

ASBESTOS



Indian Minerals Yearbook 2017

(Part- III : Mineral Reviews)

56th Edition

ASBESTOS

(FINAL RELEASE)

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

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

March, 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-1).

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

PRODUCTION & STOCKS

No production of asbestos was reported in 2016-17 as well as in the previous year and there were no reporting mines in 2016-17 as well as in preceding year.

The mine-head closing stocks of asbestos remained 'Nil' for the year 2016-17 as well as in the preceding year 2015-16.

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 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

ASBESTOS

**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.

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 200 to 250, 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.

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 A 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

ASBESTOS

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 remained unchanged to 2 million tonnes in 2016 as compared to 2015. Russia was the leading producer and accounted for 35% production followed by China (20%), Brazil (15%) and Kazakhstan (10%) (Tables-3 and 4).

**Table – 3 : 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, 2018.

* India's total reserves/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 – 4 : World Production of Asbestos
(By Principal Countries)**

(In '000 tonnes)

Country	2014	2015	2016
World: Total (rounded off)	2000	2000	2000
Brazil	311	300 ^e	300 ^e
China ^c	410	400	400
Kazakhstan	213	180	193
Russia	800 ^e	650	692
Other countries	++	-	-

Source: World Mineral Production, 2012-2016, BGS.

FOREIGN TRADE**Exports**

Exports of asbestos decreased to 102 tonnes in 2016-17 as compared to 524 tonnes in the previous year. Exports were mainly to Nepal (75%) and Bangladesh (16%). Exports of asbestos (fibre products) were 33,973 tonnes in 2016-17 as compared to 31,916 tonnes in the previous year. Exports were mainly to USA (23%), Egypt (8%), UAE (6%), Saudi Arabia, Poland, Sri Lanka and Canada (3% each). Export of asbestos (chrysotile) was 26 tonnes during the year 2016-17 as compared to 306 tonnes in the preceding year. Exports of asbestos (others) decreased to 76 tonnes during the year 2016-17 as compared to 218 tonnes in the preceding year. Exports were mainly to Nepal and Bangladesh. Exports of asbestos-cement products were 69,125 tonnes in 2016-17 as compared to 1,33,004 tonnes in the preceding year. Exports of asbestos-cement products were mainly to UAE (41%), Saudi Arabia (23%), Nepal (9%) and Qatar (8%) (Tables - 5 to 9).

Imports

Imports of asbestos were 3,10,592 tonnes in 2016-17 against 3,55,686 tonnes in the previous year. Entire import was that of chrysotile asbestos. Imports of asbestos were mainly from Russia (67%), Kazakhstan (20%) and Brazil (12%). A total of 28,416 tonnes asbestos-cement products were also imported in 2016-17 as against 26,385 tonnes in the previous year. Imports were mainly from Thailand (89%) and China (8%). Besides above, asbestos-fibre of 3,10,592 tonnes was also imported during the year 2016-17 as compared to 3,54,725 tonnes in the previous year. Imports of asbestos-fibre were mainly from Russia (67%), Kazakhstan (20%) and Brazil (12%). Imports of fibre products were 5,227 tonnes during the year 2016-17 as compared to 5,459 tonnes in previous year. Imports of fibre products were mainly to Japan (35%), China (27%), Philippines and Thailand (8% each). 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-10 to 15).

**Table – 5 : Exports of Asbestos
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	524	23587	102	963
Bangladesh	-	-	16	495
Nepal	219	675	76	250
UAE	-	-	10	218
Sri Lanka	305	22912	-	-

**Table – 6 : Exports of Asbestos (Fibres Products)
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	31916	4091562	33973	4523801
USA	8744	1201700	7971	1217412
UAE	1892	257557	2204	309045
Egypt	2277	182877	2622	191770
Sri Lanka	1018	157118	990	158846
Poland	1281	131630	1099	153458
Canada	620	81596	998	139677
Saudi Arabia	1186	176614	1017	139539
Thailand	663	117147	688	139046
Algeria	543	87114	675	107703
South Africa	876	126307	897	107359
Other countries	12816	1571902	14812	1859946

ASBESTOS

**Table – 7 : Exports of Asbestos (Chrysotile)
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	306	22919	26	395
UAE	-	-	10	218
Nepal	1	7	16	177
Sri Lanka	305	22912	-	-

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	218	668	76	568
Bangladesh	-	-	16	495
Nepal	218	668	60	73

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	133004	2103471	69125	1166022
UAE	46424	644914	28070	393279
Saudi Arabia	39276	563684	15898	219741
Nepal	10821	210168	6088	200362
Qatar	16612	239720	5574	86612
Oman	1339	19228	1708	25571
Sri Lanka	1057	16339	1240	25198
Angola	3954	65443	1490	21697
Kuwait	2149	37573	1176	20056
Maldives	811	21270	1057	18610
Baharain	726	11882	998	17241
Other countries	9835	273250	5826	137655

**Table – 10 : Imports of Asbestos
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	355686	14865511	310592	11279369
Russia	212020	8598364	208696	7791467
Kazakhstan	92290	4008685	63497	2110813
Brazil	49221	2184710	37280	1341595
China	2087	71452	1005	32011
Poland	68	2300	68	1851
Marshall Island	-	-	46	1632

**Table – 11 : Imports of Asbestos (Chrysotile)
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	354725	14834080	310592	11279369
Russia	211980	8596853	208696	7791467
Kazakhstan	91369	3978765	63497	2110813
Brazil	49221	2184710	37280	1341595
China	2087	71452	1005	32011
Poland	68	2300	68	1851
Marshall Island	-	-	46	1632

**Table – 12 : Imports of Asbestos (Others)
(By Countries)**

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	961	31431	-	-
Kazakhstan	921	29920	-	-
Russia	40	1511	-	-

ASBESTOS

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	26385	494037	28416	526153
Thailand	24350	424029	25295	429339
China	1743	55222	2135	51673
USA	34	5515	127	16497
Belgium	-	-	30	9809
Indonesia	++	3	376	5841
Malaysia	226	6005	256	5120
Philippines	-	-	167	4069
Germany	27	2758	30	3765
Spain	-	-	++	36
Japan	-	-	++	4
Other countries	5	505	-	-

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	5459	2735037	5227	2711359
Japan	1390	947355	1812	1176347
Germany	278	265438	235	280996
Thailand	656	313549	409	241875
China	822	264388	1422	203075
Philippines	735	215578	506	184740
Korea, Rep. of	82	92305	108	137857
Indonesia	109	129016	86	109475
USA	547	133488	180	109268
Denmark	205	122400	124	63872
Spain	74	60470	69	63503
Other countries	561	191050	276	140351

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	354725	14834080	310592	11279369
Russia	211980	8596853	208696	7791467
Kazakhstan	91369	3978765	63497	2110813
Brazil	49221	2184710	37280	1341595
China	2087	71452	1005	32011
Poland	68	2300	68	1851
Marshall Island	-	-	46	1632

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 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.