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(Part- III : MINERAL REVIEWS)

60th Edition

ASBESTOS

(Advance 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 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 1.4.2020 has been placed at 22.90 million tonnes. A total of 22.90 million tonnes of asbestos are placed 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 2020-21 as well as in the previous year and there were no reporting mines in 2020-21 as well as in preceding year.

Similarly, the mine-head closing stocks of asbestos also remained 'Nil' for the year 2020-21 as well as in the preceding year 2019-20. 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	Anantapur	Chrysotile
	Cuddapah	
Jharkhand	Singhbhum (East)	Chrysotile, tremolite, chrysotile mixed with other minerals
	Singhbhum (West)	
Karnataka	Chikkamagaluru	Amosite
	Hassan	Anthophyllite
	Mandya	Mixed amphibole minerals
	Mysuru	Chrysotile
	Shivamogga	Amosite
Odisha	Kendujhar	-
Rajasthan	Ajmer	Mixed amphibole minerals
	Bhilwara	-do-
	Dungarpur	-do-
	Pali	Tremolite, chrysotile mixed with other amphibole minerals
	Rajsamand	Tremolite, actinolite and mixed amphibole minerals
	Udaipur	Chrysotile, tremolite and mixed amphibole minerals
Uttarakhand	Chamoli	Others

Table – 1 : Reserves/Resources of Asbestos as on 1.4.2020 (P)
(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	**-**	**-**	**-**	**-**	**2488022**	**3113446**	**4062376**	**100687**	**2527959**	**10557777**	**57800**	**22908067**	**22908067**
By Grades													
Chrysotile	-	-	-	-	684838	39126	16553	2885	17660	70843	-	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	-	-	-	-	1	-	-	10000	37200	9500	-	56701	56701
By States													
Andhra Pradesh	-	-	-	-	684839	39126	16553	-	1541	55936	-	79799	79799
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. Russia was the leading producer with670 thousand tonnes, followed by Kazakhstan (227thousand tonnes) China (100 thousand tonnes) and Brazil (100 thousand tonnes) (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, 2022.*

** India's total reserves/resources of asbestos as per NMI database, based on UNFC system, as on 1.04.2020 have been estimated at 22.90 million tonnes.*

Table – 4 : World Production of Asbestos (By Principal Countries)

(In '000 tonnes)

Country	2018	2019	2020
Brazil	101	100	100
China	125	150	100
Colombia	355	0	0
Kazakhstan	202	210	227
Russia	753	790	670

Source: *BGS, World Mineral Production, 2016-2020.*
(e) : Estimated.

FOREIGN TRADE

Exports

Exports of asbestos decreased substantially to 299 tonnes in 2020-21 as compared to 1,001 tonnes in the previous year. Exports were mainly to Bangladesh (92%) and Nepal (1%). Exports of asbestos (fibre products) were at 41739 tonnes in 2020-21 as compared to 43298 tonnes in the previous year. Exports were mainly to USA (32%), UAE (8%), Egypt (5%) and Nepal, Canada, (2% each). Exports of asbestos (chrysotile) were at 275 tonnes during the year 2020-21 as compared to 997 tonnes in the preceding year. Exports of asbestos (others) increased to 24 tonnes during the year 2020-21 as compared to 5 tonnes in the preceding year. Exports were mainly to Nepal. Exports of asbestos-cement products were 89833 tonnes in 2020-21 as compared to 91101 tonnes in the preceding year. Exports of asbestos-cement products were mainly to UAE (30%), Nepal (23%) and Qatar (20%) (Tables-5 to 9).

Imports

Imports of asbestos were 308506tonnes in 2020-21 decreased by only 15% as against 3,61163 tonnes in the previous year. Almost entire import was that of chrysotile asbestos. Imports of asbestos were mainly from Russia (63%), Brazil (23%), Kazakhstan (3%), & Hungary (5%). A total of 19306 tonnes asbestos-cement products were also imported in 2020-21 as against 25008 tonnes in the previous year. Imports were mainly from Thailand (91%) and Indonesia (6%). Imports of asbestos fibre products were 2309 tonnes during the year 2020-21 as compared to 3577 tonnes in previous year. Imports of asbestos fibre products were mainly from Denmark (29%), Japan (25%) and China (22%). 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 14).

Table – 5 : Exports of Asbestos (By Countries)

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1001**	**31011**	**299**	**11991**
Bangladesh	925	28048	275	11887
Nepal	4	20	24	54
Kenya	-	-	++	42
Cote D' Ivoire	-	-	++	8
Sri Lanka	72	2943	-	-

Figures rounded off

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**43298**	**5071610**	**41739**	**5548536**
USA	10458	1404246	13407	1834003
UAE	3137	318572	3355	388212
Brazil	534	101953	817	262332
Egypt	2392	184881	2244	179241
Canada	1252	172383	1149	160061
Nepal	1479	178182	1076	151558
Saudi Arabia	1018	149929	1203	150218
Sri Lanka	1161	166185	888	146252
Kenya	1287	132236	1440	133834
Turkey	507	113604	464	131610
Other countries	20073	2149439	15696	2011215

Figures rounded off

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**997**	**30994**	**275**	**11895**
Bangladesh	925	28048	275	11887
Cote D' Ivoire	-	-	++	8
Sri Lanka	72	2943	-	-
Nepal	++	3	-	-

Figures rounded off

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**4**	**17**	**24**	**96**
Nepal	4	17	24	54
Kenya	-	-	++	42

Figures rounded off

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**91101**	**1447617**	**89833**	**1444464**
UAE	32432	458930	27254	389165
Nepal	23572	360084	20814	323160
Qatar	9822	148841	18132	283356
U K	3155	55953	6398	128380
South Africa	1203	19533	3319	55863
Oman	3355	47728	2577	41041
Maldives	2048	48543	1313	27240
Kuwait	972	13271	1060	19232
Angola	1687	23149	1338	18314
Seychelles	1186	20070	858	16019
Other countries	11669	251515	6770	142694

Figures rounded off

Table – 10 : Imports of Asbestos (By Countries)

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**361163**	**12432333**	**308506**	**11851124**
Russia	307429	10565063	195419	7749132
Brazil	12606	432985	72385	2454931
Hungary	11457	410060	16549	688296
Kazakhstan	9390	323600	10105	379339
Poland	7088	237275	9614	348194
South Africa	8657	324670	2816	169062
China	3667	113566	1017	33651
U S A	653	19679	240	18102
Singapore	68	2008	136	4864
U K	72	2320	45	2446
Other countries	76	1107	180	3107

Figures rounded off

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**360839**	**12422164**	**308100**	**11840174**
Russia	307159	10555466	195419	7749132
Brazil	12606	432985	72385	2454931
Hungary	11457	410060	16549	688296
Kazakhstan	9390	323600	10105	379339
Poland	7088	237275	9344	338450
South Africa	8657	324670	2816	169062
China	3667	113458	1016	33621
USA	653	19679	240	18102
Singapore	68	2008	136	4864
U K	72	2320	45	2446
Other Countries	22	643	45	1931

Figures rounded off

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**324**	**10169**	**406**	**10950**
Poland	-	-	270	9744
Turkey	54	464	135	1176
China	++	108	1	30
Russia	270	9597	-	-

Figures rounded off

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**25008**	**570692**	**19306**	**466845**
Thailand	23191	474446	17629	373669
Indonesia	880	25624	1185	36903
U S A	85	38139	24	18133
Germany	1	8198	2	14552
China	452	11374	202	8747
Turkey	20	4961	22	6063
Mexico	-	-	119	3924
Belgium	-	-	9	1431
Philippines	90	3059	7	1220
Bangladesh	206	2827	85	982
Other countries	83	2064	22	1221

Figures rounded off

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

Country	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**3577**	**2740754**	**2309**	**2750723**
Japan	826	1448298	589	1251083
Denmark	433	297280	667	526425
USA	153	187427	150	198495
China	1094	181465	510	183946
Germany	147	114685	93	182431
Korea, Rep. of	193	97026	76	110737
UK	328	83128	65	68067
Netherlands	45	42084	18	35352
France	17	6896	30	32344
Thailand	46	60937	18	31159
Other countries	295	221528	93	130684

Figures rounded off

FUTURE OUTLOOK

Consumption of asbestos minerals in India & other countries of the world will decline steadily in near future. 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.