NATIONAL STUDY

ON

OCCUPATIONAL SAFETY, HEALTH AND

WORKING ENVIRONMENT

IN

ASBESTOS-CEMENT PRODUCT INDUSTRIES

DIRECTORATE GENERAL FACTORY ADVICE SERVICE & LABOUR INSTITUTES
GOVERNMENT OF INDIA, MINISTRY OF LABOUR AND EMPLOYMENT
MUMBAI

2019

EXCEUTIVE SUMMARY

*Director General Factory Advice Service and Labour Institutes (DGFASLI), Ministry of Labour and Employment, Government of India carried out a "**National Study on Occupational Safety, Health and Working Environment in Asbestos Cement Product Industries"** to find out the status of safety, health and hygiene and detect the cases of asbestosis and asbestos related disorder. The study was conducted from November, 2018 to February, 2019 covering 50 functional asbestos cement product industries of the country. It was subsequently followed up by an interventional study from June to August, 2019 to further investigate the suspected cases of asbestos related disorders, detected during the study based on the reports of the X-ray chest PA view. During the Intervention Study, non-invasive High Resolution CT (HRCT) Scan was carried out amongst the suspected cases to take up for further investigation.*

A total number of 2603 out of 3791 workers including permanent and contract asbestos fibre exposed workers in 50 Asbestos Cement Product Industries were subjected to medical examination and investigation. Ten (10) cases were concluded as suspected cases of Asbestosis/Asbestos related disorders with abnormal X-ray findings. 531 asbestos fibre exposed workers were found to have PFT abnormalities but PFT is a non-specific diagnostic test for asbestos related disorders. HRCT of the suspected cases of asbestosis/asbestos related disorders was carried out during intervention study. Out of which 4 workers are identified as having asbestos related disorder subject to further investigation. HRCT of one suspected case was not available thus could not be investigated.

A total number of 145 samples of airborne asbestos dust were collected from 50 Asbestos Cement Product Industries during the National Study. The concentration of asbestos fibres exceeded the permissible limit of exposure i.e. 0.1 fibre/cc in 15 industries which was ranging from 0.185 to 0.400 fibre/cc.

Existing engineering and administrative control system were reviewed in these with particular focus on type of dust collection system/ equipments, use of wet method/water spray, ventilation system, house- keeping, waste disposal and supply of PPE`s (Respiratory).

Based on the findings of the study several recommendations are given in the report to protect the workers from asbestosis/ asbestos related disorders and improve health, hygiene and safety status in asbestos cement products industries.

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1.0 INTRODUCTION:

Asbestosis is naturally occurring mineral fibre possessing unique insulating, heat and chemical resistant properties. It is used extensively over a century in different application for electrical and heat insulation, fire proofing, brake and clutch linings in automobile industry, construction etc. The workers who are working in industrial set-up using asbestos or asbestos containing materials are likely to suffer from serious diseases / disorders including lung cancer, asbestosis and mesothelioma.

Asbestosis is present in nature broadly in two groups, i.e. serpentine and amphibole constituting six different mineral types. All six material types are known to be human carcinogen. Government of India has stipulated stringent statutory provisions under the Factories Act, 1948 for the use of asbestos in industry.

It is estimated by the World Health Organisation (WHO) that about 125 million people in the world are exposed to asbestos at the work place. Asbestos related lung cancer, mesothelioma and asbestosis from occupational exposure resulted in 1,07,000 deaths and 15,23,000 Disability Adjusted Years (DALYS).

Public concern and mobilisation against the use of asbestos over a period of time has compelled different countries to ban it or severely restrict its use or phase it out over a specified period of time.

In view of the above, Director General Factory Advice Service and Labour Institutes (DGFASLI), Ministry of Labour and Employment, Government of India carried out a National Study on Occupational Safety, Health and Working Environment in Asbestos Cement Product Industries to find out the status of safety, health and hygiene.

The study was conducted during the period from November, 2018 to February, 2019 covering 50 functional asbestos cement product industries of the country, the findings of which are presented in the present report.

2.0 COMPOSITION OF THE STUDY TEAM:

The National Study covered 50 Asbestos Cement Product Industries across the country. Therefore, region-wise 4 teams were constituted by DGFASLI involving Officials of different Regional Labour Institutes at Faridabad, Kanpur, Kolkata, Chennai and Central Labour Institute, Mumbai under the Chairmanship of Dr. S. K. Haldar, Deputy Director General, DGFASLI. The composition of the team is as follows:-

1. Central Labour Institute, Mumbai:

a) Dr. S. N. Banerjee, Director (IH) - Member
b) Dr. D. Kolekar, Dy. Director (IM) - Member
c) Shri R. Shukla, Asstt. Director (ST&P) - Member
d) Shri A. K. Singh, Asstt. Director (IH) - Member
e) Shri A. Jambhe, Asstt. Director (Safety) - Member
f) Shri M. Kasula, Adl. Asstt. Director (Safety) - Member
g) Shri V. G. Bansode, SSA (IH) - Member

2. Regional Labour Institute, Faridabad & Kanpur:

a) Dr. Brij Mohan, Dy. Director (IH) - Member
b) Dr. S. Saini, Dy. Director (Medical) - Member
c) Dr. Arkaprabha Sau, Dy. Director (Medical) - Member
d) Shri K. Srivastava, Asstt. Director (Safety) - Member
e) Shri V. M. Markar, Asstt. Director (IH) - Member
f) Shri P. S. Satpute, Asstt. Director (IH) - Member
g) Shri Sanjeev Kumar, AAD (Safety) - Member
h) Shri Om Prakash, JSA (IH) - Member

3. Regional Labour Institute, Chennai:

a) Shri G.P. Nijalingappa, Director (Safety) - Member
b) Dr. Anjani Kumar, Dy. Director (Medical) - Member
c) Dr. N.S. Gedam, Asstt. Director (IH) - Member
d) Shri Gnana Sundaram, AAD (Safety) - Member
e) Shri C. Rengraj, SSA - Member

f) Shri G. Vasu, JSA - Member

4. Regional Labour Institute, Kolkata:

a) Dr. Sushant Kumar, Dy. Director (Medical) - Member
b) Dr. S. M. Chaugule, Dy. Director (IH) - Member
c) Shri N. B. Rashamwar, Asstt. Director (Safety) - Member
d) Shri Meena Harikesh, AAD (Safety) - Member
e) Ms. Ruby Maity, SSA (IH) - Member
f) Shri S.K. Pine, Lab. Asstt. (IH) - Member

3.0 INTERVENTION STUDY

In order to further investigate the suspected cases of asbestos related disorders detected during the study based on the reports of the X-ray chest PA view, the Competent Authority constituted a central team for Intervention Study. During the Intervention Study, non-invasive High Resolution CT (HRCT) Scan was carried out amongst the suspected cases. This intervention study was conducted from the month of June to August, 2019.

4.0 NATIONAL STUDY ON STATUS OF WORK ENVIRONMENT IN ASBESTOS PRODUCTS MANUFACTURING INDUSTRY: PAST INITIATIVE OF DGFASLI

DGFASLI is consistently striving to promote safety and health in industry. DGFASLI carried out a National Study to determine the status of work environment in Asbestos Products Manufacturing Industries in 2005. The findings of the above study indicated that the levels of air-borne asbestos fibres were comfortably low in industrial units having in-built environmental control measures and good work practices whereas in other units the levels were comparatively high. However, it has been noted that the air-borne level of asbestos in different AC sheets industrial units covered during the national study were within the permissible limit of exposure for 8 hours time weighted average i.e. 1 fibre / cc.(as prescribed at that time in Second Schedule under Section 41F of the Factories Act).

5.0 OBJECTIVES

The National Study in Asbestos Cement Industries was carried out with the following objectives:

5.1 To identify and evaluate morbidity as a result of asbestos fibre exposure among the workers by suitable medical examination & investigations.

5.2 To diagnose the disease / disorders caused by the inhalation of asbestos fibres including radiological and pulmonary abnormalities.

5.3 To suggest suitable measures to control morbidity among the workers exposed to asbestos fibres.

5.4 To assess the levels of airborne concentration of asbestos fibres in work environment in different Asbestos Cement Product Industries with a view to determine the status of workplace environment determine the status of workplace environment with regard to safety and health measures.

5.5 To survey the existing safety control measures adopted by the industry for prevention and control of 'Asbestosis/asbestos related disorder'.

5.6 To suggest suitable preventive and control measures where necessary to improve the safety, health and workplace environment in Asbestos Cement Product Industry.

6.0 BRIEF DESCRIPTION OF ASBESTOS SHEETS AND PIPE MANUFACTURING PROCESS

Cement, Fly Ash, Asbestos Fibres, Water & Cotton Rag Pulp are the raw materials for the manufacture of asbestos sheets and pipes. Raw Chrysotile asbestos received in palletized and pressure packed in HDPE bags are fed into the bag opening device under negative pressure. The fibre is milled where water is added to prevent the dissipation of dust. The milled fibre is mixed with water and pumped into the storage tank called beater. Proportionate quantity of cement and fly ash is added to make slurry and resulted slurry is discharged and stored in the storage tank.

The slurry is fed into the sheet forming machine where the excess water is removed by vacuum and the material comes in the form of wet thick sheet which is then cut into required size, dried and sent for curing.

Curing is done by water spraying for about 20 days. Thereafter the sheets are finished and subject to quality control test and sent to warehouse.

The process of pipe making is similar to that of sheets. Asbestos cement films are wrapped on steel mandrel under pressure. After forming the desired thickness, asbestos cement pipe with steel mandrel is transferred to dwell conveyor. Pipe is separated from mandrel and passed through a heating chamber or directly to the sunlight for drying. After drying, the pipes are cured for 21 days. Thereafter, the edges of the pipes are trimmed and mechanized at finishing stage.

Process flow charts of the Asbestos cement sheet and pipes are enclosed as **Annexure- I.**

7.0 ASBESTOS FIBRES: HEALTH HAZARDS AND PERMISSIBLE LIMIT OF EXPOSURE

Asbestos fibre is a collective term for some of the metamorphic, fibrous, mineral silicate of the serpentine and amphibole groups. They have different physical and chemical properties, but share a fibrous form or habit.

Asbestos, a mineral fibre, exists mainly in two forms, i.e. Serpentine group (Chrysotile) and Amphibole group (Crocidolite, Actinolite, Amosite, Tremolite and Anthrophylite).

Asbestos has unique properties, i.e. it is resistant to heat, acids and chemicals. Because of its unique property and economic affordability, asbestos is widely used in asbestos cement products, friction materials, brake lining, thermal insulation of pipes, insulation of electric equipment, corrugated sheet for roofing, boilers including boards for fire protection, fire fighting jackets etc.

7.1 Asbestos-related diseases/disorders:

7.1.1. Asbestos wart: When asbestos fibres get into the skin as a result of abrasion, they provoke a low grade inflammatory reaction with

hyperkeratosis which eventually swells out, taking the fibres with it and leaving no scar.

7.1.2. Pulmonary Fibrosis (Asbestosis): In the early stage, asbestos fibres accumulate in those alveoli which open directly off the bronchioles. They penetrate the wall and produce a low grade inflammatory response followed by fibrosis. This causes thickening and some narrowing of the terminal airways which is picked up as a reduction of gas transfer and compliance on lung function testing. Fibres migrate away from these centrilobular foci into the interstitial between the alveoli and towards the pleura, causing extension of the low-grade inflammatory response and interstitial fibrosis.

The inflammation and interstitial fibrosis interferes with ventilation by making the lung rigid and lead to shrinkage of the affected area with honeycomb change. The change affects only the periphery of the lung and leaves the central part undamaged, but this normal lung is of little functional value as it is held immobile by the surrounding damage. Lavage of the airways yield increased numbers of polymorphs and other inflammatory cells and also asbestos fibres & asbestos bodies.

Asbestosis gives rise to no specific symptoms or signs apart from the inspiratory crepitations on auscultation. The patient will complain of very gradually increasing breathlessness, but unless he is a smoker, he will have no cough or sputum until the disease is very advanced. Before this he may complain of tightness in the chest or inability to breathe in fully. The major cause of death in individuals with asbestosis is malignancy, i.e. primary lung cancer or mesothelioma.

The earliest abnormalities are usually found in both lower zones near the costophrenic angles. The first perceptible changes consist of more fine vessel opacities than are normal in these regions with thickening of the vascular markings where they branch and divided. The linear opacities which look like extensions of vascular markings may reach the periphery, often over each other to give a net-like appearance.
As the asbestosis progresses, linear and irregular opacities become thicker

and spread into the middle zones and rarely reach the upper zones.

7.1.3 Radiological Findings:

The radiological manifestations that are commonly encountered in the cases exposed to asbestos fibres are as follows:

7.1.3.1 Pulmonary Fibrosis:

a) More fine vessel markings than normal may be visible.
b) The markings tend to be thickened where they branch and divide, a small triangular shade filling in the space between two branches.
c) The vessels may maintain the same calibre for the last 2-3 cms. and extend right up to the pleura.
d) Fine nodules can be seen along some of the smallest vessels. They are usually about 1 mm in diameter and are not very dense, but sometimes they are about 2 mm and have blurred outline.
e) A horizontal pattern may be the first sign and often closely resembles 'Kerley's B lines'.

7.1.3.2. Pleural Changes:

a) ***Fibrous Pleural Plaque*:** The characteristic lesion of pleural asbestosis is the plaque described by Thomson (1969) as a fibrotic process starting in the deepest part of the parietal pleura which later calcify (Dystrophic calcification). Plaques are of ivory white colour with a smooth or nodular surface and may be up to 1 cm in thickness.

b) ***Calcified Pleural Plaques*:** Pleural calcification is the most striking and characteristic abnormality in asbestosis.

- The commonest is multinodular type, consisting of round dots of 2-3 mm diameter arranged in groups and tending to run together.
- Thick linear shadows are often seen particularly in the axillary regions, mainly running vertically or following the direction of the ribs.
- Irregular ring shadows occur due to circumferential calcification in a circular plaque, but they do not usually resemble cavities.

- Peripheral calcification is referred by Sluis-Cremer (1965). Many irregular shapes occur, to which the title "Holly Leaf" was given by Hourichane et al (1966).
- Very occasionally the calcification is in the form of thick lines which are grouped together in such a way as to resemble vessel marking, particularly when they occur in the mid zones near groups of vessel of similar calibre.
- Any vessels of unusual density should be investigated by an oblique film. Irregular shaped calcification can easily be mistaken for vessel markings.
- Bilateral calcified plaques are at most diagnostic of previous exposure to asbestos.

c) ***Diaphragmatic Plaques:*** The diaphragm is a common site for pleural plaque. On a PA chest film, plaques usually affect the middle third of each hemi diaphragm. Most fibrous plaques are rounded or button shaped and may be confused with the normal polycyclic outline of the diaphragm due to uneven muscle contraction, which is often confined to the outer half of the diaphragm and is more often seen on the right side. Diaphramatic calcification is most easily seen on lateral chest films, usually appearing as thin line along the dome and starting just behind the heart.

7.1.3. Other Clinical manifestations of exposure to Asbestos fibres:

a) Hyaline Plaques of the parietal pleura.
b) Benign pleural effusion.
c) Diffuse mesothelioma of pleura and peritoneum.
d) Lung cancer: It has been estimated that cigarette smokers are 8 – 20 times more likely to develop lung cancer (synergistic effect) than lifelong non-smokers and that the extend of this risk correlate closely with the number of cigarette smoked.
e) Laryngeal cancer

7.1.5. Permissible limit of exposure for asbestos fibre:

Factories Act, 1948 has provided permissible limit of exposure for certain chemical substances including asbestos in Second Schedule under Section

41 F. An amendment was made in 2013 which is known as Factories Act (Second Schedule) Amendment Act, 2013 revising the permissible limit of some chemicals including asbestos and has described for PLE for asbestos - 8 hours time weighted average as follows:

Amosite: 0.1 fibre / cc
Chrysotile: 0.1 fibre / cc
Crocidolite: 0.1 fibre / cc

The fibres should be greater than 5 micrometre in length and less than 3 micrometer width with a length to width ratio equal to or greater than 3:1.

8.0 STATUTORY PROVISIONS ON SAFETY & HEALTH:

8.1 The First Schedule under Section 2 (cb) of the Factories (Amendment) Act, 1987 enlists Industries involving hazardous process where in the absence of special care or cause material impairment of the health in the persons engaged in or connected therewith or result in the pollution of general environment. In view of this, the asbestos fibre related work in asbestos cement product industries is identified as "Hazardous Process". Again under Section 41C of the Act, the Occupier of the factory is assigned to specific responsibility in relation to hazardous process. It involves:

(a) Maintenance and update of health record of workers.

(b) Medical examination of every worker.

(c) Appointment of competent person.

According to the Third Schedule and section 89 of the Factories Act, Asbestosis comes under the list of Notifiable Occupational Diseases. It is also compensable under the Employee's Compensation Act, 1923 and ESI Act, 1948.

8.2 The occupier of the factory carrying a 'Hazardous Process' shall provide and maintain in good order in Occupational Health Centre with the service and facilities as per scale laid down under Factories Act.

8.3 Model Rules are framed by DGFASLI under the Factories Act. Schedule XIV has been provided in Model rules under section 87 on Handling and Processing of Asbestos, Manufacture of any Article or Substance of Asbestos and any other Processes of Manufacture or otherwise in which Asbestos is used in any Form. It provides the detail guidelines on various aspects of safety and health for asbestos handling, the copy of the schedule is appended as an **Annexure -II** for reference to the asbestos cement product industry.

9.0 METHODOLOGY:

9.1 The study was planned in Asbestos Cement product industries of all the States and Union Territories in such a manner that it can cover comprehensively occupational safety, health and hygiene in all operational units across the country. The study has covered 50 Asbestos Cement product industries in different states and union territories, the details of which are presented in **Table 1**.

Table 1

STATE WISE DETAILS OF ASBESTOS CEMENT PRODUCT INDUSTRIES (ACPI) IN INDIA.

S.No.	State	No. of ACPI	No. of unit covered during the survey
1.	Andhra Pradesh	05	04
2.	Assam	03	03
3.	Bihar	01	01
4.	Chhattisgarh	01	01
5.	Dadar Nagar Haveli	01	01
6.	Gujarat	05	03
7.	Haryana	01	01
8.	Delhi	01	NIL
9.	Jharkhand	01	01
10.	Karnataka	02	02

11.	Madhya Pradesh	05	02
12.	Maharashtra	09	05
13.	Orissa	04	04
14.	Rajasthan	12	05
15.	Tamil Nadu	07	04
16.	Telangana	02	02
17.	Uttar Pradesh	07	06
18.	Uttrakhand	02	01
19.	West Bengal	08	04
Total		**77**	**50**

The industries covered under the study are coded from Unit 1 to 50.

9.2 ACPIs located in various States and UTs were advised to provide the following documents to facilitate the study:

- List of Asbestos Fibre exposed workers of the Industry.
- Good quality X-ray PA View of the asbestos fibre exposed workers in a machine having capacity more than 300 mA either digital or conventional method.
- Pulmonary Function Test Reports of the asbestos fibre exposed workers
- Work Environment Monitoring (asbestos fibre) report of the State or Central Pollution Control Board or recognized third party.

9.3 Good quality of X-ray Chest PA view is the specific diagnostic test for asbestos related lung disorders. Pulmonary Function Test (PFT) is a non-specific test. High Resolution CT Scan (HRCT) and Lung Biopsy are advisable, if required to the doubtful cases as a non-invasive and invasive confirmatory test respectively. Evaluation of x-ray and Pulmonary Function Test (PFT) of asbestos fibre exposed workers were done.

9.4 The team members from the medical division visited the workplace to observe the workplace health conditions of the workers. They conducted

the clinical examination of the exposed workers and noted the detailed history as per the medical format prepared for this National study **(Annexure-III).** The Team collected the X-ray chest PA view and Pulmonary Function Test of the exposed workers and evaluated.

9.5 An intervention study of the suspected cases of Asbestos related disorders was also carried out. During intervention study, Non-invasive HRCT (High Resolution CT Scan) was carried out for the suspected workers.

9.6 During the survey 2603 workers were medically examined out of 3791 exposed workers. The workers found to be suspected with asbestosis/asbestos related disorders are coded and represented during discussion as Worker Code varying from **Code A to J.**

9.7 Questionnaires were developed by the study team to collect basic information about the plant, processes and system that are existed in asbestos cement products industries, format of which are attached with report as **Annexure- VI & V**.

9.8 The work place monitoring was carried out in all the industrial units covered under the National Study to determine asbestos exposure amongst workers. The samples of air-borne asbestosis were collected from the Breathing Zone (within hemisphere of 1 feet centered around the mouth) as far as possible on 37 mm membrane filter paper mounted on filter cassettes with the help of battery operated personal samplers at the flow rate of 1 litre/min. The flow rate was adjusted as per requirement to get fibre densities on optimal range for accuracy and precision. Wherever it was not feasible to collect personal samples from the breathing zone, static samples of air-borne asbestos were collected along with the date of the activities/movement of workers so that their personal exposure on particular area/ operation could be predicted:

9.9 As far as possible repeat samples were collected from the work locations to get representative values of Time Weighted Average (TWA) asbestos exposure among workers in asbestos cement products industries. The collected samples were transported to the Industrial Hygiene Laboratory of the Central Labour Institute, Mumbai and RLIs for subsequent analysis.

9.10 The Membrane Filter Method as prescribed in the Second Schedule under Section 41 F was used to analyse and count asbestos fibres. The samples so collected on membrane filters during the study were rendered transparent (cleared) and mounted on glass microscopic slide using acetone-triacetin. The fibres on a measured area of the filters are counted usually using Phase Contrast Optical Microscopy using Olympus make Model No.CX-41 and the number of concentration of the fibres in the volume of air is calculated. During counting, fibres less than 3 micrometer in width, greater than 5 micrometer long with length to width ratio equal to or greater than 3:1 were counted.

9.11 The study team visited different plant areas of the each industrial units and gathered information about existing administrative and engineering control etc. for control of asbestos dust in the work environment.

10.0 GENERAL OBSERVATIONS:

The following observations were made the study team during the field visit to the industries:

10.1 It has been observed that the areas where asbestos pellets are handled and fibres are discharged into the mill in asbestos cement product industries are highly vulnerable for workers from asbestos exposure point of view.

10.2 In some industries storage area of asbestos fibre pellets were in confined area and were poorly ventilated. Such areas were having considerable asbestos dust due to unattended damaged pellets leading to risk of asbestos exposure among the workers.

10.3 The reclamation area of cutting of asbestos cement sheets or pipes emanates air-borne asbestos dust during cutting operation. The operation is usually carried out in open to air as result workers are likely to get exposure of asbestos dust during reclamation / cutting operations.

10.4 It has been observed during the study that the workers involved in different industrial units were using dust respirators and other protective equipments at the time of work.

10.5 It has been seen that the asbestos cement product industries are importing and using chrysotile asbestos (white variety) only for the manufacture of asbestos cement sheets and pipes.

11.0 RESULTS, DISCUSSIONS & FINDINGS OF THE STUDY:

11.1 Occupational Health:

11.1.1 A total number of 2603 out of 3791 workers including permanent and contract asbestos fibre exposed workers in 50 Asbestos Cement Product Industries were subjected to medical examination and investigation. The details of number of workers exposed, medically examined during the evaluation with the findings of abnormalities and suspected cases of asbestosis/asbestos related disorders etc. are presented in **Table 2.**

11.1.2 Ten (10) cases were concluded as suspected cases of Asbestosis/Asbestos related disorders with abnormal X-ray findings. 531 asbestos fibre exposed workers were found to have PFT abnormalities but PFT is a non-specific diagnostic test for asbestos related disorders. The results of medical evaluation are presented in summarised form in **Table - 3.** The details of suspected cases along with years of exposure etc. are presented in **Table 4.**

11.1.3 The intervention study was conducted for the suspected cases indentified during the study and the findings of which are given in **Table 5**. HRCT of the suspected cases of asbestosis/asbestos related disorders was carried out. It has been seen from **Table 5** that **4 workers** identified as worker code No. **D, E, G & I** out of 10 was revealed by HRCT as **asbestos related disorder subject to further investigation**. One suspected case having worker code No. **H** could not be examined due to non-availability of HRCT.

11.1.4 A total number of 145 samples are collected from 50 Asbestos Cement Product Industries during the National Study. The levels of air-borne Asbestos fibres as observed during the study are presented in **Table 6**. As seen from the table, the level of air-borne asbestos in various industries indicate that the concentration of airborne asbestos fibres in Asbestos Cement Product Industries where in-built environmental control measures are in place and good work practices followed, are quite low as compared to those units where such measures are unavailable. It has been observed from Work Environment Evaluation sheet that the airborne levels of asbestos fibres in 35 industries are found well within the PLE

i.e. 0.1 fibre/cc however the concentration of asbestos fibre has been exceeded than permissible limit of exposure for asbestos fibres in 15 industries. The concentration of asbestos fibres in these industries was ranging from 0.185 to 0.400 fibre/cc.

11.1.5. Status of existing safety system in Asbestos Cement Product Industries

A total no. of 50 Asbestos Cement Product Industries were evaluated and reviewed their control systems and work practices. The efforts were specifically focussed on to assess the type of Dust Collection System/ Equipments, Use of Wet Method/Water Spray, Ventilation system, House- keeping, Waste Disposal and Supply & Use of PPE`s (Respiratory). The unit wise observations are presented in **Table 7.**

12.0 RECOMMENDATIONS:

Based on general observations and findings of the study following recommendations are given to protect the workers from asbestosis/ asbestos related disorders and improve health, hygiene and safety status in asbestos cement products industries:

12.1 Health monitoring of asbestos exposed workers in asbestos cement product industry should be carried out at regular intervals for the identification of any effect of asbestos fibre in them. The abnormal findings detected by X-ray & HRCT of the workers should be dealt with appropriate statutes.

12.2 Asbestos fibre handling and processing in all Asbestos Cement Product Industries should be done with utmost care so as to avoid escape and emission of fibres in atmosphere.

12.3 Local Exhaust Ventilation:

a) Asbestos feeding, bag opening should be carried out by automatic or semiautomatic machines and conveyers.
b) Filter bags or the cyclone dust collecting system should be provided with automatic vibrators to prevent chocking.
c) Dust accumulated in the exhaust system and dust collectors should be clean periodically and the system maintained efficiently.
d) Fine fibres discharged from the dust collecting system should be checked periodically for performance and defects, if found any, should be rectified.

e) Asbestos dust and fibres deposited on plants, machinery and equipments and on the walls and floors should be periodically cleaned by vacuum cleaner.

12.4. Keeping in view the health hazards posed by exposure of Asbestos, it becomes imperative that all the units adopt and maintain efficient environmental control measures and good work practices to prevent the exposure of workers and achieve reduction in environmental asbestos fibres and maintain work place environment. The efficiency of ventilation system/dust control devices should be periodically monitored to maintain their effectiveness.

12.5 Storage and Handling of asbestos Bags:

a) Sharp edged, pointed devices or hooks should be avoided for loading, unloading and lifting of asbestos bags.
b) Cranes, conveyors, elevators/ forklifts should be used for handling of asbestos bags.
c) Bags torn/ damaged during handling should be immediately repaired/ sealed with adhesive tape. After repairs/ sealing the bags should be cleaned by using vacuum cleaner to remove adhering asbestos fibres.
d) Split asbestos in case of damage of bags should be collected in impervious bags and reused in the process.
e) Floor cleaning in asbestos storage, handling and processing areas should be done using vacuum cleaner.
f) Each and every bag must be cleaned by a vacuum cleaner before taking out from warehouse to the production floor.
g) Asbestos bags should be stored in a separate room away from the manufacturing plant.
h) Storage should be well ventilated with a separate entrance.

12.6 Plant Layout, Design and Ventilation:

a) Plant building should be well ventilated and have separate entrances and exits not connected with other department.
b) Inner surface of the walls and flooring of the building should be even, smooth and impressive to prevent adherence and accumulation of asbestos dust.

c) As far as possible, process and operations such as cutting of pipes, sheets and moulds, surface filling, turning etc. should be carried out under wet condition.

12.7 Work Uniform and Personal Hygiene:

a) Work uniforms made from smooth cloth and not having any pocket and folds should be provided to worker.
b) A room provided with exhaust system for workers to change their cloths.
c) Workers to de-duct their body and work uniform in a separate chamber before proceeding to canteen or home.
d) Contaminated uniform to be collected in a container and sent for laundry.
e) Workers should be properly instructed strictly not to eat and drink on the shop floor or smoke in the factory.
f) As for as possible non-smokers should be employed in the factory and smoking habits should be discouraged.

12.8 Environmental Monitoring:

a) Environmental monitoring should be periodically conducted at all dust emitting locations/operations.
b) Equipment and method used for environmental monitoring should follow standards, test procedures and calibrations.

12.9 Personal Protective Equipments:

a) The workers engaged in asbestos handling and processing area should be provided with dust respirators.
b) Workers engaged in filing, drilling, trimming and cutting of asbestos cement sheets/pipes also should be provided with dust respirators.
c) Workers should be educated and trained about the health hazards, safe handling of asbestos and use of PPEs.
d) Cautionary notice board in local language should be displayed at appropriate place.

12.10. The workers in ACPI should be trained and educated from time to time to generate awareness among the them about the health hazards of asbestos, safety in handling and processing of asbestos fibres, housekeeping,

disposal of waste material, use, care and maintenance of personal protective equipment etc.

13. CONCLUSION:

Asbestos cement product industries should maintain sound system for controlling the airborne asbestos to protect the workmen from asbestosis and asbestos related disorders. The periodical medical surveillance and work place monitoring, use of PPE at the time of work and awareness programmes for handling and use of asbestos etc should be ensured by the management for ensuring safety & health in the plant.

13. ACKNOWLEDGEMENT:

We are thankful to the management and employees of Asbestos Cement Product Industries for their support and cooperation during the study.

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7. IS11451: 1986- Recommendations for Safety and Health Requirements relating to Occupational Exposure to Asbestos.
8. IS11767: 2005- Recommendations for cleaning of premises and plants using Asbestos Fibres.
9. IS11768: Recommendations for disposal of Asbestos Waste Material.
10. IS11769: 1987 (Part-1)- Guidelines for safe use of products containing Asbestos (Part-1 Asbestos Cement Products).
11. IS 12078: 1987- Recommendations for Personal Protection of workers engaged in Handling Asbestos.
12. IS12079: 1987- Recommendations for Packaging, Transport and Storage of Asbestos.
13. 12080-1987- Recommendations for Local Exhaust Ventilation System in premises manufacturing products containing Asbestos.
14. Report on Occupational Health Study at an Asbestos cement product industry: Conducted by Regional Labour Institute, Kolkata in the year 2003.
15. National Study on Status of Work Environment in Asbestos Products Manufacturing Industry : Industrial Hygiene Division, DGFASLI, Sion, Mumbai: 2005.
16. Model Rules framed under the Factories Act , DGFASLI, Mumbai.

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Table 2

DETAILS OF OCCUPATIONAL HEALTH EVALUATION OF THE EXPOSED WORKERS IN ASBESTOS CEMENT PRODUCT INDUSTRIES

Sl. No.	Code of the Industry	No. of Asbestos exposed Workers	No. of Asbestos exposed workers medically evaluated	No. of Workers detected with abnormal findings			Code of suspected cases of Asbestos related Diseases/Disorders
				PFT (Non-specific)	X-Ray	Others	
1.	**Unit-1**	27	27	NIL	1	NIL	**A**
2.	**Unit-2**	94	94	26	1	NIL	**B**
3.	**Unit-3**	66	59	NIL	NIL	NIL	**–**
4.	**Unit-4**	37	34	4	NIL	NIL	**–**
5.	**Unit-5**	55	53	24	1	NIL	**C**
6.	**Unit-6**	87	87	3	NIL	NIL	**–**
7	**Unit-7**	46	46	27	NIL	NIL	**–**
8	**Unit-8**	18	18	16	02	NIL	**D & E**
9	**Unit-9**	06	06	NIL	NIL	NIL	**–**
10	**Unit-10**	100	100	12	02	NIL	**F & G**
11	**Unit-11**	96	96	PFT Report cannot be accepted on	01	NIL	**H**

				technical ground.			
12	**Unit-12**	04	04	01	NIL	NIL	**–**
13	**Unit-13**	02	02	NIL	NIL	NIL	**–**
14	**Unit-14**	05	05	PFT Report cannot be accepted on technical ground.	NIL	NIL	**–**
15	**Unit-15**	55	55	11	NIL	NIL	**–**
16	**Unit-16**	22	15	1	NIL	NIL	**–**
17	**Unit-17**	86	76	5	NIL	NIL	**–**
18	**Unit-18**	52	25	NIL	NIL	NIL	**–**
19	**Unit-19**	99	99	21	NIL	NIL	**–**
20	**Unit-20**	498	498	38	NIL	NIL	**–**
21	**Unit21**	173	173	35	NIL	NIL	**–**
22	**Unit-22**	100	62	35	1	NIL	**I**
23	**Unit-23**	39	33	1	NIL	NIL	**–**
24	**Unit-24**	100	90	25	NIL	NIL	**–**
25	**Unit-25**	160	160	29	NIL	NIL	**–**
26	**Unit-26**	60	43	31	NIL	NIL	**–**
27	**Unit-27**	105	95	19	NIL	NIL	**–**

28	**Unit-28**	50	50	01	NIL	NIL	**–**
29	**Unit-29**	32	28	NIL	NIL	NIL	**–**
30	**Unit-30**	25	19	NIL	NIL	NIL	**–**
31	**Unit-31**	11	08	NIL	NIL	NIL	**–**
32	**Unit-32**	22	20	NIL	NIL	NIL	**–**
33	**Unit-33**	80	78	01	01	NIL	**J**
34	**Unit-34**	25	24	NIL	NIL	NIL	**–**
35	**Unit-35**	20	15	NIL	NIL	NIL	**–**
36	**Unit-36**	25	21	NIL	NIL	NIL	**–**
37	**Unit-37**	35	33	01	NIL	NIL	**–**
38	**Unit-38**	35	31	01	NIL	NIL	**–**
39	**Unit-39**	8	8	2	NIL	NIL	**–**
40	**Unit-40**	150	25	14	NIL	NIL	**–**
41	**Unit-41**	130	18	14	NIL	NIL	**–**
42	**Unit-42**	166	23	22	NIL	NIL	**–**
43	**Unit-43**	150	20	13	NIL	NIL	**–**

44	**Unit-44**	32	13	4	NIL	NIL	**–**
45	**Unit-45**	65	25	19	NIL	NIL	**–**
46	**Unit-46**	100	18	23	NIL	NIL	**–**
47	**Unit-47**	120	25	13	NIL	NIL	**–**
48	**Unit-48**	130	25	9	NIL	NIL	**–**
49	**Unit-49**	72	15	16	NIL	NIL	**–**
50	**Unit-50**	116	8	14	NIL	NIL	**–**

Table: 3

SUMMARY OF MEDICAL EVALUATION OF EXPOSED WORKERS

IN ASBESTOS CEMENT PRODUCT INDUSTRIES

Total no. of factories covered	Total no. of exposed workers	Total no. of workers medically evaluated	Total number of workers detected with abnormal		Total no. of suspected cases of Asbestosis	Samples collected for Work Environment Monitoring		
			PFT (Nonspecific)	X-Rays		Within PLEs	Beyond PLEs	Total
50	3791	2603	531	10	10	125	20	145

Table:4

DETAILS OF SUSPECTED CASES OF ASBESTOSIS /ASBESTOS RELATED DISORDERS IN ASBESTOS CEMENT PRODUCT INDUSTRIES

Sl. No.	Industry code of present service	Code of Suspected Cases of workers	Total Years of Asbestos Exposure		Over time done by the workers	Working Area of the worker	Environmental Asbestos Concentration Level measured (PLE = 0.1 F/CC)		Preventive Safety Measures in existence	USE OF PPE among the workers with observation if any
			Present	Past #			Area of Working	Highest PEL		
1	**Unit-1**	**A**	8 Yrs	Nil	No.	Maintenance	Within limit	Within limit	Wet Process, Bag Filters, Local Exhaust System	Dust Mask, Hand Gloves
2	**Unit-2**	**B**	10 Yrs	Nil	No	Administration	NA	Within limit	Bag Filter, Wet Process,	Dust Mask Hand Gloves
3	**Unit-5**	**C**	3 Yrs	16 Yrs	Occasio-nally	Supervisor	Exceeded Limited	Exceeded Limit	No local exhaust system , Manual handling, Wet Process, Poor Housekeeping	Occasionally Using Dust Mask
4	**Unit-8**	**D**	32 Yrs	Nil	Nil	Supervisor	Exceeded Limited	Exceeded Limit	Wet Process, Bag Filters, Very Poor Housekeeping	Dust Mask, H. Gloves, Poor Awareness
5		**E**	39 Yrs	Nil	Nil	Crane Operator	Exceeded Limited	Exceeded Limit	-do-	-do
6	**Unit-10**	**F**	30 Yrs.	Nil	Nil	S r. Operator	NA	Exceeded Limit	Wet Process, Bag Filters, Local	Hand Gloves, Dust Mask,

									Exhaust System, Poor Housekeeping	Poor Awareness
7		**G**	28 Yrs	Nil	Nil	Operator	NA	Exceeded Limit	-do-	-do-
8	**Unit-11**	**H**	02 Yrs (DOJ: 03/03/18)	Nil	Nil	Security Guard	NA	Within limit	Wet Process, Bag Filters, Local exhaust System, Manual Operations	Hand gloves, Dust Mask, Poor Awareness
9	**Unit-22**	**I**	20 Years	Nil	No	Storage	Within limit	Within limit	Wet Process, Bag Filters, Local exhaust System, Poor Housekeeping	Dust Mask
10	**Unit-33**	**J**	10 Years	Nil	No	BOD	Within limit	Within limit	Wet Process, Bag Filters, Local exhaust System, Poor Housekeeping	Using Poor Quality Nose Mask, Hand Gloves

 # Past history of Asbestos Exposure recorded as per the information provided by the workers during field visit.

Table:5

FINDINGS OF INTERVENTION OCCUPATIONAL HEALTH STUDY OF SUSPECTED CASES

Sl. Nos.	Workers Code	Industry Code	X- ray findings of suspected worker	Finding of HRCT, subject to further investigation	Remarks
1	A	(Unit-1)	Asbestosis with CP Angle Obliteration (Rt) & Pleaural thickening (Rt)	No significant abnormality noted.	
2	B	(Unit-2)	Ill defined patchy haziness noted in right lower zone.	No significant abnormality noted.	
3	C	(Unit-5)	Multiple reticulo-nodular and irregular opacities seen in bilateral lower zones and right mid zone.	Essentially normal study.	
4	**D**	(Unit-8)	Irregular shadow noted in the lower 3rd of both lungs.	Calcified pleural plaques in bilateral costal pleura and diaphragmatic pleura.	
5	**E**		Irregular shadow noted in the lower 3rd of both lungs.	Ground glass haziness in bilateral lung fields and multiple bilateral pleural based plaques.	
6	F	(Unit-10)	Calcified diaphragmatic plaques noted on right side.	Smoking related small airways disease and apical pleural thickening on both side.	
7	**G**		Asbestosis with costophrenic angle obliteration both side with plural thickening.	Asbestos related benign pleural plaques and smoking related small airways disease.	

8	H	(Unit-11)	Calcified diaphragmatic plaques noted on right side.	_____	Investigation team advised HRCT for confirmation but it was not provided by the Management.
9	I	(Unit-22)	Asbestosis with costophrenic angle obliteration both side with plural thickening.	Pleural plaque with pleural thickening and calcification involving costal pleura predominantly b/l lower lobes, left 3^{rd}, 4^{th} intercostals space and 3^{rd},4^{th},5^{th} and 6^{th} intercostals space on right side and diaphragmatic pleura noted. Minimal changes of fibrosis in form of interstitial subtle thickening noted involving lingual segment of left upper lobe. Suggested change of Asbestosis likely.	
10	J	(Unit-33)	Pulling of the right dome of diaphragm by fibrotic bands and irregular opacities at lower zone of both side of the lung	No Significant Abnormality Detected.	

TABLE :6

CONCENTRATION OF AIR-BORNE ASBESTOS IN DIFFERENT WORK LOCATIONS IN

ASBESTOS CEMENT PRODUCT INDUSTRIES

Sl. No.	Code of the Industry	Air Sampling Locations	Avg. Concentration of Asbestos Fibre/CC	Permissible Limit of Exposure (PLE) for Chrysotile Asbestos Fibre = 0.1 fibre/cc * *(As per Factories Act,1948)
1	**Unit-1**	BOD Area	0. 076	Within Limit
		Mixing Area	0.030	
		Sheet Cutting Area	NIL	
2	**Unit-2**	BOD Area	0.045	Within Limit
		Mixing Area	NIL	
		Pulveriser Area	0.067	
		Ball Mill Area	NIL	
		Dust Collector Area	0.025	
3	**Unit-3**	**Ball Mill Area**	**0.175**	**Beyond Limit**
		BOD Area	0.058	Within Limit
		Pulveriser Area	0.092	
4	**Unit-4**	Ball Mill Area	0.058	Within Limit
		Carbo cutting area	NIL (wet Process)	

		Storage Godown	NIL	
		General Atmosphere	0.001	
5	**Unit-5**	Storage Godown	NIL	Within Limit
		BOD Area	**0.180**	**Beyond Limit**
		Mixing Area	**0.330**	**Beyond Limit**
6	**Unit-6**	Pulverising Area	0.076	Within Limit
		BOD Conveyer belt	NIL	
		BOD Door Opening	0.029	
		Near Edge Runner Mill Area	Nil	
7	**Unit-7**	BOD Area	0.067	Within Limit
		Milling Area	0.040	
8	**Unit-8**	**BOD Area**	**0.200**	**Beyond Limit**
		Pulveriser Area	**0.400**	**Beyond Limit**
9	**Unit-9**	Near Milling Machine	Nil	Within Limit
10	**Unit-10**	BOD Area-I	NIL	Within Limit
		Coupling Area	**0.204**	**Beyond Limit**
		Pipe Turning Area	NIL	Within Limit
		BOD Area-II	NIL	
11	**Unit-11 (1)**	BOD Area	0.090	Within Limit
		Ball Mill Area	0.036	
	UNIT-11 (2)	BOD Area	NIL	Within Limit
		Pulverising Area	0.061	

12	**Unit-12**	No Sampling	----------	----------
13	**Unit-13**	No Sampling-No BOD Machine	----------	----------
14	**Unit-14**	No asbestos Charging Operation	----------	----------
15	**Unit-15**	BOD Area	0.054	Within Limit
		Pulveriser	0.025	
16	**Unit-16**	**BOD**	**0.145**	**Beyond Limit**
17	**Unit-17**	BOD	0.092	Within Limit
18	**Unit-18**	**BOD**	**0.160**	**Beyond Limit**
19	**Unit-19**	BOD	0.051	Within Limit
20	**Unit-20**	BOD unit 2	0.016	Within Limit
		BOD unit 3	0.030	
21	**Unit-21**	**BOD**	**0.236**	**Beyond Limit**
22	**Unit-22**	BOD	0.071	Within Limit
23	**Unit-23**	**BOD**	**0.192**	**Beyond Limit**
		Pulveriser	**0.224**	**Beyond Limit**
24	**Unit-24**	Pulveriser area	0.050	Within Limit
25	**Unit-25**	**BOD**	**0.150**	**Beyond Limit**
		Pulveriser	**0.340**	

26	**Unit-26**	**BOD**	**0.171**	**Beyond Limit**
27	**Unit-27**	**BOD**	**0.213**	**Beyond Limit**
		Pulveriser	**0.149**	
28	**Unit-28**	BOD / Fibre Bag Loading Area	0.040	Within Limit
		De-Staker Area	0.020	
29	**Unit-29**	BOD Area	0.064	Within Limit
		Near wastes Grinding Area	0.070	
30	**Unit-30**	BOD Area	0.090	Within Limit
		Near wastes material cutting area	0.040	
		Near Carbo cutting area	**0.110**	**Beyond Limit**
		Near asbestos bag storage area	0.090	Within Limit
31	**Unit-31**	BOD Area	0.030	Within Limit
		Near asbestos bag storage area	0.070	
32	**Unit-32**	BOD Region	0.025	Within Limit
		Godown area	0.020	

33	**Unit-33**	BOD Area	0.040	Within Limit
		Near mixing and slurry making area	0.030	
		Near stapler Area	0.060	
34	**Unit-34**	BOD Area	0.046	Within Limit
		Ball mill scrap sheets cutting area	**0.120**	**Beyond Limit**
35	**Unit-35**	BOD	0.040	Within Limit
		Near hard ground wastes loading area	0.060	
		BOD Area	0.060	
36	**Unit-36**	BOD Area	0.060	Within Limit
		Near Wastes sheets loading area	0.020	
37	**Unit-37**	BOD Area (Unit-I)	0.040	Within Limit
		BOD Area (Unit-II)	0.060	
38	**Unit-38**	BOD Area	0.060	Within Limit

		Near Hard Wastes Cutting Area	0.080	
39	**Unit-39**	Not using Asbestos	----------	----------
40	**Unit-40**	BOD Area	0.031	Within Limit
		Fiber Godown	0.016	
41	**Unit-41**	BOD Area	0.047	Within Limit
		Fiber Godown	0.031	
42	**Unit-42**	BOD Area	0.047	Within Limit
		Fiber Godown	0.078	
43	**Unit-43**	BOD Area	0.078	Within Limit
		Fiber Godown	0.047	
44	**Unit-44**	**BOD Area**	**0.110**	**Beyond Limit**
		Fiber Godown	0.047	Within Limit
45	**Unit-45**	BOD Area	0.031	Within Limit
		Fiber Godown	0.031	

46	**Unit-46**	**BOD Area**	**0.110**	**Beyond Limit**
		Fiber Godown	0.047	Within Limit
47	**Unit-47**	BOD Area	0.031	Within Limit
		Fiber Godown	0.016	
48	**Unit-48**	BOD Area	0.063	Within Limit
49	**Unit-49**	Fiber Godown	0.047	Within Limit
		BOD Area	0.094	
50	**Unit-50**	BOD Area	0.078	Within Limit
		Fiber Godown	0.031	Within Limit

**** As per Amended Factories Act.**

***** For fibre greater than 5 µm in length and less than 3 µm in breadth with length to breadth ratio equal to or greater than 3:1**

****** As determined by the membrane filter method at 400-450 X magnification (4mm objective) phase contrast illumination.**

Table 7

STATUS OF SAFETY CONTROL SYSTEMS IN ASBESTOS CEMENT PRODUCT INDUSTRIES

Sr No	Code of the Industry	Asbestos Dust Generation Activity	Type Of Dust Collection System/ Equip.	Use Of Wet Method/ Water Spray	Ventilation system	House-keeping	Waste Disposal	Supply & Use of PPE`s-Respirator y	Recommendation
1	**Unit-1**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Natural ventilation	Satisfactory	Waste Recycled in process.	Cotton hand gloves, Rubber hand gloves, Apron and Dust mask provided but required to improve the awareness.	In Carbo-cutting machine safety guard and air plug to be provided.
2	**Unit-2**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit &	Bag filter	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural	Vacuum cleaning and wet mopping. Overall satisfactory.	Waste Recycled in process.	Hand gloves (cotton/ rubber), Gum boots, Dust mask provided but required to improve the awareness	Curtains to be provided below the cutting trolley of carbo cutting machine. Air plugs to be provided to the workers

		Waste Disposal			ventilation				working on crusher and carbo-cutting machine. Dust collector bags should be air tight.
3	**Unit-3**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Natural Ventilation provided	Using wet mopping and vacuum cleaning. Satisfactory	West recycled and processed in Pulveriser. Dry west collected in bags and stored in open go down.	Dust mask, hand gloves provided but required to improve the awareness	In use of PPEs required to increase the awareness and proper supervision especially in the Pulversing section to ensure the use of PPEs. West disposal should be converted into wet method.

4	**Unit-4**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with suction blower.	Wet Method process after BOD section	Natural Ventilation provided.	Wet mopping with vacuum cleaner provided. Poor & needs improvement.	Waste Recycled in process	Dust mask, Hand gloves provided but required to improve the awareness	Workers who exposed to high level of noise, ear plugs should be provide especially areas like pulversier and ball mill. Water jet should be provide on corbo-cutting machine to avoid dust exposure.
5	**Unit-5**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal Feeding of	Bag filter with Pneumatic Pulse Jet not available.	Wet Method process after BOD section	Natural ventilation	Poor	Not available	Dust Mask and hand gloves provided	Manual handling of the fibre bags at BOD as well as manual handlenig of loose fibre below BOD machine should be avoided. Local exhaust should be

		Asbestos is by manual method.							provided on BOD and Bag Shredding machine. Waste recycling method such as pulveriser, ball mill, etc. along with local exhaust system and dust bag filters for collection of the dust should be introduced.
6	**Unit-6**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with vacuum cleaner	Wet Method process after BOD section	Natural & Turbo ventilation	Satisfactory	Waste Recycled in process.	Dust mask, helmet and Safety shoes provided but required to improve the awareness.	Changing rooms for the workers should be provided as per Indian Standards.

7	**Unit-7**	Fiber preparation, Finishing operations within the factory, Handling of finished product, Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filters and vacuum cleaning pumps provided.	Wet Method process after BOD section	Natural ventilation	Satisfactory	Waste Recycled in process through Ball Mill.	Cotton hand gloves, Helmet and Dust mask provided.	In Ball Mill area manual grinding of waste sheets observed. All waste recycling system should be automated and in slurry form.
8	**Unit-8**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet & Waste Disposal	Bag filters available only for BOD area.	Wet Method process after BOD section but not up to mark	Natural ventilation	Very poor.	Fibre sheet waste collected and grinding manually. Then transported manually for recycling.	Hand gloves (cotton/ rubber), Dust mask provided but required to improve the awareness	All dust generated areas should be atomized. Housekeeping needs improvement. Change rooms for the workers should be as per Indian standards.

9	**Unit-9**	Fiber preparation	NIL	After fibre preparation all process is wet process.	Natural Ventilation	Not up to mark.	Manual collection of waste generated from fibre preparation area.	Dust mask, hand gloves provided but required to improve the awareness	Manual operation of Fibre preparation should be atomized.
10	**Unit-10**	Fiber preparation, Finishing operations within the factory, Handling of finished product, Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Natural ventilation along with Local Exhaust Ventilation system is available but efficacy of the system to be checked.	Poor	Waste Recycled in process through Ball MILL.	Cotton hand gloves, Rubber hand gloves, Apron and Dust mask provided but required to improve the awareness.	Dust collected from Bag filters are being transferred to BOD in dry state. It should be transferred to BOD in slurry form. Plant layout should be maintained and in order. Overall housekeeping needs improvement.

									In BOD bag entrance point is open and manual. It should be automated.
11	**Unit-11**	Fiber preparation, Finishing operations within the factory, Handling of finished product, Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Natural ventilation	Vacuum cleaning and wet mopping. Overall satisfactory.	Waste Recycled in process through Ball Mill.	Hand gloves (cotton/ rubber), Dust mask provided but required to improve the awareness	Pulverizer operation is manual. Crushed raw material is being transferred to Pulverizer manually. It should be automated.
12	**Unit-12**	Fiber preparation	NIL	After fibre preparation all process is wet process.	Natural Ventilation	Not up to mark.	Manual collection of waste generated from fibre preparation area.	Dust mask, hand gloves provided but required to improve the awareness	Changing room must be provided as per the standards.

13	**Unit-13**	Fiber preparation, Finishing operations within the factory, Handling of finished product.	Nil	Wet Method process	Natural Ventilation provided	Poor	Dry and wet Waste transferred to Milling area.	Dust mask provided but required to improve the awareness	In milling operation mixing of fibre and cement is manual. Automated BOD system should be installed.
14	**Unit-14**	Milling operation.	NIL	Wet Method	NIL	NIL	Waste Recycled in process	Not found	Operation found closed.

15	**Unit-15**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Needs Improvement	Waste Recycled in process	Dust mask provided but required to improve the awareness.	Floors should be regularly cleared of accumulated dust and waste Material.
16	**Unit-16**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with venture scrubber & Pulse Jet system	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Needs Improvement	Waste Recycled in process	Dust mask provided but required to improve the awareness	

17	**Unit-17**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Needs Improvement	Waste Recycled in process	Dust mask provided but required to improve the awareness	Access areas and passages to be regularly cleared of accumulated dust and waste Material.
18	**Unit-18**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Needs Improvement	Waste Recycled in process	Dust mask provided	Proper enclosure should be provided to avoid fibredust leakages in BOD section.

19	**Unit-19**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Good	Waste Recycled in process	Dust Mask provided	
20	**Unit-20**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Good	Waste Recycled in process	Disposable Dust Mask provided	Proper enclosure should be provided to avoid fibre dust leakages (carryback from conveyor belt for fibre feeding) in BOD section.

21	**Unit21**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Poor & needs improvement	Waste Recycled in process	Dust mask provided but required to improve the awareness	Reclamation /Pulverizeris not in operation but waste collected at place. Access areas and passages to be regularly cleared of accumulated dust and waste Material.
22	**Unit-22**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Poor & needs Improvement	Waste Recycled in process	Dust Mask provided	

23	**Unit-23**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Very Poor & needs improvement	Waste Recycled in process	Dust mask provided but required to improve the awareness	Water arrangement to be provided in pulveriser/reclamation while reuse of damaged/waste sheets. Access areas and passages to be regularly cleared of accumulated dust and waste Material.
24	**Unit-24**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Average, Needs improvement	Waste Recycled in process	Dust Mask provided	

25	**Unit-25**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Good	Waste Recycled in process	Dust Mask provided	
26	**Unit-26**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Good	Waste Recycled in process	Dust mask provided but required to improve the awareness	Proper enclosure should be provided to avoid fibre dust leakage in BOD section.Fibres are coming out of broken glass in BOD section.

27	**Unit-27**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with Pneumatic Pulse Jet cleaning	Wet Method process after BOD section	Local Exhaust Ventilation provided at dust generation points including natural ventilation	Good	Waste Recycled in process	Disposable Dust Mask, Safety Shoes & Helmet	Access areas and passages to be regularly cleared of accumulated dust and waste Material.
28	**Unit-28**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter	Wet Method process after BOD section	Natural ventilation /Turbo Ventilators	Satisfactory	Waste recycled byregistered waste management company M/s GEPIL	Cotton hand gloves, Rubber hand gloves, Apron and Dust mask provided but required to improve the awareness.	

29	**Unit-29**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag type dust collector	Wet Method process after BOD section	Natural Ventilation provided/Turbo Ventilators	Satisfactory (Using wet mopping and vacuum cleaning).	West is used in ball mill. Dry west is again grinded.	Nose mask (N 95), Safety Shoes, Helmets are provided but required to improve the awareness	West disposal should be converted into wet method.
30	**Unit-30**	Fiber preparation, Finishing operations within the factory, Handling of finished product,Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter with suction blower.	Wet Method process after BOD section	Natural Ventilation provided.	Wet mopping with vacuum cleaner provided.	Waste Recycled in process	Dust mask, Helmets, Safety Shoes, Hand gloves provided but required to improve the awareness	Workers who exposed to high level of noise, ear plugs should be provide especially areas like pulversier and ball mill.

31	**Unit-31**	Fiber preparation, Finishing operations within the factory, Handling of finished product, Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag Type dust collectors used.	Wet Method process after BOD section	Natural Ventilation provided.	Water Spraying is done, House keeping needs improvement	Recycled and reused	Dust mask, Helmets, Safety Shoes, Hand gloves provided but required to improve the awareness	
32	**Unit-32**	Fiber preparation, Finishing operations within the factory, Handling of finished product, Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag Type dust collectors used.	Wet Method process after BOD section	Natural Ventilation provided.	Satisfactory, Water sprinkling done on the floors, Vacuum Cleaners are used	Recycled and reused	Gloves, Shoes, Nose Mask are provided and workers were seen to use them	Ventilation at storage area needs to be improved
33	**Unit-33**	Fiber preparation, Finishing operations within the factory, Handling of finished product, Reclamation of	Bag filter with suction blower.	Wet Method process after BOD section	Natural ventilation & Roof ventilators	Housekeeping needs to be improved, Vacuum cleaners must be used in	Waste is recycled and residual of it is used for making boundary	Only ordinary Nose Mask and Cotton hand gloves are provided by	Washing places, Eating place must be designated. Safe operating procedures must be

		damaged/rejected sheet in pulveriser unit & Waste Disposal				place of brooms.	wall	the management. Advised for N95 Nose masks, Safety Shoes, Helmet & Apron.	displayed in language known by the majority of Workers. Pulveriser area needs immediate attention.
34	**Unit-34**	Fiber preparation, Finishing operations within the factory, Handling of finished product, Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag type dust collector	Water sprinkling and wet mopping	Natural ventilation & Roof ventilators	Satisfactory (Using wet mopping and vacuum cleaning).	No waste generation. Recycled and reused	Helmets and Nose masks of good quality are provided to each employee.	Broken sheet area may be taken care. SOP found displayed in English. Suggestions were given for improvement in pulverizer area ,Lockers and SOP in the hindi language.

35	**Unit-35**	Fiber preparation, Finishing operations within the factory, Handling of finished product, Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag Type dust collectors used.	Through Water tanker and Pipe line	Natural ventilation	Brooms found used for cleaning, needs to be improved	Waste is recycled in ball mill/ Pulveriser	Only nose masks and Helmets are provided to contract employees. Company employees are using safety Helmet, Nose Mask, apron, Safety shoes and gloves	Workers who exposed to high level of noise, ear plugs should be provided especially in pulversier and ball mill area. Suggestions wer given for SOP, Use of Vaccum cleaner, Facility of Canteen, First Aid boxes etc.

36	**Unit-36**	Fiber preparation, Finishing operations within the factory, Handling of finished product, Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter/ Cyclone filter	Wet Method process after BOD section	Natural ventilation	Dust filters found Chocked, Cleaning system, Lighting must be taken care	Waste is recycled in ball mill/ Pulveriser.	PPE' s i.e. Safety helmets, Nose Mask, Hand gloves, Shoes are provided to employees.	Dust collection system must be checked for its efficiency. Cleaning by Brooms should not be done and it may be replaced by Vacuum Cleaner.
37	**Unit-37**	Fiber preparation, Finishing operations within the factory, Handling of finished product, Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposa	Bag Type dust collectors / Blowers	Water spray through pipe line & Tankers twice a day	Natural ventilation & Roof ventilators	Needs to be improved	Waste recycled and residual waste material is given to approved agency "M/S Ramkey"	Gloves, Shoes,Ear plugs, Nose Mask , Hand gloves, dangri are provided and workers were seen to use them	Ventilation at storage and Pulveriser area needs to be improved

38	**Unit-38**	Fiber preparation, Finishing operations within the factory, Handling of finished product, Reclamation of damaged/rejected sheet in pulveriser unit & Waste Disposal	Bag filter	Water spray Through Pipe line & Wet mopping	Natural ventilation /Roof Ventilators	Satisfactory	Waste recycled and residual waste material is given to approved agency "M/S Ramkey"	PPE' s i.e. Safety helmets, Nose Mask, Hand gloves, Shoes are provided to employees	Some suggestions were given for improvement of Housekeeping , lighting, Bag loading and Sop's in Hindi.
39	**Unit-39**	Not using Asbestos in the pipe manufacturing process. (small unit)	Not applicable as no Asbestos is used in the process.	Wet process and not using Asbestos	Natural Ventilation	Good	Recycling in the process	Dust Mask provided	--

40	**Unit-40**	Fiber preparation, Finishing operations carried within the factory. Handling of damaged or rejected product, Reclamation of damage and rejected sheets in pulveriser. Godown area.	Bag filter with Pneumatic Pulse Jet cleaning	Wet process after bag opening device section	Local Exhaust Ventilation provided at dust generation points including natural ventilation found satisfactory.	Housekeeping well maintained	Rejected & damaged sheets were recycled in process	Dust mask provided. Hand gloves was provided. Full body Coverall was provided at loading point. P2/P3 Mask to be provided for all the workers.	P2/P3 Mask to be provided for all the workers.
41	**Unit-41**	Fiber preparation, Finishing operations carried within the factory. Handling of damaged or rejected product, Reclamation of damage and rejected sheets in pulveriser. Godown area.	Bag filter with Pneumatic Pulse Jet cleaning	Wet process after bag opening device section	Local Exhaust Ventilation provided at dust generation points including natural ventilation found satisfactory.	Housekeeping was poor.	Rejected & damaged sheets were recycled in process.	Dust mask provided. Hand gloves was provided. Full body Coverall was provided at loading point.	Recommended for improvement in housekeeping. P2/P3 Mask to be provided for all the workers.

42	**Unit-42**	Fiber preparation, Finishing operations carried within the factory. Handling of damaged or rejected product, Reclamation of damage and rejected sheets in pulveriser. Godown area.	Bag filter with Pneumatic Pulse Jet cleaning	Wet process after bag opening device section	Local Exhaust Ventilation provided at dust generation points including natural ventilation found satisfactory.	Housekeeping well maintained	Rejected & damaged sheets were recycled in process	Dust mask provided. Hand gloves was provided. Full body Coverall was provided at loading point.	P2/P3 Mask to be provided for all the workers.
43	**Unit-43**	Fiber preparation, Finishing operations carried within the factory. Handling of damaged or rejected product, Reclamation of damage and rejected sheets in pulveriser. Godown area.	Bag filter with Pneumatic Pulse Jet cleaning	Wet process after bag opening device section	Local Exhaust Ventilation provided at dust generation points including natural ventilation found satisfactory.	Needs improvement	Rejected & damaged sheets were recycled in process	Dust mask provided. Hand gloves was provided. Full body Coverall was provided at loading point.	Informed to improve housekeeping in the shop floor area. P2/P3 Mask to be provided for all the workers.

44	**Unit-44**	Fiber preparation, Finishing operations carried within the factory. Handling of damaged or rejected product, Reclamation of damage and rejected sheets in pulveriser. Godown area.	Bag filter with Pneumatic Pulse Jet cleaning	Wet process after bag opening device section	Local Exhaust Ventilation provided at dust generation points. Natural ventilation found satisfactory.	well maintained	Rejected & damaged sheets were recycled in process	Dust mask provided. Hand gloves was provided. Full body Coverall was provided at loading point.	P2/P3 Mask to be provided for all the workers.
45	**Unit-45**	Fiber preparation, Finishing operations carried within the factory. Handling of damaged or rejected product, Reclamation of damage and rejected sheets in pulveriser. Godown area.	Bag filter with Pneumatic Pulse Jet cleaning	Wet process after bag opening device section	Local Exhaust Ventilation provided at dust generation points. Natural ventilation found satisfactory.	well maintained	Rejected & damaged sheets were recycled in process	Dust mask provided. Hand gloves was provided. Full body Coverall was provided at loading point.	P2/P3 Mask to be provided for all the workers.

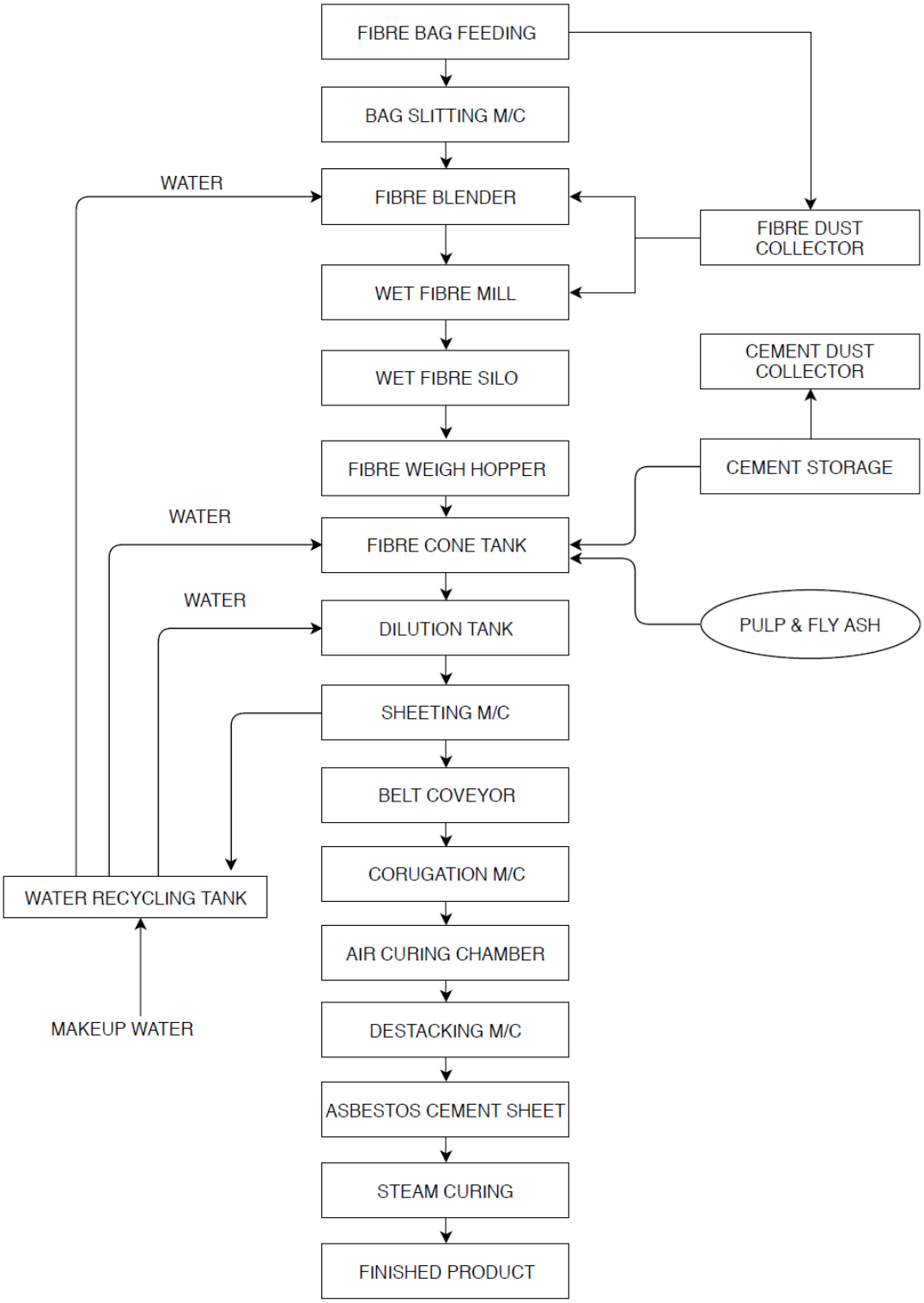
46	**Unit-46**	Fiber preparation, Finishing operations carried within the factory. Handling of damaged or rejected product, Reclamation of damage and rejected sheets in pulveriser. Godown area.	Bag filter with Pneumatic Pulse Jet cleaning	Wet process after bag opening device section	Local Exhaust Ventilation provided at dust generation points including natural ventilation found satisfactory.	housekeeping well maintained	Rejected & damaged sheets were recycled in process	Dust mask provided. Hand gloves was provided. Full body Coverall was provided at loading point.	P2/P3 Mask to be provided for all the workers.
47	**Unit-47**	Fiber preparation, Finishing operations carried within the factory. Handling of damaged or rejected product, Reclamation of damage and rejected sheets in pulveriser. Godown area.	Bag filter with Pneumatic Pulse Jet cleaning	Wet process after bag opening device section	Local Exhaust Ventilation provided at dust generation points including natural ventilation found satisfactory.	Housekeeping Needs Improvement.	Rejected & damaged sheets were recycled in process.	Dust mask provided. Hand gloves was provided. Full body Coverall was provided at loading point.	Recommended for to improve housekeeping in shop floor area and reclamation area. P2/P3 Mask to be provided for all the workers.

48	**Unit-48**	Fiber preparation, Finishing operations carried within the factory. Handling of damaged or rejected product, Reclamation of damage and rejected sheets in pulveriser. Godown area.	Bag filter with Pneumatic Pulse Jet cleaning	Wet process after bag opening device section	Local Exhaust Ventilation provided at dust generation points including natural ventilation found satisfactory.	Needs improvement	Rejected & damaged sheets were recycled in process	Dust mask provided. Hand gloves was provided. Full body coverall was provided at loading point.	Recommended for to improve housekeeping in the shop floor area. P2/P3 Mask to be provided for all the workers.
49	**Unit-49**	Fiber preparation, Finishing operations carried within the factory. Handling of damaged or rejected product, Reclamation of damage and rejected sheets in pulveriser. Godown area.	Bag filter with Pneumatic Pulse Jet cleaning	Wet process after bag opening device section	Local Exhaust Ventilation provided at dust generation points including natural ventilation found satisfactory.	housekeeping well maintained	Rejected & damaged sheets were recycled in process	Dust mask provided. Hand gloves was provided. Full body coverall was provided at loading point.	P2/P3 Mask to be provided for all the workers.

50	**Unit-50**	Fiber preparation, Finishing operations carried within the factory. Handling of damaged or rejected product, Reclamation of damage and rejected sheets in pulveriser. Godown area.	Bag filter with Pneumatic Pulse Jet cleaning	Wet process after bag opening device section	Local Exhaust Ventilation provided at dust generation points including natural ventilation found satisfactory.	Needs improvement	Rejected & damaged sheets were recycled in process	Dust mask provided. Hand gloves was provided. Full body Coverall was provided at loading point.	Informed to improve housekeeping in the shop floor area. P2/P3 Mask to be provided for all the workers.

ANNEXURE – I

PROCESS FLOW CHART-ASBESTOS-CEMENT SHEET/PIPE



ANNEXURE -II

RULE PRESCRIBED UNDER SECTION 87 IN MODEL RULES FOR **HANDLING AND PROCESSING OF ASBESTOS, MANUFACTURE OF ANY ARTICLE OR SUBSTANCE OF ASBESTOS AND ANY OTHER PROCESSES OF MANUFACTURE OR OTHERWISE IN WHICH ASBESTOS IS USED IN ANY FORM** (Schedule XIV)

1.Application.-

(1) This schedule shall apply to all manufacturing process as defined under Section 2(k) of the Act, carried on in a factory involving exposure of workers to asbestos and/or product containing Asbestos.

(2) The Government may, at any time, for the purpose of giving effect to any scientific proof obtained from specialised institutions or experts in the field, notification in the Office Gazette, make suitable changes in the said schedule:

(3) The provisions of this schedule shall apply to all workers exposed to asbestos in the factory and it shall be the responsibility of the occupier of the factory to comply with the provisions of the schedule in respect of the workers.

(4) (a) The occupier of the factory wherein asbestos or substances containing asbestos are in use, shall prepare work procedures and practices, in the light of scientific research and technological progress for approval by the Chief Inspector and shall follow only such approved procedures.

(b) Notwithstanding anything mentioned in sub-paragraph (1) use of asbestos is prohibited in the manufacturing process as may be notified by the Government in this behalf.

(c) (i) spraying of all forms of asbestos is prohibited in a factory. (ii) The prohibition in respect of spraying of asbestos referred to in sub-para (i) may be exempted by the Chief Inspector if the Occupier represents that such spraying is inevitable certain purposes provided adequate measures for ensuring the safety and health of workers are undertaken by the occupier to the satisfaction of the Chief Inspector. 2.

Definition.-

For the purpose of this Schedule –

(a) "asbestos" means any fibrous silicate mineral and any admixture containing actionlite, amosite, anthophyllite, chrysotile, crocidolite, tremolite or any mixture thereof, whether crude, crushed or opened; (b) "asbestos textiles" means yarn or clothes composed of asbestos or asbestos mixed with any other materials; (c) "approved" means approved for the time being in writing by the Chief Inspector; (d) "breathing apparatus" means a helmet or face piece with necessary connection by means of which a person using it breathes air free from dust, or any other approved apparatus; (e) "efficient exhaust draught" means a localised ventilation by mechanical means for the removal of dust so as to prevent dust from escaping into air of any place in which work is carried on. No draught shall be deemed to be efficient which fails to control dust produced at the point where such dust originates; (f) "preparing" means crushing, disintegrating, and any other processes in or incidental to the opening of asbestos; (g) "protective clothing" means overalls and head covering, which (in either case) will when worn exclude asbestos dust; (h) "asbestos dust" means airborne

particles of asbestos or settled particles of asbestos which are liable to become airborne in the factory; (i) "airborne asbestos dust" means, for the purposes of measurement, dust particles measured by gravimetric assessment or other equivalent method; (j) "repairable asbestos fibres" means asbestos fibres having diameter of less than 3 micrometre and a length to diameter ratio greater than 3:1; (k) "exposure to asbestos" means exposure to airborne repairable asbestos fibres or asbestos dust; whether originating from asbestos or from minerals, materials or products containing asbestos in the factory.

2-A Demolition of plants or structures –

No person shall carry out any demolition of plants or structures containing friable asbestos insulation material and removal of asbestos from building or structures in which asbestos is liable to become air-borne, unless he is recognized and duly empowered by the Chief Inspector of Factories as qualified to carry out such work in accordance with the provisions of this Schedule.

3. Tools and equipment.-

Any tools or equipment used in processes to which this schedule applies shall be such that they do not create asbestos dust above the permissible limit or are equipped with efficient exhaust draught.

4. Exhaust draught.-

(1) An effective exhaust draught shall be provided and maintained to control dust from the following processes and machines as per the relevant National Standards - (a) manufacture and conveying machinery namely - (i) preparing, grinding, or dry mixing machines; (ii) carding, card waste and ring spinning machines, and looms; (iii) machines or other plant fed with asbestos; (iv) machines used for the sawing, grinding, turning, drilling, abrading or polishing; in the dry state, of articles composed wholly or partly of asbestos; (b) cleaning, and grinding of the cylinders or other parts of a carding machine; (c) chambers, hoppers or other structures into which loose asbestos is delivered or passes; (d) work-benches for asbestos waste sorting or for other manipulation or asbestos by hand; (e) workplaces at which the filling or emptying of sacks, skips or other portable containers, weighing or other process incidental thereto which is effected by hand, is carried on; (f) sack cleaning machines; (g) mixing and blending of asbestos by hand; and (h) any other process in which dust is given off into the work environment. (2) Exhaust ventilation equipment provided in accordance with sub-paragraph (1) shall, while any work of maintenance or repair to the machinery, apparatus or other plant or equipment in connection with which it is provided is being carried on, be kept in use so as to produce an exhaust draught which prevents the entry of asbestos dust into the air of any work place. (3) Arrangements shall be made to prevent asbestos dust discharged from exhaust apparatus being drawn into the air of any workroom. (4) The asbestos bearing dust removed from any workroom by the exhaust system shall be collected in suitable receptacles or filter bags which shall be isolated from all work areas.

5. Testing and examination of ventilating systems.-

(1) All ventilating systems used for the purpose of extracting or suppressing dust as required by this schedule shall be as per the relevant Indian Standards, examined and inspected once every week by a responsible person. It shall be thoroughly examined and tested by a competent person once in every period of 12 months. Any defects found by such examinations or test shall be rectified forthwith.

(2) A register containing particulars of such examination and tests and the state of the plant and the repairs or alternations (if any) found to be necessary shall be kept and shall be available for inspection by an Inspector.

6. Segregation in case of certain process.-

Mixing or blending of asbestos by the hand, or making or repairing of insulating mattresses composed wholly or partly of asbestos shall not be carried on in any room in which any other work is done.

7. Storage and distribution of loose asbestos.-

All loose asbestos shall, while not in use, be kept in suitable closed receptacles which prevent the escape of asbestos dust there from. Such asbestos shall not be distributed within a factory except in closed receptacles or in a totally enclosed system of conveyance.

8. Asbestos sacks –

(1) All sacks used as receptacles for the purpose of transport of asbestos within the factory shall be constructed of impermeable materials and shall be kept in good repair.

(2) A sack which has contained asbestos shall not be cleaned by hand beating but by a machine, complying with paragraph 4.

(3) Asbestos sacks or receptacles which contain asbestos shall be disposed off in a safe manner.

9. Maintenance of floors and workplaces.-

(1) In every room in which any of the requirements of this schedule apply - (a) the floors, work-benches, machinery and plant shall be kept in a clean state and free from asbestos debris and suitable arrangements shall be made for the storage of asbestos not immediately required for use; and (b) the floors shall be kept free from any materials, plant or other articles not immediately required for the work carried on in the room, which would construct the proper cleaning of the floor. (2) The cleaning as mentioned in sub-rule (1) shall so far as is practicable, as carried out by means of vacuum cleaning equipment so designed and constructed and so used that asbestos dust neither escapes nor is discharged into the air of any work place.

(3) When the cleaning is done by any method other than that mentioned in sub-paragraph (2), the persons doing cleaning work and any other person employed in that room shall be provided with respiratory protective equipment and protective clothing.

(4) The vacuum cleaning equipment used in accordance with provisions of sub-paragraph (2), shall be properly maintained and after each cleaning operation, its surfaces kept in a clean state and free from asbestos waste and dust.

(5) Asbestos waste shall not be permitted to remain on the floors or other surfaces at the work place at the end of the working shift and shall be transferred without delay to suitable receptacles. Any spillage of asbestos waste occurring during the course of the work at any time shall be removed and transferred to the receptacles maintained for the purpose without delay.

9 (A) The occupier shall replace asbestos or of certain types of asbestos or products containing asbestos by other materials or products or shall use alternative technology, scientifically evaluated as

harmless or less harmful, wherever this is possible. (B) The occupier should take all the measures to prevent or control the release of asbestos in to the air and to ensure that the exposure limits or other exposure criteria are complied with and also reduce exposure to as low as a level as is reasonably practicable. 10. Breathing Apparatus, Personnel Protective Equipment and Clothing: (1) The occupier of every factory to which this schedule applies shall provide to workers personnel protective equipments such as hand gloves shoes helmets, goggles earplug, aprons safety belt, overall suit, etc. as per the relevant National or International Standards as may be required.

ANNEXURE-III

GOVERNMENT OF INDIA
MINISTRY OF LABOUR & EMPLOYMENT
CENTRAL LABOUR INSTITUTE
MUMBAI

National Study on Asbestosis-Cement Product Industries (2018)

M E D I C A L E X A M I N A T I O N F O R M OF THE WORKER

Sl. No…… Date…….

I. Personal Data:

Name…… ……Age/Sex……..

Industry ……. Nature of work……

Contact Details……..

II. Nature of work:

Loading/Unloading/Storage/Cutting of bags/Charging/Mixing/Filling/Packing /Handling of Finished Goods/Disposal/ Others

II. Family Details:

Married/Unmarried …… No. of Family Members……

III. Occupational History:

1. Present Occupation/ Designation……
2. Nature work done ……..
3. Over time/extra time, if any ……
4. Use of PPE/Wet method, if any …….
5. Years of service in present occupation……
6. History of Past Occupational, if any ……
7. Total years of asbestos related work ……
8. Para-occupational History of Asbestos exposure, if any ……..

IV. Personal History:

1. Smoking: Duration…… No of Cig./ Beedi per day…….
2. Alcohol: Occasional/Regular …… Quantity ……..
3. Any other addiction, if any ……

V. History of past illness, if any:

VI. History of present illness, if any:

VII. <u>Physical Examination</u>:

A. General Examination:

1.	Height in Cms ……..	2.	Weight in Kgs……
3.	Nutrition …….	4.	Lymph nodes……
5.	Pallor……	6.	Anaemia……..
7.	Cyanosis……..	8.	Clubbing……..
9.	Skin…….	10.	Oedema ……
11.	Pulse …….	12.	BP ……

B. <u>Systemic Examination</u>:

(1) Respiratory System:

(2). <u>Cardio-vascular System</u> :

(3). <u>GI System</u>:

VIII. <u>Investigations</u>:

1. Pulmonary Function Test:

A. FVC: a. Observed……b. Predicted……

B. FEV1: a. Observed…….. b. Predicted……

C. a. Obstructive Index:

b. Restrictive Index:

2. X-Ray Chest-PA View:

3. HRCT (if required):

IX. <u>Clinical Impression</u>:

(Signature of attending Doctor)

ANNEXURE -VI

National Study on Occupational Safety, Health & Environment in the Asbestos – Cement Product Industries

Process Safety Format

Date:-

Name of Industry –

Address -

District - State –

Sr. No.	Preventive Safety Measures	Available Yes/ No	Remark
1	Dust collection equipment / system (Type of)		
2	Use of wet methods / water spray		
3	Ventilation system		
4	House keeping		
5	Waste disposal		
6	Supply & Use of PPE`s- Respiratory		

ANNEXURE – V

National Study on Occupational Safety, Health & Environment in the Asbestos – Cement Product Industries

Work Environment Monitoring Format

Date:-

Name of Industry –

Address -

District - State –

Sl. No.	Locations	Operational Process	Sampling Duration	Concen-tration in (f/cc)	Remark