

15 Asbestos

Asbestos is a group of fibrous minerals. The physical properties, besides fibrous characters, such as fineness, flexibility, tensile strength and length of fibres, infusibility, low heat conductivity and high resistance to electricity and 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 group 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 mainly met through imports from Russia, Brazil and Canada.

RESOURCES

As per the UNFC system, total resources (reserves and remaining resources) of asbestos in the country as on 1.4.2005 are placed at 21.7 million tonnes (Table-1). Of these, 6 million tonnes are reserves and 15.7 million tonnes are remaining resources. Out of 6 million tonnes reserves, 2.97 million tonnes are proved reserves and 3.1 million tonnes are probable reserves. Out of the total resources, Rajasthan accounts for 13.2 million tonnes (61%) and Karnataka 8.28 million tonnes (38%). The remaining one percent resources are estimated in

Andhra Pradesh, Odisha, Jharkhand and Uttarakhand. Table-2 summarises the mineralogical varieties of asbestos occurring in various parts of the country.

PRODUCTION, STOCKS & PRICES

The production of asbestos at 233 tonnes in 2009-10 decreased by about 26% as compared to that in the previous year due to shortage of less fibre veins. There were 5 reporting mines in 2009-10 and 4 mines in the previous year. Two mines in 2009-10 and one mine in 2008-09 reported production of associated minerals only. In 2009-10 the entire production of 233 tonnes was of chrysotile variety of asbestos and was produced by three mines in Cuddapah district of Andhra Pradesh.

The entire production of asbestos was from private sector in both the years. Above 89% of the chrysotile variety was the contribution of Padma Minerals (P) Ltd., The remaining production was reported by Baba Minerals Corporation (Tables 3 to 5).

The mine-head stocks of asbestos at the end of the year were 9 tonnes as against 19 tonnes in the beginning of the year (Table - 6).

The average daily employment of labour was 68 in 2009-10 as against 59 in the preceding year. Prices of asbestos are furnished in the General Review on 'Prices'.

Table – 2 : Occurrences of Asbestos in India

State	District	Mineralogical variety
Andhra Pradesh	Cuddapah	Chrysotile
Jharkhand	Singhbhum	Chrysotile, tremolite, chrysotile mixed with other minerals
Karnataka	Chickmagalur Hassan Mandya Mysore Shimoga	Amosite Anthophyllite Mixed amphibole minerals Chrysotile Amosite
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

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**Table – 1 : Reserves/Resources of Asbestos as on 1.4.2005
(By Grades/States)**

Grade/State	Reserves				Remaining resources						Total resources (A+B)	
	Proved STD111	Probable		Total A	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		Total B
		STD121	STD122		STD221	STD222						
All India : Total	2973825	204992	2861727	6040544	321847	2207339	90687	2489218	10528926	57800	15695817	21736361
By Grades												
Chrysotile	2529	1336	15656	19521	1781	1170	2885	16119	41992	-	63947	83468
Amosite	-	-	-	-	-	-	-	3987	4459680	-	4463667	4463667
Tremolite	27170	42417	83443	153030	8400	49854	-	2426700	1562125	-	4047079	4200109
Chrysotile mixed with others	-	-	-	-	3871	18309	-	-	336	-	22516	22516
Mixed amphibole	2874503	160612	2704952	5740067	305958	2090710	87802	42101	4121718	-	6648289	12388356
Actinolite	-	-	-	-	-	-	-	311	34000	-	34311	34311
Anthophyllite	-	-	-	-	-	-	-	-	20000	-	20000	20000
Unclassified	10000	-	27200	37200	-	10000	-	-	9500	-	19500	56700
Not-known	59623	627	30476	90726	1837	37296	-	-	279574	57800	376507	467233
By States												
Andhra Pradesh	2529	1336	15656	19521	1781	1170	-	-	27085	-	30036	49557
Jharkhand	-	-	-	-	3871	18309	2885	5769	124059	-	154893	154893
Karnataka	-	-	-	-	-	-	-	2441037	5841420	-	8282457	8282457
Odisha	10000	-	27200	37200	-	10000	-	-	9500	-	19500	56700
Rajasthan	2961296	203656	2818871	5983823	316195	2177860	87802	42101	4526861	57800	7208619	13192443
Uttarakhand	-	-	-	-	-	-	-	311	-	-	311	311

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Table – 3 : Principal Producers of Asbestos, 2009-10

Name & address of producer	Location of mine	
	State	District
Padma Minerals (P) Ltd, 1/5A, Ambikapalli Road, Pulivendla, Distt. Cuddapah – 516 390 Andhra Pradesh.	Andhra Pradesh	Cuddapah
Baba Minerals Pvt Ltd, 1/5A, Ambikapalli Road Pulivendla Post- Pulivendla-516 390 Distt. Cuddapah Andhra Pradesh.	Andhra Pradesh	Cuddapah

**Table – 4 : Production of Asbestos, 2007-08 to 2009-10
(By States)**

(Qty. in tonnes; value in Rs.'000)

State	2007-08		2008-09		2009-10 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	269	10598	315	14521	233	11395
Andhra Pradesh	269	10598	315	14521	233	11395
Rajasthan	–	–	–	–	–	–

**Table – 5 : Production of Asbestos, 2008-09 and 2009-10
(By States/Districts/Grades)**

(Qty. in tonnes; value in Rs.'000)

State/District	No. of mines	2008-09			Value	No. of mines	2009-10 (P)			Value
		Quantity					Quantity			
		Chrysotile	Amphibole	Total			Chrysotile	Amphibole	Total	
India	4	315	–	315	14521	5	233	–	233	11395
Private sector	4	315	–	315	14521	5	233	–	233	11395
Andhra Pradesh	3	315	–	315	14521	3	233	–	233	11395
Cuddapah	3	315	–	315	14521	3	233	–	233	11395
Rajasthan*	1	–	–	–	–	2	–	–	–	–
Ajmer	1	–	–	–	–	2	–	–	–	–

*Production of feldspar and quartz reported as associated minerals.

**Table – 6 : Mine-head Stocks of Asbestos, 2009-10 (P)
(By States/Grades)**

(In tonnes)

State	At the beginning of the year			At the end of the year		
	Chrysotile	Amphibole	Total	Chrysotile	Amphibole	Total
India	19	–	19	9	–	9
Andhra Pradesh	19	–	19	9	–	9
Rajasthan	–	–	–	–	–	–

MINING & MILLING

The mines in Rajasthan, producing amphibole variety of asbestos were small opencast workings, operating manually. The mines are now closed.

The usual method of mining chrysotile in Pulivendla tehsil, Cuddapah district, Andhra Pradesh, is 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 are 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 blasthole drilling, hoisting, pumping and ventilation are mechanised.

The run-of-mine is subjected to manual sorting of asbestos-bearing rock (ABR). ABR is 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 is removed as a waste. The asbestos concentrate is fed manually into hopper of a hammer mill. In hammer mill, asbestos and other minerals are 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 is taken as a waste which generally does not contain appreciable quantity of asbestos. The oversize is recycled in the hammer mill, and the middling fibre is sucked up by a cyclone and collected. There are five processing or milling plants located in Pulivendla area, Andhra Pradesh.

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	

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 25.4 mm fibres or larger
 - A Special -
 - 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 & 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.

CONSUMPTION

The reported consumption of asbestos in 2009-10 was about 109 thousand tonnes, almost entirely in asbestos-cement and asbestos-based products manufacturing. Minor quantity was utilised for insulation purpose in some industries. The available consumption data relate almost entirely to imported chrysotile asbestos. Reliable data on consumption of amphibole asbestos were not available as the consuming industries were mostly in small-scale sector, producing low-pressure asbestos-cement pipes used in construction industry (Table - 7).

**Table – 7 : Reported Consumption of Asbestos
2007-08 to 2009-10
(By Industries)**

Industry	(In tonnes)		
	2007-08	2008-09(R)	2009-10 (P)
All Industries	109175	108632	109020
Asbestos products	109051(25)	108508(25)	108896(25)
Foundry	24(3)	24(3)	24(3)
Paint	13(2)	13(2)	13(2)
Paper	8(2)	8(2)	8(2)
Refractories	79(4)	79(4)	79(4)

*Figures rounded off. Data collected on non-statutory basis.
Figures in parentheses denote the number of units in organised sector reporting* consumption.
Includes actual reported consumption and/or estimates made wherever required.

INDUSTRY

The installed capacity of asbestos sheets in the organised sector was not available while that of asbestos-cement pressure pipes was 149640 tpy. The

production of asbestos cement sheets and accessories in 2009-10 was about 2.43 million tonnes and production of asbestos cement pressure pipes was 149.64 thousand tonnes according to Department of Industrial Policy & Promotion. The asbestos-cement pressure building pipes and other asbestos-based products like brake linings, clutch facings, ferobestos sheets, textiles, mattresses, joining, limpet sheets, mill boards, moulded thermal insulation articles, asbestos yarn and hydraulic packings, asbestos plugs and fire-resistant cement were manufactured by a number of medium and small units. Presently, there are about 75 plants engaged in the production of asbestos products in the country and these are mainly located in Gujarat, Karnataka, Madhya Pradesh and Andhra Pradesh. Besides, about 114 asbestos cement sheet and pipe units are reported from Rajasthan.

SUBSTITUTION

Material substituted for asbestos include calcium silicate, carbon fibres, fibres of cellulose, ceramic, glass and 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 ISSUES

There has been a concern about the role of asbestos causing lung diseases. Research towards this problem has been hampered by the long period between asbestos exposure and symptoms, known as a latency period, which can exceed 30 years. Further, difficulty was faced in diagnosing the diseases and due to fragmented medical records. Results obtained so far suggested that chrysotile, most widely used asbestos, was less dangerous than amphibole asbestos minerals. Asbestosis is a chronic affliction resulting from inhalation of asbestos fibres and is commonly seen in workers who have been associated with high levels of asbestos dust. It led to an increase in the amount of fibrous protein in the lung, which ultimately decreased its flexibility and oxygen-absorbing capacity, sometimes leading to death. The incidence of severe asbestosis has been declining for years and should continue to do so because of dust control in the work place.

Mesothelioma, which can be either benign or malignant, is a tumour in tissue that encases the lung. The asbestos problem is almost certainly the wider issue involving all fibrous materials, both natural and man-

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made. However, a decision to ban asbestos is not simple. Crocidolite and amosite appear to be strongly linked to disease, whereas chrysotile is not. Just as scientific community has begun to grasp the wide diversity of fibrous materials and their effects, the public has come to think of all fibrous materials as highly dangerous as asbestos. This has resulted in clamour for removing asbestos from buildings where it is found in insulation around pipes and in ceiling and floor tiles.

Minerals and chemicals containing 0.1% or more silica are considered as carcinogenic hazard. Therefore, unless processing can reduce the crystalline silica to less than 0.1%, asbestos will come under the regulation similar to US OSHA Hazard Communication Standards. France banned the production and import of asbestos-based products in 1997, followed by Belgium in 1998. During November 1999, UK prohibited the use, import and manufacture of chrysotile asbestos on the grounds of health risks. On 10 September 1998, the Rotterdam Convention on Prior Informed Consent (PIC) adopted procedure for certain Hazardous Chemicals and Pesticides in international trade by the United Nations and in 2002, a decision was made to initiate the addition of all forms of asbestos except chrysotile to the PIC procedure. Another attempt to bring chrysotile, the most common form of asbestos, under the Prior Informed Consent (PIC) list of the Rotterdam Convention had failed. Parties to this international treaty governing trade in toxic substances met in Geneva during 10 and 13, October 2006. But they could not agree on adding chrysotile to a list of 39 substances about which exporting countries must inform importers before shipping.

The convention is a multilateral agreement that tries to ensure that export of hazardous materials takes place with the knowledge of importing nations.

TRADE POLICY & LEGISLATION

No restrictions have been imposed on exports of asbestos in the amended Foreign Trade Policy, 2009-14 effective from 1 April 2010. As per the new Foreign Trade Policy, asbestos under heading 2524 can be freely imported 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

The world reserves are believed to be quite large. Large reserves are located mainly in Canada, China, Kazakhstan and Russia. The world production of asbestos was 2.1 million tonnes in 2009. Russia the leading producer accounted for 48%, followed by China (18%), Brazil (14%), Kazakhstan (11%) and Canada (7%) (Tables 8 and 9).

**Table – 8 : World Reserves of Asbestos
(By Principal Countries)**

Country	Reserves
World: Total	Large
Brazil	Moderate
Canada	Large
China	Large
Kazakhstan	Large
Russia	Large
USA	Small
Zimbabwe	Moderate
Other countries	Moderate

Source: Mineral Commodity Summaries, 2010.

**Table – 9 : World Production of Asbestos
(By Principal Countries)**

Country	(In '000 tonnes)		
	2007	2008	2009
World: Total	2300	2200	2100
Brazil ^e	254	305	288
Canada (chrysotile) ^e	180	160	150
China ^e	390	380	380
Kazakhstan	293	230	230
Russia	1025	1017	1000
Zimbabwe (chrysotile)	84	11	5
Other countries	74	97	47

Source: World Mineral Production, 2005-2009.

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FOREIGN TRADE

Exports

Exports of asbestos was 559 tonnes in 2009-10 compared with 918 tonnes in the previous year. Out of the total exports in 2009-10, exports of chrysotile asbestos were 63 tonnes while those of other asbestos varieties were 496 tonnes.

Exports were mainly to Nepal. Exports of asbestos-cement products were 39,389 tonnes in 2009-10 compared to 40,659 tonnes in the preceding year. Exports of asbestos cement products were mainly to UAE (58%), Nepal (13%), Saudi Arabia (9%) and South Africa (6%) (Tables 10 to 13).

Imports

Imports of asbestos were 331,415 tonnes in 2009-10 against 346,658 tonnes in the previous year. The imports comprised chrysotile asbestos 330,106 tonnes and asbestos (others) 1,309 tonnes. Imports of asbestos were mainly from Russia (46%), Canada (21%), Brazil (17%) and Kazakhstan (14%). A total of 2,653 tonnes asbestos-cement products were also imported in 2009-10 as against 493 tonnes in the previous year. Imports were mainly from Thailand (86%) (Tables 14 to 17).

Table – 10 : Exports of Asbestos : Total (By Countries)

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	918	7545	559	1601
Nepal	599	3178	533	1209
UAE	193	2760	4	171
Singapore	–	–	5	110
Georgia	–	–	7	70
Ghana	26	602	–	–
Iran	10	162	–	–
Netherlands	1	101	–	–
Saudi Arabia	51	277	–	–
USA	34	343	–	–
Yeman Republic	2	90	–	–
Other countries	2	32	10	41

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	107	897	63	805
Nepal	107	897	54	781
Iraq	–	–	9	24

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	811	6648	496	796
Nepal	492	2281	479	427
UAE	193	2760	4	171
Singapore	–	–	5	110
Georgia	–	–	7	70
Ghana	26	602	–	–
Iran	10	162	–	–
Netherlands	1	101	–	–
Saudi Arabia	51	277	–	–
USA	34	343	–	–
Yemen Republic	2	90	–	–
Other countries	2	32	1	18

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	40659	484304	39389	547369
UAE	12445	150990	22692	278420
Nepal	3931	49590	5226	81780
Saudi Arabia	2246	28878	3423	43343
South Africa	1382	19637	2225	31677
Qatar	4282	54700	1091	12937
Ireland	719	6732	496	5863
Turkey	2895	35225	98	5543
Kuwait	740	14348	286	3892
Maldives	471	9633	119	2693
Ghana	3434	40255	4	67
Other countries	8114	74316	3729	81154

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	346658	8744931	331415	9387999
Russia	157839	3889972	152448	4241597
Canada	68433	1730972	70934	2014890
Brazil	56162	1538278	57427	1772798
Kazakhstan	53746	1249954	45224	1192113
Zimbabwe	5215	155281	3049	102912
Poland	1387	36173	684	19814
South Africa	1251	35076	588	18806
Ukraine	1483	35334	202	4808
Singapore	206	37153	–	–
Unspecified	222	6467	327	8189
Other countries	714	30271	532	12072

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	346032	8697307	330106	9344369
Russia	157837	3889959	152448	4241597
Canada	68413	1730705	70598	2006277
Brazil	55777	1523693	56507	1740785
Kazakhstan	53746	1249954	45224	1192113
Zimbabwe	5215	155281	3034	101713
Poland	1387	36173	684	19814
South Africa	1251	35076	573	17680
China	235	5579	374	8229
Ukraine	1483	35334	202	4808
Unspecified	222	6467	327	8189
Other countries	466	29086	135	3164

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	626	47624	1309	43630
Brazil	325	12638	920	32013
Canada	20	267	238	5931
South Africa	–	–	15	1126
UK	–	–	20	576
China	3	320	3	104
Afghanistan	19	1870	–	–
Chile	1	160	–	–
Russia	2	13	–	–
Singapore	196	30410	–	–
Other countries	60	1946	113	3880

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	493	35651	2653	75254
Thailand	112	12984	2274	54280
China	55	3522	293	12733
Malaysia	109	2715	8	2934
USA	140	3232	26	2613
Denmark	–	–	8	1089
France	5	869	1	123
UK	5	2591	1	100
Netherlands	16	4424	++	16
Indonesia	5	1808	++	12
Italy	4	1910	–	–
Other countries	42	1596	42	1354

FUTURE OUTLOOK

The resources of chrysotile variety of asbestos are very much limited in India. So, there

is an urgent need to go for detailed exploration as the internal demand for asbestos in the country cannot be met from indigenous production.