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ASBESTOSIS IN AN ASBESTOS CEMENT FACTORY

By
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Introduction

Asbestosis is a pneumoconiosis with pulmonary fibrosis due to the inhalation of asbestos dust. Minerals of fibrous form are called asbestos. They are silicates of varying composition. In asbestos the silica is combined with such bases as magnesium, iron, calcium, sodium and alumimium. The mode of action of these silicate dusts on lung tissue and the type of fibrosis produced are quite different from what is seen in silicosis. The asbestos fibres are 20 to 500 μ in length, and 0.5 to 50 in diameter. The disease does not usually appear until after 5 to 10 years of exposure. 5 million particles per cu. ft. of air is the maximum allowable safe concentration, but recent work suggests that the standards may vary with the percentage of long particles in the dust.

Occupational exposure occurs in those trades where it is used for packing, insulating or fire-proofing or where it is combind with cotton or other materials in textile processes or asbestos cement factories.

History

Asbestosis is comparatively a newer disease. In 1906, Montague-Murray reported the case of an asbestos worker who died in 1900 of "typical fibroid phthisis". In 1928 Seiler reported a case which seemed definitely to establish the relationship between the inhaltion of asbestos dust, and disabling and fatal fibrosis. Later in 1930, an enquiry was instituted under Merewether and Price throughout Great Britain and the occupational origin was proved. In America in early thirties studies were made by Lanza, Sayers, Bloomfield and others regarding inhalation of asbestos dust and pulmonary fibrosis.

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The Study

Reports of various studies conducted in U. S. A. and European countries on the incidence of asbestosis in asbestos dust laden working environment are available, but no such study has been conducted in India so far. With a view to get an idea of the incidence of asbestosis in asbestos dust laden environment in Indian factories, a study was conducted in an asbestos cement factory. Here the asbestos fibres are first ground and then mixed with cement and water for making asbestos cement sheets, pipes, ridges, joints etc.

The study consisted of investigations on the working environment and medical studies of the workers involved.

Process of Manufacture

The different processes are given below :

1. Asbestos fibre grinding : asbestos of the chrysotile type of different grades obtained from U. S. S. R and Rhodesia are ground in open roller grinding mills. Fibres are fed manually from gunny bags and water is sprayed on the rollers (upto 13%). Lot of dust is produced in this section.

2. Beating or Mixing : Portland cement is fed into the beater or mixing tank by bucket elevators, grounded asbestos fibres in gunny bags are manually fed in the beater tank through an opening at the top in the proportion of 1 : 8. Lot of dust is produced in this section. Water is added in requisite amount.

3. Machine section : The slurry thus formed in the mixing tank goes to the stock chest through pipes and from there it passes through presses and spreads over in layers on felt fixed on rotating cylinders. The rolls are formed in the shape of green sheets.

4. Corrugation Section : The green sheet is cut in required size and thickness and carried manually on steel corrugated sheets and pressed by another such to give the required shape.

5. Stripping : after 8 to 12 hours the sheets are separated.

6. Maturing : the sheets are kept under water sprayer for 14 days. The water is then stopped and kept for 7 days to mature. It is an wet process.

7. Moulding Section : Pipes, pipe fittings, ridges, ridge fittings etc are hand moulded. Some dust is produced due to drying of the left overs of the materials on the floor.

8. **Filing :** the pipes, fittings, ridges and ridge fittings are filed manually with the production of lot of dust.

9. **Sawing :** Mechanical sawing is done to cut the sheets to size. Lot of dust is produced.

So, the processes 1,2,7,8 and 9 produce lot of dust—containing asbestos fibres.

Environmental Study

The environmental study consisted of determination of dust concentration and estimation of particle size in the environment of different manufacturing processes. A series of samples were taken by both thermal precepitator and midget impinger and the average arrived at. Tables 1 and 2 show the dust concentration and the dust particle size in the environment of different processes.

Table I

Airborne dust concentration in various operations in an asbestos cement factory.

Operation	Instrument used for sampling.	Dust concent in mp/cft. Average and range.
Grinding	(a) Midget Impinger	15 7 (9 6—27 2)
	(b) Thermal Precipitator	17.5 (11 5—23 5)
Beater House (pouring of asbestos)	Thermal Precipitator	43 9
Cement asbestos mixing	Thermal Precipitator	338.8 (315.4—362.3
Filing	Midget Impinger	5.1 (4 15—5 9)
Sawing (with dust extractor)	(a) Midget Impinger	21.7
	(b) Thermal Precipitator	64 5 (56 7—72 3)
Sawing (with dust extractor)	Midget Impinger	11.6 5 8—14 8

In all the samples the dust concentration was more than maximum allowable concentration (threshold limit values)

Table II

Size distribution of airborne dust in the various operations of the asbestos cement factory.

(Sampling instrument : Thermal Preciptator)

Operations	Average percentage in size ranges		
	0.5—5 μ	5—10 μ	10—12 μ
Grinding and Shovelling	93.3	4 5	2 2
Asbestos pouring & mixing with cement (Beater House)	94.2	4.6	1.2
Cement Feeding	96 75	2 45	0 8
Sawing	96 3	2 9	0.8

Governmental Industrial Hygienists (Houston Texas), 1955 :—The maximum allowable concentration is 5 million particles per cu ft. of air. Also about 93% of the particles of airborne dust in the working environment of different dusty processes were within the most vulnerable range of 0.5 to 5 microns.

Medical Study

The medical study consisted of :—

(a) Clinical examination

(b) Sputum examination

(c) Vital Capacity determination

(d) Radiological examination of a selected group of workers exposed to asbestos dust for long time

The study group consisted of 51 workers (20% sample)—asbestos workers selected from the processes with exposure to asbestos dust. None of these workers had any history of exposure to any other occupational dust.

Age distribution : Table III shows the age distribution of the workers in the study group Majority of the workers (73%) were in the age group 31 to 50 years.

Table III

Age distribution of the workers.

Age in Years	Number	Percentage
30 and less	11	21
31 to 40	22	43
41 to 50	14	28
51 and above	4	8

Duration of exposure : Table IV shows the duration of exposure of the workers to asbestos dust in working environment. It is found that majority of the workers (90%) studied were exposed to asbestos dust continuously for a period over 5 years.

Table IV

Period of exposure to asbestos dust.

Length of exposure	Number	Percentage
Less than 5 years	5	10
5 to 10 years	27	53
More than 10 years	19	37

Clinical findings : Table V shows the clinical findings of the workers under study. 41% of the study group had dyspnoea, 31% cough. 30% showed lung crepitations particlularly at the basal region, while 5% showed some tendency to clubbing of fingers and one case showed cyanosis with tendency to right heart failure.

Table V

Clinical signs and symptoms

Signs and symptoms	Number	Percentage
Dysponea	21	41
Cough	16	31
Lung crepitations	15	30
Clubbing of fingers	3	5
Cyanosis	1 (?)	2

Sputum examination : 19 workers amongst the study group had expectoration of some sort during the course of the study and examination of their sputum showed the presence of typical asbestos bodies in each and all of them.

Vital Capacity Determination : To measure the vital capacity, a D. R. P. und Auslando patente field spirometer was used. Highest of the three direct readings made in the morning with worker standing was recorded in each case.

Low values of vital capacity at BTPS (less than 71% predicted) were found in 29 out of 51 asbestos workers i e. 28% as compared to the norm arrived at by Rao et al i e. 3.60 litres B. T. P. S. for Indian males of all ages.

Radiological Examination : 49 workers of the 51 under study were radiologically examined for the chest. Table VI shows the summary of the positive X'ray findings

Table VI

Radiological findings.

Type	Number
General haziness of the lung fields	3
Fine mottling of the lung fields particularly in the lower zones	6
Coarse granular mottling of lung fields and beyond the lower zones	4

13 out of 49 (27%) workers x'rayed had positive radiological findings. In 3 cases there was general haziness of the lung fields giving some sort of ground glass appearance. In 6 cases there was fine mottling of lung fields while in 4 the mottlings were of coarser type and spread beyond the lower zone but the apices were free. In addition in two cases, there was some cardiac enlargement. Scattared calcified spots were seen in 4 cases. No case of carcinona of lungs or pulmonary tuberculosis was detected radiologically.

Discussion

Estimation of airborne dust concentration at different sections of the factory showed that it was several times higher than the maximum allowable concentration (threshold limit values) of 5 million particles per cu. ft. of air of the working atmosphere. The determination of particle size also showed that over 93% of the particles encountered in the working atmosphere was within the range of 0.5 to 5 microns, which is potentially harmful to the lung.

Majority of the workers under study (90%) were continuously exposed to asbestos dust for a period of five years and more.

About 28% of the workers under study showed vital capacity less than 74% of the standard value for Indian males at B, T. P. S. i. e. 3.60 litres. The diminished vital capacity was corroborated by clinical findings. 41% complained of dyspnoea, 31% cough with expectoration, while 30% when examined showed lung crepitations particularly at the basal region. Only 4 cases showed (7%) showed some tendency to clubbing ; there was cyanosis in one case.

All the 19 cases with expectoration showed typical asbestos bodies, indicating that asbestos dust was being inhaled and retained in the lungs for sufficient period of time.

Radiological findings confirmed the clinical signs and symptoms. 13 cases out of 49 X'rayed (26%) showed the typical mottling of the lung fields of varying degrees.

Summary

An investigation was conducted to ascertain the incidence of asbestosis amongst workers, if any in an environment with asbestos dust.

Working environment contained dust particles above the maximum allowable concentration for asbestos dust and of potentially harmful particle size.

30% of the workers under study, who had exposure to the dust for 5 years or more showed clinical signs and symtoms of asbestosis ; while in 26% the clinical findings were corroborated with both radiological findings and lowered vital capacity.

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