	<b>13341</b>	<b>280</b>	<b>12827</b>
Andhra Pradesh	243	12268	268	13341	280	12827
Rajasthan	-	-	-	-	-	-

**Table – 5 : Production of Asbestos, 2010-11 and 2011-12  
(By States/Districts/Grades)**

(Qty in tonnes; value in ₹ '000)

State/District	No. of mines	2010-11			Value	No. of mines	2011-12(P)			Value
		Quantity					Quantity			
		Chrysotile	Amphibole	Total			Chrysotile	Amphibole	Total	
<b>India</b>	<b>5</b>	<b>268</b>	<b>-</b>	<b>268</b>	<b>13341</b>	<b>5</b>	<b>280</b>	<b>-</b>	<b>280</b>	<b>12827</b>
Private sector	5	268	-	268	13341	5	280	-	280	12827
<b>Andhra Pradesh</b>	<b>3</b>	<b>268</b>	<b>-</b>	<b>268</b>	<b>13341</b>	<b>3</b>	<b>280</b>	<b>-</b>	<b>280</b>	<b>12827</b>
Cuddapah	3	268	-	268	13341	3	280	-	280	12827
<b>Rajasthan*</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
Ajmer	2	-	-	-	-	2	-	-	-	-

\*Production of feldspar and quartz reported as associated minerals.

**Table – 6 : Mine-head Stocks of Asbestos, 2011-12 (P)  
(By State/Grades)**

(Qty in tonnes)

State	At the beginning of the year			At the end of the year		
	Chrysotile	Amphibole	Total	Chrysotile	Amphibole	Total
<b>India</b>	<b>8</b>	<b>-</b>	<b>8</b>	<b>19</b>	<b>-</b>	<b>19</b>
Andhra Pradesh	8	-	8	19	-	19
Rajasthan	-	-	-	-	-	-

## MINING & MILLING

The mines in Rajasthan producing amphibole variety of asbestos were small opencast workings and were operated manually.

The usual method of mining chrysotile in Pulivendla tehsil, Cuddapah district, Andhra Pradesh, is by opening an incline along the dip varying from 20° to 25°, keeping the trap as floor and limestone as roof. Two or three such inclines are converted into a regular underground mine by developing levels and winzes connecting them and adopting board-and-pillar system of development. In almost all the mines, operations like blast hole drilling, hoisting, pumping and ventilation are mechanised.

The run-of-mine is subjected to manual sorting of asbestos-bearing rock (ABR). ABR is then hand-combed for chipping off the asbestos-bearing portion in small pieces of about 2.5 cm for producing asbestos concentrates. From ABR, the serpentine is removed as a waste. The asbestos concentrate is fed manually into hopper of a hammer mill. In hammer mill, asbestos and other minerals are separated and then fed to double-deck screen having 10 to 40 mesh sieves. The screening gives three fractions: (a) oversize, (b) middling, and (c) tailing.

Tailing is taken as a waste which generally does not contain appreciable quantity of asbestos. The oversize is recycled in the hammer mill, and the middling fibre is sucked up by a cyclone and collected.

## GRADING & MARKETING

Small fibres recovered through milling process account for nearly a two-third production. The general grading system adopted is as follows:

Grade	Fibre Size	Method
Grade - As	45 mm and above	Hand-sorted
Grade - A	Between 25 and 45 mm	
Grade - B	Between 12 and 25 mm	
Grade - C	Above 16 mesh	Mill-processed
Grade - D3	24 mesh	
Grade - D4	40 mesh	
Grade - D6	60 mesh	

*Producers of amphibole asbestos sell their output as crude or fluff and powder.*

## CLASSIFICATIONS

Various classifications of chrysotile asbestos followed in India are based, by and large, on fibre length:

- (1) Grade As or 25.4 mm fibres or larger  
A Special -
- As<sub>1</sub> - 25.4 mm and larger fibres but brittle compared to As or A Special
- A - 19.05 to 25.4 mm fibres
- A<sub>1</sub> - 19.05 to 25.4 mm fibres but brittle compared to A
- A<sub>2</sub> - 19.05 to 25.4 mm fibres but brittle compared to A<sub>1</sub>
- Grade B - 6.35 to 19.05 mm fibres
- B<sub>1</sub> - 6.35 to 19.05 mm fibres but brittle compared to B
- B<sub>2</sub> - 6.35 to 19.05 mm fibres but brittle compared to B<sub>1</sub>
- C - Below 6.35 mm fibres
- (2) Grade A Special - Above 31.5 mm
- A - Between 19 and 31.5 mm
- B - Between 6.3 and 19 mm
- C - Below 6.3 mm including powder
- D - Dust

(3) Quebec standard asbestos testing machine classification of chrysotile asbestos according to groups is given below:

### Crude Asbestos

- Group No. 1 Crude No. 1: Consists basically of crude, 3/4 inch and longer staple
- Group No. 2 Crude No. 2: Consists basically of crude, 3/8 to 3/4 inch staple.

### Milled Asbestos

Standard designation of grade	Guaranteed minimum spinning test
Group No. 3 (spinning fibres)	
3 D	10.5-3.9-1.3-0.3
3 Z	0-8-6-2
Group No. 4 (shingle fibres)	
4 D	0-7-6-3
4 Z	0-1.5-9.5-5

(Contd.)

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(Concl'd.)

Standard designation of grade	Guaranteed minimum spinning test
Group No. 5 (paper fibres)	
5 D	0-0.5-10.5-5
5 R	0-0-10-6
Group No. 6 (waste)	
6 D	0-0-7-9
Group No. 7 (shorts or refuse)	
7 D	0-0-8-11
7W	0-0-0-16
Group No. 7 (floats)*	
7 RF	No test
7 TF	No test
Group No. 8 (sand & gravel)	
8 S	Less than 50 lb per cu ft loose measure
8 T	Less than 75 lb per cu ft loose measure.
Group No. 9 (gravel & stone)	
9 T	More than 75 lb cu ft loose measure

\* The suffix 'F' designates 'floats' in the case of 7R and 7T grades.

## USES

Industrial use of asbestos is linked with the type of asbestos. Chrysotile asbestos, being more fibrous and possessing better tensile strength than amphibole variety is used in the manufacture of asbestos fabrics, cement sheets, pipes and allied products. It is also used in brake linings, insulation and fireproof clothing. Short fibres are used with cement as binders for manufacturing asbestos-cement products. Amphibole asbestos generally finds use in heat insulation and treatment of acids. Anthophyllite and tremolite fibres, although of good length, are too weak and brittle to be spun. They are therefore used for boiler lagging, hard-setting magnesia composition and as a filler in asbestos paints and various asbestos-moulded articles.

## CONSUMPTION

The reported consumption of asbestos in 2011-12 was about 104 thousand tonnes and was almost entirely utilised for manufacturing asbestos-cement and asbestos-based products. (Table - 7).

**Table – 7 : Reported Consumption of Asbestos  
2009-10 to 2011-12  
(By Industries)**

Industry	2009-10	2010-11(R)	2011-12 (P)
<b>All Industries</b>	<b>104000</b>	<b>103200</b>	<b>104200</b>
Asbestos products	103900(22)	103100(22)	104100(22)
Refractory	100(4)	100(4)	100(4)
Others (foundry, paper paint)	++	++	++

*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).*

## SUBSTITUTION

Material substituted for asbestos include calcium silicate, carbon fibres, fibres of cellulose, ceramic, glass & steel, wollastonite and several organic fibres like aramid, polyethylene, polypropylene and polytetrafluoroethylene. Where reinforcement properties of fibres are not required, several non-fibrous minerals are also considered for possible substitution. However, no single substitution is found to be as versatile or as cost-effective as asbestos.

## THE ENVIRONMENTAL IMPACT OF ASBESTOS

Asbestos used as a part of construction material due to flame retardant quality, pose major risk to human health and environment.

Asbestos has been linked in number of serious medical conditions. These include the lungs and respiratory problems because asbestos is made of tiny fibres that when released into the air can settle inside the lungs and irritate the tissues in the chest cavities.

Besides the personal health, asbestos has negative impact on the environment. A study presented in 2006 at the international conference on Health, the Environment and justice found that asbestos dust can easily travel through the air into the water supply. It can also settle on the surface of the soil instead of getting absorbed into the ground, which means that it can still get picked up by the wind and inhaled into human respiratory system.

## TRADE POLICY & LEGISLATION

No restrictions have been imposed on exports of asbestos in the amended Foreign Trade Policy, 2009-14. As per the prevailing Foreign Trade Policy, asbestos under heading 2524 can be imported freely with the exception of amosite which is restricted. However, the imports of crocidolite, actinolite, anthophyllite, amosite and tremolite are restricted in terms of Interim Prior Informed Consent (PIC) Procedure of Rotterdam Convention for Hazardous Chemicals and Pesticides.

Ministry of Environment and Forest, vide Notification dated 13.10.1998, under Sections 3 (1) and 6 (2) (d) of Environment (Protection) Act, 1986 and Rule 13 of Environment (Protection) Rules, 1986, has prohibited the imports of waste asbestos (dust and fibre), being a hazardous waste detrimental to human health and environment.

## WORLD REVIEW

Large reserves are located mainly in Canada, China, Kazakhstan and Russia. The world production of asbestos was around 2 million tonnes in 2011. Russia was the leading producer and accounted for 49% production, followed by China (21%), Brazil (15%) and Kazakhstan (11%) (Tables - 8 and 9).

**Table – 8 : World Reserves of Asbestos  
(By Principal Countries)**

Country	Reserves
<b>World: Total</b>	<b>Large</b>
Brazil	Moderate
Canada	Large
China	Large
Kazakhstan	Large
Russia	Large
USA	Small
Other countries	Moderate

*Source: Mineral Commodity Summaries, 2013.*

**Table – 9 : World Production of Asbestos  
(By Principal Countries)**

Country	(In '000 tonnes)		
	2009	2010	2011
<b>World: Total</b>	<b>2113</b>	<b>2028</b>	<b>2023</b>
Brazil	288	312	310
Canada (chrysotile) <sup>e</sup>	150	100	50
China <sup>c</sup>	440	400	440
Kazakhstan	230	214	223
Russia <sup>e</sup>	1000	1000	1000
Zimbabwe (chrysotile)	5	2	-
Other countries	-	-	-

*Source: World Mineral Production, 2007-2011.*

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**FOREIGN TRADE**

**Exports**

Exports of asbestos were 1296 tonnes in 2011-12 as compared to 231 tonnes in the previous year.

Exports were mainly to Italy. Exports of asbestos-cement products were 41,304 tonnes in 2011-12 as compared to 44,449 tonnes in the preceding year. Exports of asbestos cement products were mainly to UAE (52%), Saudi Arabia (19%), Nepal (7%), and Qatar (5%) (Tables-10 to 12).

**Imports**

Imports of asbestos were 378,122 tonnes in 2011-12 against 365,795 tonnes in the previous year. The imports comprised chrysotile asbestos 377,302 tonnes and asbestos (others) 820 tonnes. Imports of asbestos were mainly from Russia (51%), Kazakhstan (18%), Brazil (13%) and Canada (7%). A total of 6,641 tonnes asbestos-cement products were also imported in 2011-12 as against 5,561 tonnes in the previous year. Imports were mainly from Thailand (82%) (Tables-13 to 16).

**Table – 10 : Exports of Asbestos : Total  
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>231</b>	<b>1154</b>	<b>1296</b>	<b>2862</b>
Italy	-	-	1040	1850
Nepal	209	390	124	487
Nigeria	-	-	38	148
Kenya	-	-	28	144
Ghana	++	48	15	138
French Polynesia	-	-	++	59
Cameroon	-	-	51	35
Other countries	22	716	++	1

**Table – 11 : Exports of Asbestos (Others)  
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>182</b>	<b>566</b>	<b>1276</b>	<b>2667</b>
Italy	-	-	1040	1850
Nepal	166	293	119	430
Nigeria	-	-	38	148
Kenya	-	-	28	144
French Polynesia	-	-	++	59
Cameroon	-	-	51	35
Other countries	16	273	++	1

**Table – 12 : Exports of Asbestos Cement Products  
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>44449</b>	<b>655180</b>	<b>41304</b>	<b>883930</b>
UAE	28492	402964	21682	462828
Saudi Arabia	3459	41743	7668	160257
Qatar	1241	14944	2093	47226
Nepal	2612	43353	2691	42975
Israel	-	-	663	22751
Angola	28	172	1112	20885
South Africa	1587	21268	354	19804
Oman	76	1456	1247	18152
Canada	707	8858	870	14706
Maldives	200	3471	300	8858
Other countries	6047	116951	2624	65488



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**Table – 13 : Imports of Asbestos : Total  
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>365795</b>	<b>10025266</b>	<b>378122</b>	<b>11991739</b>
Russia	178479	4872619	193207	5951611
Brazil	55414	1722218	47484	1692332
Canada	58052	1629659	25323	805482
Kazakhstan	51844	1428290	66493	2081109
China	2204	59392	17577	560103
USA	928	25566	3152	111736
Poland	67	2520	2946	102314
Japan	-	-	2330	69085
Thailand	337	7274	2197	64494
Korea Rep. of	92	2084	1995	62523
Other countries	18378	275644	15418	490950

**Table – 14 : Imports of Asbestos (Chrysotile)  
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>353441</b>	<b>9939377</b>	<b>377302</b>	<b>11964029</b>
Russia	176782	4856407	193129	5948611
Brazil	55414	1722218	47484	1692332
Canada	57562	1616584	25105	797786
Kazakhstan	51844	1428290	66267	2073950
China	2141	56746	17559	559356
USA	928	25566	3132	111165
Poland	67	2520	2946	102314
Japan	-	-	2272	67298
Thailand	337	7274	2197	64494
UAE	392	11975	1319	59902
Other countries	7974	211797	15892	486821

## FUTURE OUTLOOK

The resources of chrysotile variety of asbestos are very much limited in India. So, there is an urgent need to go for detailed exploration as the internal demand for asbestos in the country cannot be met

**Table – 15 : Imports of Asbestos (Others)  
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>12354</b>	<b>85889</b>	<b>820</b>	<b>27710</b>
Russia	1697	16212	78	3000
Canada	490	13075	218	7696
China	63	2646	18	747
Korea, Rep. of	36	775	202	6750
Kazakhstan	-	-	226	7159
Japan	-	-	58	1786
USA	-	-	20	571
Other countries	10068	53181	++	1

**Table – 16 : Imports of Asbestos Cement  
Products  
(By Countries)**

Country	2010-11		2011-12	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>5561</b>	<b>111165</b>	<b>6641</b>	<b>202887</b>
Thailand	5185	86457	5474	115781
China	151	9033	705	33858
USA	45	4234	141	19679
UAE	1	281	5	12330
Philippines	102	1290	57	2344
Italy	++	589	3	1910
Malaysia	20	857	87	5578
Saudi Arabia	++	794	96	5697
Germany	2	773	8	1824
Sweden	-	-	17	1358
Other countries	55	6857	48	2528

from indigenous production. The apparent demand of asbestos was estimated to be 393 thousand tonnes in 2011-12 and is expected to touch 605 thousand tonnes by 2016-17 with 9% growth rate as per the Report of the Working Group for 12th Plan.