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(Part- III : MINERAL REVIEWS)

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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 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 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

No production of asbestos was reported in 2019-20 as well as in the previous year and there were no reporting mines in 2019-20 as well as in preceding year.

Similarly, the mine-head closing stocks of asbestos also remained 'Nil' for the year 2019-20 as well as in the preceding year 2018-19. 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 and 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 2017 to 2019. Russia was the leading producer and accounted for 66% production followed by Kazakhstan (18%), China (10%) 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	11
China	95
Kazakhstan	Large
Russia	110
USA	Small
Zimbabwe	Large

Source: *USGS, Mineral Commodity Summaries, 2021.*

** 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	2017	2018	2019(e)
World: Total (rounded off)	**1200**	**1200**	**1200**
Russia	714	753	790
Kazakhstan	193	203	211
Brazil	129	101	100(e)
China	125	125(e)	125(e)
Colombia	4	4	0

Source: *BGS, World Mineral Production, 2015-2019.*
(e) : Estimated.

FOREIGN TRADE

Exports

Exports of asbestos decreased substantially to 1,001 tonnes in 2019-20 as compared to 1,112 tonnes in the previous year. Exports were mainly to Bangladesh (92%) and Sri Lanka 7%. Exports of asbestos (fibre products) were at 43,310 tonnes in 2019-20 as compared to 41,677 tonnes in the previous year. Exports were mainly to USA (24%), UAE (7%), Egypt (6%) and Nepal, Canada, Sri Lanka & Kenya (3% each). Exports of asbestos (chrysotile) were at 997 tonnes during the year 2019-20 as compared to 1090 tonnes in the preceding year. Exports of asbestos (others) decreased to 5 tonnes during the year 2019-20 as compared to 22 tonnes in the preceding year. Exports were solely to Nepal. Exports of asbestos-cement products were 91,100 tonnes in 2019-20 as compared to 67,352 tonnes in the preceding year. Exports of asbestos-cement products were mainly to UAE (36%), Nepal (26%) and Qatar (11%) (Tables-5 to 9).

Imports

Imports of asbestos were 3,61,164 tonnes in 2019-20 decreased by only 1% as against 3,64,105 tonnes in the previous year. Almost entire import was that of chrysotile asbestos. Imports of asbestos were mainly from Russia (85%), Brazil , Kazakhstan & Hungary (3% each), and Poland & South Africa (2% each). A total of 25,009 tonnes asbestos-cement products were also imported in 2019-20 as against 29,358 tonnes in the previous year. Imports were mainly from Thailand (93%) and Indonesia (4%). Besides above, asbestos-fibre of 3,60,839 tonnes was also imported during the year 2019-20 as compared to 3,63,902 tonnes in the previous year. Imports of asbestos- fibre were mainly from Russia (85%), Brazil, Kazakhstan & Hungary (3% each). Imports of asbestos fibre products were 3,580 tonnes during the year 2019-20 as compared to 4,425 tonnes in previous year. Imports of asbestos fibre products were mainly from China (31%), Japan (23%) and Denmark (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-10 to 15).

Table – 5 : Exports of Asbestos (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1112**	**33913**	**1001**	**31011**
Bangladesh	1090	33647	925	28048
Sri Lanka	-	-	72	2943
Nepal	20	231	5	20
Malawi	2	33	-	-
Bhutan	++	2	-	-
Finland	++	1	-	-
Qatar	++	++	-	-

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**41677**	**5252141**	**43310**	**5071608**
USA	10825	1476813	10458	1404248
UAE	2666	354901	3138	318572
Egypt	2725	203109	2391	184880
Nepal	1492	201816	1476	178182
Canada	1116	157365	1252	172383
Sri Lanka	951	137898	1161	166185
Saudi Arabia	660	86076	1019	149930
Poland	1026	132788	1172	145756
Kenya	1382	142583	1288	132236
Algeria	557	85438	794	118460
Other countries	18278	2273354	19161	2100776

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1090**	**33647**	**997**	**30994**
Bangladesh	1090	33647	925	28048
Sri Lanka	-	-	72	2943
Nepal	-	-	++	3

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**22**	**267**	**5**	**17**
Nepal	20	231	5	17
Malawi	2	33	-	-
Bhutan	++	2	-	-
Finland	++	1	-	-
Qatar	++	++	-	-

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**67352**	**970413**	**91100**	**1447617**
UAE	20406	276310	32431	458930
Nepal	18159	243553	23571	360085
Qatar	9792	139760	9822	148841
Zambia	16	486	4020	115497
UK	1940	28561	3155	55953
Maldives	2146	38845	2049	48544
Oman	2704	34883	3355	47728
Angola	852	12988	1687	23149
Seychelles	1805	28358	1186	20069
South Africa	993	17504	1203	19533
Other countries	8540	149166	8622	149289

Figures rounded off

Table – 10 : Imports of Asbestos (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**364105**	**12253120**	**361164**	**12432335**
Russia	250890	8362947	307429	10565063
Brazil	66041	2325929	12606	432985
Hungary	1711	59266	11457	410060
South Africa	8855	285600	8657	324670
Kazakhstan	7545	236783	9391	323600
Poland	23569	780527	7088	237275
China	1508	48051	3667	113567
USA	3920	151702	653	19679
UK	-	-	72	2320
Singapore	-	-	68	2008
Other countries	69	2315	77	1108

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**363902**	**12246919**	**360839**	**12422166**
Russia	250823	8361089	307159	10555466
Brazil	66041	2325929	12606	432985
Hungary	1711	59266	11457	410060
South Africa	8855	285600	8657	324670
Kazakhstan	7545	236783	9391	323600
Poland	23434	776624	7088	137275
China	1508	48051	3667	113459
USA	3920	151702	653	19679
UK	-	-	72	2320
Singapore	-	-	68	2008
Other Countries	68	1875	23	643

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**203**	**6202**	**324**	**10619**
Russia	68	1858	270	9597
Turkey	++	28	54	464
China	-	-	++	108
Poland	135	3903	-	-
Japan	1	413	-	-

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**29358**	**592294**	**25009**	**570692**
Thailand	26820	478242	23190	474446
USA	73	27623	85	38139
Indonesia	1058	22077	880	25624
China	502	15470	453	11374
Germany	1	6676	1	8198
Turkey	6	2975	20	4961
Philippines	222	6550	90	3059
Bangladesh	-	-	206	2827
Malaysia	149	2734	80	1847
South Africa	-	-	3	173
Other countries	526	29946	++	43

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**363902**	**12246919**	**360839**	**12422166**
Russia	250823	8361089	307159	10555466
Brazil	66041	2325929	12606	432985
Poland	23434	776624	7088	137275
South Africa	8855	285600	8657	324670
Kazakhstan	7545	236783	9391	323600
USA	3920	151702	653	19679
Hungary	1711	59266	11457	410060
China	1508	48051	3667	113459
UK	-	-	72	2320
Singapore	-	-	68	2008
Other countries	68	1875	23	643

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**4425**	**3605942**	**3580**	**2740751**
Japan	1087	1870216	826	1448298
Denmark	423	355580	433	297281
USA	184	198601	153	187427
China	1352	217486	1093	181465
Germany	156	183395	147	114685
Korea, Rep. of	167	176993	192	97026
UK	347	73803	328	83129
Thailand	232	132513	46	60936
Spain	55	54187	67	45122
Netherlands	65	86092	45	42085
Other countries	357	257073	248	183297

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.