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ASBESTOS

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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 and 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 has been placed at 22.95 million tonnes. Out of these, 0.025 million tonnes are placed under Reserves and 22.92 million tonnes under 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 per cent 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 2018-19 as well as in the previous year and there were no reporting mines in 2018-19 as well as in preceding year.

The mine-head closing stocks of asbestos remained 'Nil' for the year 2018-19 as well as in the preceding year 2017-18. The average daily employment of labour for both the years was 'Nil.'

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

Table – 1 : Reserves/Resources of Asbestos as on 1.4.2015
(By Grades/States)

(In 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	**20016**	**-**	**4617**	**24633**	**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	24633	146	-	155	10000	37200	23884	-	71385	96018
By States													
Andhra Pradesh	20016	-	4617	24633	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 20^0 to 25^0, 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

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 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 health hazards, asbestos also 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) held 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), on account of it being a hazardous waste detrimental to human health and environment.

WORLD REVIEW

Large reserves are located mainly in Russia, China, Kazakhstan and Zimbabwe. The world production of asbestos remained unchanged at 1.2 million tonnes from 2016 to 2018. Russia was the leading producer and accounted for 63% production followed by Kazakhstan (16%) and Brazil (8%) (Tables-3 and 4).

Table – 3 : World Reserves of Asbestos (By Principal Countries)

(In million tonnes)

Country	Reserves
World: Total	**Large**
Brazil	12
China	96
Kazakhstan	Large
Russia	110
USA	Small
Zimbabwe	Large

Source: *USG, Mineral Commodity Summaries, 2020.*

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	2016	2017	2018
World: Total (rounded off)	**1200**	**1200**	**1200**
Russia	692	714	753
Kazakhstan	192	193	196
Brazil	118	129	101
China*	200	125	100
Colombia	10	4	4

Source:*BGS, World Mineral Production, 2014-2018, BGS.*

** estimated.*

FOREIGN TRADE

Exports

Exports of asbestos increased substantially to 1,112 tonnes in 2018-19 as compared to 132 tonnes in the previous year. Exports were mainly to Bangladesh (more than 98%) and Nepal 2%. Exports of asbestos (fibre products) were at 41,677 tonnes in 2018-19 as compared to 35,812 tonnes in the previous year. Exports were mainly to USA (26%), Egypt & UAE (6% each) and Nepal & Kenya (3% each). Exports of asbestos (chrysotile) were at 1,090 tonnes during the year 2018-19 as compared to one tonne in the preceding year. Exports of asbestos (others) decreased to 22 tonnes during the year 2018-19 as compared to 131 tonnes in the preceding year. Exports were mostly to Nepal. Exports of asbestos-cement products were 67,352 tonnes in 2018-19 as compared to 62,379 tonnes in the preceding year. Exports of asbestos-cement products were mainly to UAE (30%), Nepal (27%) and Qatar (15%) (Tables - 5 to 9).

Imports

Imports of asbestos were 3,64,108 tonnes in 2018-19 as against 3,57,182 tonnes in the previous year. Majority of the imports was that of chrysotile asbestos. Imports of asbestos were mainly from Russia (69%), Brazil (18%) and Poland (6%). A total of 29,357 tonnes asbestos-cement products were also imported in 2018-19 as against 29,031 tonnes in the previous year. Imports were mainly from Thailand (91%) and Indonesia (4%). Besides above, asbestos-fibre of 3,63,905 tonnes was also imported during the year 2018-19 as compared to 3,57,182 tonnes in the previous year. Imports of asbestos- fibre were mainly from Russia (69%), Brazil (18%) and Poland (6%). Imports of asbestos fibre products were 4,425 tonnes during the year 2018-19 as compared to 4,477 tonnes in previous year. Imports of asbestos fibre products were mainly from China (31%) and Japan (25%). 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	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**132**	**943**	**1112**	**33915**
Bangladesh	131	847	1090	33647
Nepal	1	55	20	231
Malawi	_	_	2	33
Bhutan	_	_	++	2
Finland	_	_	++	1
Qatar	_	_	++	++
Kenya	++	40	++	++
Thailand	++	1	++	1

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**35812**	**4636847**	**41677**	**5252141**
USA	9149	1281826	10825	1476813
UAE	2465	337495	2666	354901
Egypt	2946	200677	2725	203109
Nepal	791	134253	1492	201816
Canada	1168	169813	1116	157365
Kenya	773	69771	1382	142583
Sri Lanka	844	138226	951	137898
Turkey	507	64579	543	134199
Poland	1009	142218	1026	132788
South Africa	852	109493	971	131428
Other countries	15308	1988497	17980	2179241

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**1**	**95**	**1090**	**33647**
Bangladesh	-	-	1090	33647
Nepal	1	55	-	-
Kenya	++	40	-	-

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**131**	**848**	**22**	**264**
Nepal	-	-	20	231
Malawi	-	-	2	33
Qatar	-	-	++	++
Bangladesh	131	847	-	-
Thailand	++	1	-	-

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**62379**	**976622**	**67352**	**970413**
UAE	21417	284613	20406	276310
Nepal	9685	186918	18159	243553
Qatar	11395	165299	9792	139760
Maldives	1477	30585	2146	38845
Saudi Arabia	4472	56298	2920	37108
Oman	2570	38607	2704	34883
UK	1298	18219	1940	28561
Seychelles	855	14120	1805	28358
South Africa	765	16563	993	17504
Bahrain	988	15401	1165	17123
Other countries	7456	150000	5324	108409

Figures rounded off

Table – 10 : Imports of Asbestos (By Countries)

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**357182**	**11603678**	**364108**	**12253121**
Russia	225255	7286072	250890	8362947
Brazil	74560	2580637	66041	2325929
Poland	136	3577	23569	780527
South Africa	-	-	8855	285600
Kazakhstan	55851	1680885	7545	236783
USA	-	-	3920	151702
Hungary	-	-	1711	59266
China	705	24750	1508	48051
UAE	-	-	68	1875
Japan	-	-	1	413
Other countries	675	27757	++	28

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**357182**	**11603543**	**363905**	**12246919**
Russia	225255	7286072	250823	8361089
Brazil	74560	2580637	66041	2325929
Poland	136	3577	23434	776624
South Africa	-	-	8855	285600
Kazakhstan	55851	1680885	7545	236783
USA	-	-	3920	151702
Hungary	-	-	1711	59266
China	705	24750	1508	48051
UAE	-	-	68	1875
Switzerland	675	27622	-	-

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**++**	**135**	**204**	**6202**
Poland	-	-	135	3903
Russia	-	-	68	1858
Japan	-	-	1	413
Turkey	-	-	++	28
Colombia	++	135	-	-

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**29031**	**535896**	**29357**	**592294**
Thailand	25715	419480	26820	478242
USA	45	19129	73	27623
Indonesia	467	7242	1058	22077
China	993	20751	502	15470
Mexico	727	19842	420	13640
Belgium	21	3203	53	8886
Germany	206	6822	1	6676
Philippines	249	6332	222	6550
UAE	-	-	5	4586
Turkey	18	7695	6	2975
Other countries	590	25400	197	5569

Figures rounded off

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

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**357182**	**11603543**	**363905**	**12246919**
Russia	225255	7286072	250823	8361089
Brazil	74560	2580637	66041	2325929
Poland	136	3577	23434	776624
South Africa	-	-	8855	285600
Kazakhstan	55851	1680885	7545	236783
USA	-	-	3920	151702
Hungary	-	-	1711	59266
China	705	24750	1508	48051
UAE	-	-	68	1875
Switzerland	675	27622	-	-

Figures rounded off.

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

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**4477**	**2994153**	**4425**	**3605942**
Japan	1544	1370690	1087	1870216
Denmark	173	124292	423	355580
China	674	190233	1352	217486
USA	656	188825	184	198601
Germany	205	272636	156	183395
Korea, Rep. of	130	153384	167	176993
Thailand	377	272036	232	132513
Netherlands	46	36124	65	86092
UK	42	23265	347	73803
Spain	65	59862	55	54187
Other countries	565	302804	357	257073

Figures rounded off.

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 technological advancement.

While the economic impact of asbestos mining in India is minimal, mining operations do adversely affect human and environmental health. Globally, asbestos-cement products are expected to continue to be the leading market for asbestos. India's imports of chrysotile asbestos too have been showing significant growth. 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.