

ASBESTOS



Indian Minerals Yearbook 2016

(Part- III : Mineral Reviews)



55th Edition

ASBESTOS

(FINAL RELEASE)

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

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February, 2018

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 met through imports from Russia, Kazakhstan, Brazil and China.

RESERVES/RESOURCES

As per NMI database, based on UNFC system, the total reserves/resources of asbestos in the country as on 1.4.2015 have been placed at 22.95

million tonnes. Out of these, 0.025 million tonnes are placed under reserves and 22.92 million tonnes are remaining resources. Out of the total resources, Rajasthan accounts for 13.61 million tonnes (59%) and Karnataka 8.28 million tonnes (36%). The remaining five percent resources are estimated in states of Jharkhand, Andhra Pradesh, Odisha and Uttarakhand.

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

PRODUCTION & STOCKS

No production of asbestos was reported in 2015-16 as well as in the previous year and there were no reporting mines in 2015-16 as well as in preceding year (Table-4). However, a list of producers of asbestos who produced asbestos in the past is given in Table-3.

The mine-head closing stock of asbestos was not reported for the year 2015-16 whereas in the preceding year it was 11 tonnes (Table-5).

Table – 2 : Occurrences of Asbestos in India

State	District	Mineralogical variety
Andhra Pradesh	Cuddapah	Chrysotile
Jharkhand	Singhbhum (East) Singhbhum (West)	Chrysotile, tremolite, chrysotile mixed with other minerals
Karnataka	Chikkamagaluru Hassan Mandya Mysuru Shivamogga	Amosite Anthophyllite Mixed amphibole minerals Chrysotile Amosite
Odisha	Kendujhar	-
Rajasthan	Ajmer Bhilwara Dungarpur Pali amphibole minerals Rajsamand Udaipur	Mixed amphibole minerals -do- -do- Tremolite, chrysotile mixed with other 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 1.4.2015
(By Grades/States)**

Grade/State	Reserves				Remaining Resources				Total Resources (A+B)			
	Proved STD111	Probable STD121	Total (A)	Feasibility STD211	Pre-feasibility STD221	Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334	Total (B)	
												STD122
All India : Total	20016	-	4617	2488167	3114728	4064178	100687	2527959	10569233	57800	22922751	22947384
By Grades												
Chrysotile	-	-	-	684838	40408	18200	2885	17660	67915	-	831905	831905
Amosite	-	-	-	-	-	-	-	3987	4459680	-	4463667	4463667
Tremolite	-	-	-	-	94768	116516	-	2426700	1562125	-	4200109	4200109
Chrysotile mixed with others	-	-	-	-	3871	18309	-	-	336	-	22516	22516
Mixed Amphibole	-	-	-	1743560	2642595	3745856	87802	42101	4121718	-	12383632	12383632
Actinolite	-	-	-	-	-	-	-	311	34000	-	34311	34311
Anthophyllite	-	-	-	-	-	-	-	-	20000	-	20000	20000
Others	-	-	-	-	332459	99675	-	-	-	-	432134	432134
Not-known	-	-	-	59623	627	65467	-	-	279574	57800	463091	463091
Unclassified	20016	-	4617	146	-	155	10000	37200	23884	-	71385	96018
By States												
Andhra Pradesh	20016	-	4617	684984	40408	18355	-	1541	67392	-	812679	837312
Jharkhand	-	-	-	-	3871	18309	2885	5769	124059	-	154893	154893
Karnataka	-	-	-	-	-	-	-	2441037	5841420	-	8282457	8282457
Odisha	-	-	-	-	-	-	10000	37200	9500	-	56700	56700
Rajasthan	-	-	-	1803183	3070449	4027514	87802	42101	4526861	57800	13615710	13615710
Uttarakhand	-	-	-	-	-	-	-	311	-	-	311	311

Figures rounded off.

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Table – 3 : Producers of Asbestos

Name & address of producer	Location of mine	
	State	District
Padma Minerals (P) Ltd, Door No 4-11-146, Ambikapalli Road, Pulivendla, Distt. Cuddapah – 516 390 Andhra Pradesh.	Andhra Pradesh	Cuddapah
Baba Minerals Corporation, Door No. 1/125, Krishnappa Nagar, Near Rly. Station, Distt. Cuddapah – 516 004. Andhra Pradesh.	Andhra Pradesh	Cuddapah

**Table – 4 : Production of Asbestos, 2013-14 to 2015-16
(By States)**

(Quantity in tonnes; Value in `'000)

State	2013-14		2014-15		2015-16 (P)	
	Qty	Value	Qty	Value	Qty	Value
India/Andhra Pradesh	172	7271	-	-	-	-

**Table – 5 : Mine-head Closing Stocks of Asbestos, 2014-15 & 2015-16
(By State/Grades)**

(Quantity in tonnes)

State	2014-15			2015-16 (P)		
	Chrysotile	Amphibole	Total	Chrysotile	Amphibole	Total
India /Andhra Pradesh	11	-	11	*	*	*

* Not reported

MINING & MILLING

Presently there is no working mine in India. The usual method of mining chrysotile in Pulivendla Tehsil, Cuddapah district, Andhra Pradesh, was 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 were 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 blasting, hole drilling, hoisting, pumping and ventilation were mechanised.

The run-of-mine was subjected to manual sorting of asbestos-bearing rock (ABR). ABR

was 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 was removed as a waste. The asbestos concentrate was fed manually into hopper of a hammer mill. In hammer mill, asbestos and other minerals were 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 was taken as a waste which generally did not contain appreciable quantity of asbestos. The oversize was recycled in the hammer mill, and the middling fibre was sucked up by a cyclone and collected.

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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	

Note: 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 A Special - 25.4 mm fibres or larger
- As₁ - 25.4 mm and larger fibres but brittle compared to As or A Special
 - A - 19.05 to 25.4 mm fibres
 - A₁ - 19.05 to 25.4 mm fibres but brittle compared to A
 - A₂ - 19.05 to 25.4 mm fibres but brittle compared to A₁
- Grade B - 6.35 to 19.05 mm fibres
- B₁ - 6.35 to 19.05 mm fibres but brittle compared to B
 - B₂ - 6.35 to 19.05 mm fibres but brittle compared to B₁
 - 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
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.

SUBSTITUTION

Materials 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.

ENVIRONMENTAL IMPACT OF ASBESTOS

Asbestos used as a part of construction material due to flame retardant quality, poses 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 and prolonged breathing of air laden with asbestos dust, it can settle inside the lungs and irritate the tissues in the chest cavities. Mesothelioma is a rare form of cancer of the lungs and digestive tract which is most commonly caused by exposure to asbestos mixed air. 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.

However, as per the report of the 'Asbestos Cement Products Manufactures' Association', in India, only chrysotile (white) asbestos fibre is used for the manufacture of asbestos-cement sheets and asbestos-cement pipes which contain a very small quantity of chrysotile fibre (only 8–10%). The other raw materials used are cement 45%, fly ash 30–35% and wood pulp. The asbestos fibres are firmly locked-in or encapsulated within the cement matrix during manufacture so that fibres cannot be emitted into the atmosphere under normal use and thus, pose no health risk to the general public or environment. Several studies abroad have concluded that use of chrysotile in the manufacture of Asbestos Cement Products under controlled conditions is safe for the workers, environment and the general public.

India has again opposed the listing of chrysotile asbestos as a hazardous substance under the Rotterdam Convention at the eighth meeting of the Conference of Parties (COP) that concluded in Geneva from 24th April to 5th May 2017.

TRADE POLICY & LEGISLATION

No restrictions have been imposed on exports of asbestos in the Foreign Trade Policy, 2015-20. 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 China, Kazakhstan and Russia. The world production of asbestos was 1.58 million tonnes in 2015 which decreased by 20% from 1.98 million tonnes during 2014. Russia was the leading producer and accounted for 44% production followed by China (25%), Brazil (19%) and Kazakhstan (11%) (Tables - 6 and 7).

**Table – 6 : World Reserves of Asbestos
(By Principal Countries)**

(In million tonnes)

Country	Reserves
World: Total	Large
Brazil	10
China	Large
India*	Moderate
Kazakhstan	Large
Russia	Large
USA	Small

Source: Mineral Commodity Summaries, 2017.

* India's total reserve/resources of asbestos as per NMI database, based on UNFC system, as on 1.04.2015 have been estimated at 22.95 million tonnes.

**Table – 7 : World Production of Asbestos
(By Principal Countries)**

(In '000 tonnes)

Country	2013	2014	2015
World: Total	1955	1984	1580
Brazil	291	311	300
China	420	410	400
Kazakhstan	243	213	180
Russia	1000	1050	700
Other countries	1	-	-

Source: World Mineral Production, 2011-2015.

FOREIGN TRADE

Exports

Exports of asbestos increased to 524 tonnes in 2015-16 as compared to 393 tonnes in the previous year. Exports were mainly to Sri Lanka (58%) and Nepal (42%). Exports of asbestos (fibre products) were 31,916 tonnes in 2015-16 as compared to 31,471 tonnes in the previous year. Exports were mainly to USA (27%), Egypt (7%), UAE (6%), Saudi Arabia & Poland (4% each) and Sri Lanka (3%). Export of asbestos (chrysotile) was 306 tonnes during the year 2015-16 as compared to 248 tonnes in the preceding year. Exports of asbestos (others) increased to 218 tonnes during the year 2015-

16 as compared to 145 tonnes in the preceding year. All exports were to Nepal. Exports of asbestos-cement products were 1,33,004 tonnes in 2015-16 as compared to 1,61,018 tonnes in the preceding year. Exports of asbestos-cement products were mainly to UAE (35%), Saudi Arabia (30%), Qatar (12%) and Nepal (8%) (Tables - 8 to 12).

Imports

Imports of asbestos were 3,55,686 tonnes in 2015-16 against 3,96,493 tonnes in the previous year. The imports comprised chrysotile asbestos 3,54,725 tonnes and asbestos (others) 961 tonnes in 2015-16. Imports of asbestos were mainly from Russia (60%), Kazakhstan (26%) and Brazil (14%). A total of 26,385 tonnes asbestos-cement products were also imported in 2015-16 as against 24,216 tonnes in the previous year. Imports were mainly from Thailand (92%) and China (7%). Besides above, asbestos-fibre of 3,54,725 tonnes was also imported during the year 2015-16 as compared to 3,96,258 tonnes in the previous year. Imports of asbestos-fibre were mainly from Russia (60%), Kazakhstan (26%) and Brazil (14%). Imports of fibre products were 5,459 tonnes during the year 2015-16 as compared to 5,778 tonnes in previous year. Imports of fibre products were mainly to Japan (25%), China (15%), Philippines (13%) and Thailand (12%). In addition to asbestos minerals, an unknown quantity of asbestos is traded within manufactured products, possibly including brake linings and pads, building materials, gaskets, millboard, yarn and thread (Tables-13 to 18).

**Table – 8 : Exports of Asbestos : Total
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value ('000)	Qty (t)	Value ('000)
All Countries	393	12026	524	23587
Sri Lanka	248	11511	305	22912
Nepal	109	280	219	675
Bangladesh	30	189	-	-
Kenya	5	22	-	-
Fiji	1	21	-	-
Bahrain	++	3	-	-
Tanzania	-	-	-	-

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**Table – 9 : Exports of Asbestos (Fibres Products)
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	31471	4139396	31916	4091558
USA	8722	1095028	8744	1201700
UAE	1932	267790	1892	257557
Egypt	1651	126009	2277	182877
Saudi Arabia	1535	192793	1186	176614
Sri Lanka	904	138934	1018	157118
Poland	1387	157182	1281	131630
South Africa	796	127224	876	126307
UK	796	172835	591	121984
Thailand	653	115562	663	117147
Germany	535	100560	658	96871
Other countries	12560	1645479	12730	1521753

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	248	11511	306	22919
Sri Lanka	248	11511	305	22912
Nepal	-	-	1	7
Tanzania	++	++	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	145	515	218	668
Nepal	109	280	218	668
Bangladesh	30	189	-	-
Kenya	5	22	-	-
Fiji	1	21	-	-
Baharain	++	3	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	161018	2428932	133004	2103472
UAE	53447	713480	46424	644914
Saudi Arabia	48220	670637	39276	563684
Qatar	17652	252534	16612	239720
Nepal	16865	236411	10821	210168
Zambia	3597	192030	1538	71416
Angola	5190	70560	3954	65443
Canada	622	14990	1536	37854
Kuwait	1195	23780	2149	37573
Pakistan	328	4892	1434	23625
Labanon	78	1127	1036	21457
Other countries	13824	248491	8224	187618

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	396493	17168105	355686	14865511
Russia	257698	11413958	212020	8598364
Kazakhstan	73524	2925536	92290	4008685
Brazil	61790	2713900	49221	2184710
China	2782	89604	2087	71452
Poland	271	9052	68	2300
Singapore	360	13921	-	-
USA	68	2134	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	396258	17159659	354725	14834080
Russia	257653	11412467	211980	8596853
Kazakhstan	73354	2919131	91369	3978765
Brazil	61790	2713900	49221	2184710
China	2762	89054	2087	71452
Poland	271	9052	68	2300
Singapore	360	13921	-	-
USA	68	2134	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	235	8446	961	31431
Kazakhstan	170	6405	921	29920
Russia	45	1491	40	1511
China	20	550	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	24216	491702	26385	494037
Thailand	19796	338127	24350	424029
China	3034	66431	1743	55222
Malaysia	287	5709	226	6005
USA	8	1166	34	5515
Germany	29	2639	27	2758
UAE	7	466	4	238
Italy	-	-	1	154
France	-	-	++	110
Indonesia	30	741	++	3
U.K.	++	3	++	3
Other countries	1025	76420	-	-

FUTURE OUTLOOK

Consumption of asbestos minerals in India & other countries of the world will decline steadily in near future. This decline will be due to health and liability issues associated with asbestos use, leading to the displacement of asbestos from traditional domestic markets by substitutes, alternative materials, and new technology globally.

While the economic impact of asbestos mining in India is minimal, mining operations nevertheless pose significant adverse consequences for human and

**Table – 17 : Imports of Asbestos Fibre
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	396258	17159659	354725	14834080
Russia	257653	11412467	211980	8596853
Kazakhstan	73354	2919131	91369	3978765
Brazil	61790	2713900	49221	2184710
China	2762	89054	2087	71452
Poland	271	9052	68	2300
Singapore	360	13921	-	-
USA	68	2134	-	-

**Table – 18: Imports of Asbestos Fibre Products
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	5778	2665795	5459	2735038
Japan	2070	1156791	1390	947355
Thailand	788	339438	656	313549
Germany	440	249235	278	265438
China	1161	151688	822	264388
Phillippines	419	153674	735	215578
USA	180	136636	547	133488
Indonesia	110	126615	109	129016
Denmark	167	23837	205	122400
Korea, Rep. of	83	46523	82	92305
Spain	89	68537	74	60470
Other countries	271	212821	561	191051

environmental health. Globally, asbestos-cement products are expected to continue to be the leading market for asbestos. All the while India's import of chrysotile asbestos continues to grow significantly. Owing to continued demand for asbestos products in many regions of the world, global production is likely to remain steady at approximately 2.0 million tonnes per year for the near future as per USGS report on asbestos.