STUDY OF IMPACT OF GLASS WOOL IN SHIP RECYCLING ACTIVITIES AT ALANG (GUJARAT)

DIRECTORATE GENERAL
FACTORY ADVICE SERVICE & LABOUR INSTITUTES
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STUDY OF IMPACT OF GLASS WOOL IN
SHIP RECYCLING ACTIVITIES AT ALANG
(GUJARAT)

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ABSTRACT

Author : Brij Mohan (Dr.) & Bhattacharya C (Dr.)
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Summary : The report presents the findings of study of impact of glass wool in ship recycling activities at Alang (Gujarat) and suggests measures to improve the conditions of occupational health and hygiene in the ship recycling units with reference to glass wool handling.
Abstract : Evaluation of the personal exposure of airborne glass wool among the workers involved in glass wool handling in ship recycling activities at Alang/ Sosiya and their medical examination covering clinical, pathological & radiological investigations was carried out in randomly selected ship recycling units to assess the impact of glass wool. The levels of airborne glass wool were exceeded PLE in some units. No significant radiological & pathological findings of occupational diseases was recorded in workers involved in glass wool handling. However, several recommendations like portable local exhaust ventilation system on glass wool operation, use of PPE, washing & change room facilities, medical examination at periodical interval, training & education etc are given to improve the condition of work and to prevent workers from occupational...
diseases in the ship recycling units during glass wool handling.

**Major Descriptor**: Ship Recycling, Occupational Hygiene & Occupational Health

**Minor Descriptor**: Synthetic Vitreous Fibre, Glass Wool, Personal Monitoring, Permissible Limit of Exposure, Dust Control, Portable Local Exhaust Ventilation, Personal Protective Equipment, Medical Examination, Personal Hygiene, Education & Training

**Special Category**: Industrial Hygienist & Occupational Health

**Document**: Report

**Publication Year**: 2012

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**EXECUTIVE SUMMARY**

Alang is the largest ship recycling yard in the world located on the western coast of Gulf of Cambay (Gulf of Khambat) and a large number of workforce is associated with the ship recycling industry. Ministry of Labour & Employment, Government of India at the initiative of Inter Ministerial Committee (IMC) on Ship Breaking under Ministry of Steel, Government of India directed Directorate General Factory Advice Service & Labour Institutes (DGFASLI) to carry out study on the impact of glass wool on the workers in the ship recycling activities at Alang. Therefore the present study in ship recycling activities at Alang (Gujarat) was carried out by the DGFASLI in the month of April 2012 focusing broadly on occupational health and hygiene aspects in glass wool handling in ship recycling activities at Alang.
In Alang / Sosiya 171 ship recycling units are existing, out of which 130 units were operational employing about 20,000 workers at the time of study. In each ship recycling unit 4 to 6 workers were reported to be involved in glass wool handling. The glass wool is a synthetic vitreous fibre and used as an insulating material on surface, equipment, pipelines etc. During dismantling of ship, glass wool is manually taken out after removing the metal surface of the cut portion using oxygen–fuel cutting torch and collected in PVC bags by workers. The collected glass wool in PVC bags is stored in the unit and subsequently transferred to “Treatment, Storage and Disposal Facility” (TSDF) for safe disposal.

Monitoring of airborne glass wool was carried out in 10 randomly selected ship recycling units and personal exposure of glass wool among workers handling glass wool during ship recycling activities were determined by harnessing the personal samplers. 55 workers from 13 ship recycling units were subjected to detail clinical, pathological, radiological investigations to find out the prevalence of occupational diseases among them due to exposure of glass wool.

It was observed that time weighted exposure (TWA) of the airborne glass wool among workers in different ship breaking yards in Alang were varying from 3.47 mg/m$^3$ to 12.00 mg/m$^3$ whereas in the units located in Sisoya Shipping Yard average exposure was ranging 3.07 mg/m$^3$ to 5.56 mg/m$^3$. The permissible limit of Exposure of exposure of glass wool dust is 10 mg/m$^3$ & exposure of airborne glass wool dust exceeded in some of the units. The workers involved in glass wool handling were found using helmets safety shoes, gloves, dust respirator for personal protection but personal hygiene and awareness among workers on safety & health was not satisfactory.

General information related to physical, social etc aspects of workers engaged in glass wool handling were also collected through questionnaire to correlate the results of medical study. General examination of the selected workers was done followed by examination of the respiratory & other systems. The clinical examination was carried out with particular reference to respiratory, cardio-vascular
system and skin. Chest radiograph of the workers was compared with Standard ILO Radiographs of Pneumoconiosis to categorize and quantify the radiological abnormality consistent with exposure of workers to inhale glass wool particle. The workers were also subjected to Lung Function Tests to measures their FVC (Forced Vital Capacity) and FEV1 (Forced Expiratory Volume in one second) Complete blood count (CBC) & examination of sputum for AFB was also conducted. No significant radiological & pathological findings of occupational diseases was observed in workers randomly selected for medical study.

Based on the general observations & findings of industrial hygiene and medical study, several recommendations are suggested like portable local exhaust ventilation system on glass wool operation, use of personal protective equipment, good personal hygiene & effective medical surveillance of the workers, training & education etc to improve the condition of work and protect the health of workers involved in ship recycling activities for glass wool handling.

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1. INTRODUCTION:

Alang is the largest ship recycling yard in the world located on the western coast of Gulf of Cambay (Gulf of Khambat) near Alang – Sosiya village on approximately 10 Km. long sea front. Ships which are not capable or uneconomical to run are recycled/demolished. The ship recycling yard at Alang/Sosiya as reported has recycled record number of 415 ship with 38.60 million tones of Light Ton Displacement (LDT) during financial 2011-12. The activity of ship recycling/breaking is a labour-intensive and about 20,000 workers of different categories are engaged in Alang/Sosiya Ship Yards.

During ship recycling, workers are exposed to different hazardous substances/contaminants like asbestos, glass wool, metallic fumes, polychlorinated biphenyls (PCBs), noise, heat which may cause adverse health effects on prolonged exposure. Besides that, hazardous work activities/conditions are likely to cause injuries/death on accident. The growing use of glass wool as an insulating material in ship & likely exposure of workers on its removal from demolished structure, demands a systematic study to assess its impact on the workers.

Ministry of Labour & Employment, Government of India at the initiative of Inter Ministerial Committee (IMC) on ship breaking under Ministry of Steel, Government of India directed Directorate General Factory Advice Service & Labour Institutes (DGFASLI) to carry out study on the impact of glass wool on the workers in the ship recycling activities at Alang. Therefore present study in ship recycling activities at Alang (Gujarat) was carried out by the Directorate General Factory Advice Service & Labour Institutes (Ministry of Labour & Employment, Government of India) from 10th to 13th April 2012 to study the above aspect.

2. OBJECTIVES:

Study of Impact of Glass Wool In Ship Recycling Activities at Alang (Gujarat) RLJK/DGFASLI/2012-13
The study was carried out with following objectives:

2.1 to evaluate the personal exposure of air borne glass wool among the workers involved in glass wool handling in ship recycling activities at Alang/Sosiya,

2.2 to conduct clinical, pathological, radiological investigations of a cross section of workers working in a ship recycling industry to find out the prevalence rates of occupational diseases especially occupational lung diseases and dermatitis caused by inhalation or contact of glass wool, and

2.3 to suggest appropriate measures to improve the conditions of occupational health and hygiene in the ship recycling units with reference to glass wool handling to prevent the occurrences of occupational diseases and disorders.

3. PROCESS OF SHIP RECYCLING / BREAKING IN BRIEF:

The ship dismantling/breaking process starts after removing fuels, oils and combustible materials. Fixtures, anchors, chains and small equipments are removed first and large reusable components are removed when accessible. The dismantled items are sorted out and graded. The tidal gradient of Gulf of Cambay facilitate the ship to beach & a large winch at the head of the slip is used to drag the hull further out of the water.

The ship structure is symmetrically cut step by step in size and moved to the plots/yards for dismantling.
During cutting, the upper decks, superstructure and systems are cut first followed by main and lower deck. Metal cutting is done manually with the help of oxygen–fuel cutting torches. The part of the ship so cut are lifted by crane and then subsequently cut into specific shapes & sizes. As cutting continues the remaining hull floats higher, which exposes lower portion of hull. The remaining portion is pulled and cut into size.
Prior to cutting away the surface, the insulation materials (glass wool, asbestos, foam) used for thermal & mechanical insulation, are removed. The passenger ships, refeer ship, RORO etc involve more thermal/mechanical insulation than cargo ships.

Earlier asbestos was heavily used but due to ban in asbestos in developed country it has mainly been substituted by glass wool as an insulating material.

*Study of Impact of Glass Wool In Ship Recycling Activities at Alang (Gujarat) RLK/DGFAISLI /2012-13*
Insulation on cut portion of ship is being removed
4. HEALTH HAZARDS OF GLASS WOOL AND ITS PERMISSIBLE LIMIT OF EXPOSURE (PLE)

Glass wool is a synthetic vitreous fibre & occupational exposure to such fibrous glass materials can cause irritation of the eyes, nose, & throat, and lungs. When these fibers contact the skin, they may also cause acute irritation ("fiberglass itch"). These effects are reversible and disappear shortly after exposure stops. Repeated or
prolonged contact with skin is reported to cause dermatitis. Skin reactions are generally transient and superficial. The rash is an irritant response to mechanical micro trauma, arising from the relatively large (non-respirable) fiber fraction.

Most typically it takes the form of a fine, punctuate, itching erythema, which often disappears with continued exposure. It can generally be alleviated by washing with water. The initial lesion is papular or papulovesicular, though secondary infection, or lichenification, can occur.

Sore throat, nasal congestion, laryngeal pain, and cough are some of the symptoms of upper respiratory tract irritation. (ATSDR\textsuperscript{2002, ILO\textsuperscript{2006}})

Symptoms of irritation of the upper respiratory tract have been mostly associated with unusually dusty workplace conditions (concentrations >1 fiber/cc) involving removal of fibrous glass materials without respiratory protection (ACGIH\textsuperscript{2001,}). The symptoms have been reported to disappear shortly following cessation of exposure (ATSDR\textsuperscript{2002,}).

Animal studies show that breathing air containing a lot of synthetic vitreous fibers can lead to inflammation and fibrosis of the lung. If pulmonary inflammation continues over a long period of time, a slow build up of scar tissue may occur in the lungs and in the membrane (ATSDR\textsuperscript{2004}).

Fiber properties of glass wool such as dose, dimensions, chemical composition, and surface reactivity determine whether a fiber can be effectively engulfed by an alveolar macrophage and efficiently cleared from the lungs or remain and cause a chronic inflammatory response.
American Conference of Governmental Industrial Hygienists (ACGIH) has classified glass wool fibres as Category A3 (Confirmed Animal Carcinogen with Unknown Relevance to Human) under head Carcinogenicity. Category A3 defines agent as carcinogenic in experimental animals at a relatively high dose, by routes of administration, at site(s), of histologic type(s), or by mechanism(s) that are not considered relevant to worker exposure. Available epidemiologic studies do not confirm an increased risk of cancer in exposed humans. Available evidence does not suggest that the agent is likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure. (ACGIH 2007)

The Factories (Amendment) Act has laid down Permissible Limit of Exposure – Time Weighted Exposure (PLE-TWA) of 10 mg/m$^3$ as a Total Dust for Amorphous Silicates. Since glass wool is an amorphous silicate, a permissible limit of exposure of 10 mg/m$^3$ (TWA) can be adopted for glass wool as total dust.

5. EVALUATION OF AIRBORNE GLASS WOOL AT WORK PLACE IN SHIP RECYCLING ACTIVITIES

Monitoring of airborne glass wool was carried out in randomly selected ship recycling units in Alang/Sosiya Ship Breaking Yards to evaluate the exposure of workers involved in the handling of glass wool and to suggest appropriate control measures to improve the work conditions in ship recycling activities.

Methodology adopted for evaluation work environment along with the discussion on general observations & results is given below:
5.1 **Methodology**

5.1.1 A preliminary survey was carried out prior to the collection of airborne samples from ship recycling units to familiarize with the ship recycling activity, glass wool handling and control measures adopted by the units to protect the workers from airborne glass wool.

5.1.2 Samples of airborne glass wool were collected on a tarred 37 mm Glass Fibre Filter Paper (GF/A) mounted in a filter holder at the sampling rate of 2 litre per minutes (LPM). A personal sampling was done by harnessing the sampler head to the breathing zone. Battery operated personal samplers were used to draw air from the filter disc. The flow rate of the personal samplers was calibrated with the help of rota meter before & after collection of each sample.
5.1.3 The repeat samples were collected as far as possible from each work location to reflect true concentration of airborne contaminant at the workplace.

5.1.4 The collected samples were transported to the institute and subsequently analysed in the industrial hygiene laboratory by gravimetric method for total dust.

5.2 Observations, Results and Discussions:

The levels of airborne glass wool as observed in different ship breaking/recycling yards in the glass wool handling are presented in Table 1. The observations taken during the study & results are discussed as follows:

5.2.1 In Alang / Sosiya 171 ship recycling units are existing, out of which as reported by Gujarat Maritime Board (GMB) 130 units are operational employing about 20,000 workers at the time of study. The workers are migrant in nature & employment rises up to 40,000 during non harvesting season.

5.2.2 The metal surface of the cut portion is removed using oxygen-fuel cutting torch and glass wool insulation so exposed is manually removed using iron bar or otherwise and collected in poly bags.
5.2.3 The workers are exposed to glass wool fibre/dust at the time of removal/ breaking and collection in poly bags. The samples of airborne glass wool dusty were collected from 10 randomly selected units, the results of which are presented in table -1. It is seen from table that the time weighted exposure (TWA) of the workers in different ship breaking yards in Alang were varying from 3.47 mg/m$^3$ to 12.00 mg/m$^3$.

The TWA exposure of the glass wool dust in unit at S.No. 4 was found to be 12 mg/m$^3$ which is higher than the permissible limit of Exposure of 10 mg/m$^3$ for glass wool dust whereas in other units the average exposure was found to be within permissible limit of Exposure i.e. 10 mg/m$^3$.
It was observed that in every unit on average 4 to 6 workers of the Category of BEGARI as nomenclature by ship recycling units, are involved in glass wool removal & collection & transfer of the dismantled glass wool.

5.2.4 As seen from table -1 the TWA exposure of workers involved in removing the glass wool from cargo cabin in unit at S.No 1 was found to varying from 5.20 mg/m$^3$ to 12.28 mg/m$^3$ with average personal exposure of 7.72 mg/m$^3$ which is within the PLE –TWA of 10 mg/m$^3$.

The average TWA exposure among workers during collection of dismantled glass wool in PVC bags was found to be 4.43 mg/m$^3$, which is comparatively less than the glass wool removal from the surface of the dismantled structure.

*Glass Wool Collection in Poly Bags for Disposal in Treatment, Storage and Disposal Facility*
5.2.5 In some units, glass wool insulation removal was not being done. However workers were found collecting glass wool as already removed/dismantled earlier from surface, pipelines etc & to determine their exposure the personal sampling was done. In these units as evident from table -1, the average TWA exposure of the workers was found to be within the PLE-TWA i.e. 10 mg/m$^3$ for glass wool. Those units where workers were involved in removal as well as in collection of glass wool in PVC bags, the glass wool exposure of workers was also found to be within the PLE –TWA.

5.2.6 The average exposure of glass wool in the units located in Sisoya Shipping Yard was ranging 3.07 mg/m$^3$ to 5.56 mg/m$^3$, which is also within permissible limit of exposure i.e. 10 mg/m$^3$.

5.2.7 The average TWA exposure as evident from table -1 among workers in Alang/ Sisoya shipping yards in most of the units was found to be within the permissible limit of exposure, however concentration range of glass wool indicates that exposure of some workers in ship breaking activities was near or above permissible limit of exposure (PLE). Thus, suitable engineering methods should be applied & adopted by different ship recycling / breaking units to control the exposure & to protect the health of workers from glass wool emanated during glass wool handling in ship recycling activities.

5.2.8 The workers engaged in different recycling / breaking units were found using helmets, safety shoes, gloves and disposable dust mask for personal protection. It was also observed that workers in some units were wearing dagri/shirts & pants to protect skin from glass wool or KHUJLI as locally called in ship breaking units. However it was observed that the workers were not fully aware about the use & maintenance of respirators etc
5.2.9 The glass wool collected in poly bags is stored in a separate room meant for the purpose in the yard/unit which is subsequently transferred to “Treatment, Storage and Disposal Facility” (TSDF) for safe disposal. TSDF has been created by GMB as per the directives of the Hon’ble Supreme Court & maintained by M/s Gujarat Enviro Protection Infrastructure Ltd, Surat (GEPIL) as per Hazardous Waste (Management Handling & Transboundary) Rules.

5.2.10 Hazards information about the handling of glass wool was not found displayed in the yards.

5.2.11 Most of the ship breaking/recycling units have not provided washing facilities as a results workers involved in glass wool handling are leaving yards without wash & carry home the contaminations.

5.2.12 The work areas in most of the unit were highly disorganized and housekeeping was not satisfactory in any of the unit.

6 MEDICAL EVALUATION TO ASSESS THE IMPACT OF GLASS WOOL ON THE WORKERS INVOLVED IN SHIP RECYCLING ACTIVITIES

Medical study included radiological, pathological and clinical examination of workers randomly selected from ship recycling units of Alang/Sosiya. General information related to physical, social etc aspects of workers engaged in glass wool handling were also collected through questionnaire. The following paragraphs presents the methodology & findings of the medical study based on general observation & results of various parameters.
6.1 **Methodology**

The methodology adopted to carry out medical survey to assess the impact of glass wool on the workers in ship recycling units was as follows:

6.1.1 A thorough inspection of number of plots was made to familiarize with the process of glass wool handling & based on that further strategy of the study was determined to assess the impact among workers involved in ship recycling activities.

6.1.2 Simple, random, unbiased and representative sample of a cross section of workers who handle glass wool in different ship recycling units in Alang/Sosiya was taken.

6.1.3 The selected workers were interviewed regarding their income, level of education, marital status etc. Subsequently a thorough history regarding the present & past occupational history, family history, history of past illness, present complaints with duration of illness were recorded in a questionnaire specially developed for the study in Ship Recycling Industry. History of breathlessness on exertion, cough and itching of skin were especially elicited. The height and weight of all the workers were also recorded.

6.1.4 General examination of the selected workers followed by examination of the respiratory system & other systems were done.

6.1.5 The clinical examination was carried out with particular reference to Respiratory, Cardio-Vascular systems and Skin. Bilateral crepititious & sign of pruritus were especially looked for on auscultation of chest & inspection of skin.
6.1.6 Chest radiography of the workers for radiological evaluation by comparison with Standard ILO Radiographs of Pneumoconiosis was carried out in order to categorize and quantify the radiological abnormality consistent with exposure of workers to inhale glass wool particle.

6.1.7 The workers were subjected to chest radiography under direct supervision of the study team at Hospital Allang, SBY-16, Alang, Manar, Bhavnagar. The chest radiograph was taken as per the guidelines of ILO radiographs on pneumoconiosis 2000.

6.1.8 All the workers were also subjected to Lung function tests using a calibrated Shillers Pulmonary test machine and measures of FVC (Forced Vital Capacity) and FEV1 (Forced Expiratory Volume in one second) were made. The test procedures were fully explained to the workers. The Vital capacity obtained was converted into % of PVC (Predicated Vital Capacity) using a nomogram of Korey-et al. The Lung function tests were analysed as per the Spiro-metric guidelines for assessment of respiratory impairment using Miller’s Prediction Quadrant and Conrad's Classification.

6.1.9 Spirometry, complete blood count (CBC) & examination of sputum for AFB were conducted for all the selected workers.

6.1.10 The clinical diagnosis of occupational lung disease related to inhalation of glass wool depends on the laid down criteria as under:-
   a. A History of Significant exposure to glass wool dust.
   b. Radiological features consistent with fibrosis (category 1/1 and above).
c. Presence of crackles during auscultation of chest.

d. Lung function changes consistent with at least some features of the restrictive syndrome.

Not all the criteria need to be met in all cases but (a) is essential (b) should be given greater weightage than (c) or (d).

6.1.11 Based on the findings of radiological, pathological & clinical examination of the workers appropriate preventive and control measures are suggested.

6.2 Observation, Results & Discussion:

6.2.1 During study 55 male workers were selected from 13 ship recycling industries of Alang/Sosiya & they were put under various radiological, pathological & clinical examination.

6.2.2 Age Group of the workers:

The age group of the workers subjected to medical examination is presented in Table -2. It is observed from the table that about 51% (28 out of total 55) of workers were above 35 yrs in age. 29% of them were between 25-35 yrs, 20% were in the age group of 18-25 yrs.

6.2.3 Job Category:

The workers subjected to medical examination were employed in different ship recycling units in Alang/Sosiya as mazdoors (Begari). They were mainly involved in the glass wool handling where they are exposed to glass wool
particles either though inhalation or through skin contact. All of them were temporary workers. They work for few months in a year at this recycling industry.

6.2.4 **Nature of workers:**

Maximum number of workers i.e 85% (47 out of 55 respondents) migrate from other states. They stay at Alang/ Sosiya in temporary sheds. It was observed that the workers stay alone isolated from their families.

6.2.5 **Exposure to Glass wool dust in years:**

6.2.5.1 Distribution of duration of work (in years ) of the workers employed in the ship recycling industry as reported by the them is presented in Table -3. It is seen from table that out of 55 workers 58.18 % had their duration of employment from 0 to 5 years. 34.5 % of them had an exposure of 5 to 15 years and those between 15 to 20 yrs and more than 20 years are 5.45 % & 1.81%.

6.2.5.2 It is evident from the table-3 that the industry has bad retention rate of workers as only about 6.5% workers are having experience of 15 years or more. The economic dissatisfaction reported to be the cause of bad retention of the workers in this sector.

6.2.6 **Occupational Health Services in Alang:**

6.2.6.1 Indian Red Cross Society, run a hospital with OPD services & has Indoor, Pathology & X-ray facility. The hospital is run by the retired medical officers & adequate number of qualified paramedical staff were not. Available to manages the services of the hospital.
6.2.6.2 The hospital mainly serve as a first aid center. Serious patients are referred to Bhavnagar which is about 50 Km away from Alang for further better management.

6.2.6.3 Alang has a private hospital which maintain OPD, Indoor, OT, Pathology & X-ray facility etc which are available on chargeable basis. But the hospital is not fully equipped to manage the trauma cases. However it was reported that ship recycling units in Alang/Sosiya avail the treatment in case of emergency/accident from the available private hospital.

6.2.6.4 Ship Recycling Industries Association (SRIA) has appointed one retired MBBS doctor on contractually basis to conduct the periodical medical health checkup of the workers of all the plots. The medical officer is not qualified to be appointed as factory medical officer as the Gujarat Factories Rules 1963.

6.2.6.5 It was observed that SRIA appointed Medical Officer takes the medical history of the workers & conducts physical examination at periodic interval. The finding are recorded in Health Register, Form no 32 as prescribed under Rule 68Tand 102 of Gujarat Factories Rules. It was informed that fitness certificate in Form no 33 (Prescribed under Rule 68Tand 102 of Gujarat Factories Rules was issued to the workers only on the basis of history taking & physical examination without performing any pathological or radiological tests.

6.2.6.6 The ship recycling units maintain the first aid boxes but it was observed during the study that the workers are not trained about the use of first aid.
6.2.6.7 Indian Red Cross Society Hospital maintains an ambulance which is reported to be available round the clock in case of need.

6.2.7 Literacy Among The Workers

The literacy level among the workers was also evaluated which is presented in Table -4. It is seen from the table that 34.5% respondents (19 out of 55) are illiterate & only 12.72% (7 out of 55) studied up to or beyond secondary level. The industry basically deals with the workers of low literacy so it is required to initiate awareness programme on basic health & personal hygiene to protect them from different occupational & other diseases.

6.2.8 Income & Family Dependency:

The income profile of the workers, no of children & family dependency is presented in Table-5 6 & 7 respectively. It is observed from tables that 78% of the workers earn in the range of Rs 2000 to Rs 6000 per month & 68.2% workers having more than 2 children (Table-6) with 60% workers having more than 4 dependants (Table-7). 6 respondents (11%) admit that they are not satisfied with their job due to unsatisfying income.

6.2.9 Marital Status:

Out of 55 most of the workers (49) were married (89%) & only 6 were unmarried (11%) & the migrant workers are staying here isolated from their family.

Study of Impact of Glass Wool In Ship Recycling Activities at Alang (Gujarat) RLJK/DGFAISLI /2012-13
6.2.10 Previous occupation:-

As mentioned earlier in this report that all the workers are temporary in nature & they work for few months in an year in this industry. Basically they are small farmers & they come to work in this industry during the lean season when demand of workers in agriculture is less.

36 respondents (65%) were agriculturer, 4 (7%) having experience in working in textile industry & others in transport, construction, cotton, polythene, oil, pharmaceutical industry etc.

6.2.11 Addictions:-

It was observed that tobacco in various forms is the main addiction of the workers in ship recycling industry. 38 out of 55 respondents (69%) reported that they consume bidi, cigarette, gutkha, khaini, mawa regularly & have addiction of smoking whereas 8 respondents (14.5%) were alcoholic.

6.2.12 Health Status of Workers & Impact of Glass Wool on Workers -

6.2.12.1 Nutritional Assessment Using Body Mass Index:

Body Mass Index (BMI) is calculated by dividing weight in kg to square of height in meter & following criteria is used to explain the nutritional status of the workers:

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In view of the prescribed criteria 45 (81.81%) workers were found normal, 7(12.72%) were of under weight & 3(5.45%) were over weight.

6.2.12.2 The family history of the workers was collected during study and it was observed that out of 55 workers one worker was having family history of bronchial asthma & two workers were having family history of pulmonary tuberculosis.

6.2.12.3 The morbidity of the workers in the descending order of their prevalence is shown in the Table No-8. 07 respondents out of 55 were suffering from Cough, Cold & Breathlessness, Joint Pain, Body Ache, Problem in near Vision, B/L Scrotal Swelling, Hearing Difficulty, Acute Pyrexia.

6.2.13 Impact of Glass Wool in Workers:

The impact of the glass wool on the workers can evaluated on the basis of findings of spirometry and radiological reports.

6.2.13.1 Lung Function abnormalities:

The results of the Spirometric analysis are given in Table 9A& 9B. It is evident from the tables that 5 workmen (3 shows mild to moderate restrictive abnormality & 2 shows mild to severe obstructive defect) had disorders of lung function when the results of their performance were analyzed.

6.2.13.2 Prevalence of Radiological Abnormalities:

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<tr>
<td>&lt;18.5</td>
<td>Under weight</td>
</tr>
<tr>
<td>18.5 to 24.99</td>
<td>Normal</td>
</tr>
<tr>
<td>More than equal to 25</td>
<td>Over weight</td>
</tr>
</tbody>
</table>

Study of Impact of Glass Wool in Ship Recycling Activities at Alang (Gujarat) RLJK/DGFASLI /2012-13
The radiological abnormalities in Chest X-rays of workers is presented in table-10A &10B.It is evident from the radiological reports that

- 0/55 exposed workers showed radiological abnormalities in their Chest radiographs.
- 3/55 workers had radiological abnormalities, not necessarily attributable to occupational exposure to glass wool dust.

6.2.13.3 Prevalence of Fibrosis and Occupational Lung Disorders:

As seen from table 10A&10B that prevalence rate of glass wool related occupational lung disorders among the workers is found to be the extent of 0(zero) of sample size of 55. As the workers are migratory in nature so there seems to be lack of consistent exposure of glass wool dust/fibres among worker in ship recycling activities.

6.2.13.4 Progressive breathlessness on Exertion:

Table-8 depicts the morbidity profile of ship recycling industry. Chronic cough & cold with or without progressive breathlessness is the main symptom of occupational lung disease & it is likely because of exposure of glass wool dust/fibres.

6.2.13.3 Clubbing of Fingers:
It is an inconsistent sign and may be present in varying severity in the cases of more advanced occupational lung disease and less often in those with mild disease. In the sample of 55 we could not find any case of clubbing. This could be due to non availability of advanced cases in the sample.

6.2.13.4 Bilateral Crackles:

It is also an important sign and their presence is closely related to the duration of exposure. They are of fine crisp quality i.e. high pitched, are unrelated to cough and heard at the end of full inspiration or throughout inspiration. In the present sample this sign was not observed in any of the workers.


6.2.14.1. Radiological Abnormalities Consistent with Glass Wool Related Disorders

in Different Age Groups

Although no definite fibrosis was detected in any of the chest x-rays, other radiological abnormalities detected in 03 X-rays (one in age group of 30-40 years & two in 40-50 years) as evident from Table-10A.

6.2.14.2 Radiological abnormalities consistent with Glass wool related Disorders

in different exposure (length of Service) groups.

It is observed from table 10B that workers who have working exposure of 15-20 years in this industry are having radiological abnormalities other than fibrosis.
6.2.15. **Analysis of pathological investigation reports:-**

6.2.15.1. **Blood examination**-

Complete blood count (CBC) was performed for all the selected 55 workers in the Pathological Laboratory of Hospital Alang. 31 workers (56.36%) were having mild to moderate anemia. 4 workers mild leucocytosis & 7 workers - thrombocytopenia indicating viral/bacterial diseases.

6.2.15.2. **Sputum for AFB**

Sputum for AFB was done in three samples for all the selected workers in the Pathological laboratory of Hospital Alang & all the tests were negative for sputum for AFB.

7 **RECOMMENDATIONS:**

Based on the observations, results and discussions of work place & medical evaluation in ship recycling units following recommendations are suggested to improve the work conditions and to control & prevent the occupational diseases among workers in the ship recycling activities at Alang.

7.1 The work of glass wool removal is not stationary in nature in ship recycling yards it is therefore suggested that **Portable Local Exhaust Ventilation system** may be introduced to capture glass wool dust/ fibres generated during ship recycling activity. The system is associated with movable exhaust hood, flexible exhaust duct, blower and high efficiency dust/ fibre collector.
7.2 It may be ensured that workers involved in glass wool handling should be provided with following types of personal protective equipments:

- High efficiency dust respirator for respiratory protection,
- Loose-fitting, comfortable, long-sleeved protective clothing or dagri for body protection,
- Gloves for hand protection,
- Dust-resistant safety goggles or safety glasses with side shields,
- Safety goggles for eyes, safety shoes for foot and helmet for head protection during insulation removal/handling.
- The use of personal protective equipment should be ensured among workers at the time of work through education & training. The workers should also be trained about their use, care & maintenance.

7.3 Protective clothing get contaminated with glass wool & should be changed as necessary. The workers should not wear contaminated clothing outside the workplace in order to prevent skin irritation. It is therefore suggested that suitable arrangements for washing of the contaminated protective clothing at regular interval may be made by ship recycling units. These clothing should be washed separately from other clothing.

7.4 The workers handling glass wool during removal of insulation/collection are exposed to glass wool dust/fibres. The glass wool dust/fibres on contact with hands or body may cause dermatological problems. In order to avoid or minimize dermatologic problem & maintain good personal hygiene practices among workers, hand wash facilities should be provided at convenient location and workers should be educated about the importance of their proper use.
7.5 In addition, exposed workers should shower the eyes & body at the ends of the work shift before changing the clothes. It is therefore suggested that the eyes & body washing and changing facilities for workers in ship recycling units should be provided and maintained.

7.6 The following caution sign should also be displayed at readily visible places in the ship recycling units to spread awareness among the workers:

```
GLASS WOOL
CAUTION
AVOID SKIN CONTACT & BREATHING DUST
Thoroughly Wash Exposed Skin and Flush the Eyes after Handling Glass Wool
```

The warning sign should be printed in a language known by the workers.

7.7 Hazards information & precautions for handling of glass wool should be displayed in the ship recycling units on prominent places in the language commonly understood by the workers.

7.8 The workers involved in the glass wool handling should be trained about the safe methods of handling of glass wool, occupational health, personal hygiene, & use of personal protective equipment etc. at periodic interval in the language commonly known by them.
7.9 House keeping in the ship recycling units should be improved & maintained in good condition. The glass wool as soon removed from the surface /equipments/ pipelines should be collected & disposed in prescribed manner. If glass wool left unattended on the floor its fibres/dust will dispersed in the work environment and will affect the health of the workers.

7.10 Monitoring of the glass wool in the work environment should be carried out at periodic intervals to assess & contain the airborne contaminants at work places.

7.11 The workmen should be subjected to meticulous Premedical, Periodic medical examination using special diagnostic tests as provided in State Factories Rules. The medical examination should include detailed clinical examination, Lung function and a Full size PA view Chest X-Rays and Sputum for AFB. The chest radiographs should be evaluated with reference to Standard ILO Radiographs following the stipulated guidelines.

7.12 The medical examination of the workers should be carried out periodically once in a year by qualified medical officer who possesses three month Fellow of Industrial Health (AFIH) certificate from CLI or other recognised institutes and record of such medical examinations should be maintained by the ship recycling units.

7.13 Cases or Suspects of Occupational Lung Disease detected at any stages during the course of employment and during medical examination must be notified in the prescribed form to the Chief inspector of Factories of the State of Gujarat as required under State Factories Rules.

7.14 GENERAL MISCELLANEOUS SUGGESTIONS

The Occupational health encompasses physical, social and mental well being. Therefore suggestions on general conditions which may aggravate occupational diseases are also given though are beyond the purview of the present study.

Study of Impact of Glass Wool In Ship Recycling Activities at Alang (Gujarat) RLIK/DGFASLI /2012-13
As the workforce is mainly migratory in nature & stays alone away from their family, screening test for sexually transmitted diseases/HIV may be introduced. & mass vaccination programme for Tetanus, Hepatitis- A, Hepatitis-B may be organised for the workers.

In this study it is seen most of the workers having more than 2 children & many dependents and nutritional assessment shows underweight cases & anemia. An awareness programme may be initiated to propagate small family norm so that standard of nutrition can be improved with limited income.

In ship breaking industry main injury occurred due to trauma but in Alang there is no well quipped hospital to provide timely service to the injured worker. An well equipped subsidized trauma care center may be established so that workers can get timely treatment.

Initiative may be taken to improve the residential, sanitation and drinking water facility of the workers.

8 CONCLUSION

The study on the impact of glass wool on the workers in the ship recycling activities at Alang concluded that suitable engineering measures should be adopted to reduce the personal exposure of workers from glass wool during insulation removal & collection. Use of personal protective equipment, good personal hygiene & effective medical surveillance of the workers should be introduced to protect the health of the workforce involved in ship recycling activities for glass wool handling.

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Study of Impact of Glass Wool In Ship Recycling Activities at Alang (Gujarat) RLJK/DG/ASLI /2012-13
9. ACKNOWLEDGEMENT

The study team is thankful to Gujarat Maritime Board (GMB) Ship Recycling Industries Association (SRIA) and management & employees of the following Ship Recycling Units of Alang/Sosiya Ship Yards for their cooperation & support during the study:

- Subh Arya Steel Pvt Ltd, Plot No 5, Ship Recycling Yard, Alang
- Ghasiram Gokal Chand, Plot No 8, Ship Recycling Yard, Alang
- Madhav Steel Plot No 33, Ship Recycling Yard, Alang
- Prakash Re Roller Pvt Ltd, Plot No 52M, Ship Recycling Yard, Alang
- Inducto Steel Ltd, Plot No 45, Ship Recycling Yard, Alang
- K.P.G. Enterprises, Plot No 91, Sosiya Ship Yard
- Alang Ship Breaking Corp. Plot No 93, Sosiya Ship Yard
- Akhil Ship Breaker Pvt. Ltd, Corp. Plot No 94

The team is grateful to Captain H.C. Chadda, Port Officer GMB and his team, Shri Vishnu Kumar Gupta, President SRIA, Shri Harish Parmar (SRIA), Shri Harshadbhai Padia SRIA and Shri Jayesh Desai, Deputy Director of Industrial Safety & Health & his team for their involvement and support in organising the present study.

Study of Impact of Glass Wool in Ship Recycling Activities at Alang (Gujarat) RLJK/DGFSALI/2012-13
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The team is also thankful to Dr. Ammen A. Hamidani, Chief Medical Officer, Alang Hospital for facilitating & extending all support for medical examination of the workers.

******
10 REFERENCES:


2. ACGIH. 2001. Synthetic vitreous fibers. Supplement to documentation of the threshold limit values and biological exposure indices. American Conference of Governmental Industrial Hygienists. Cincinnati, OH.

3. ACGIH (2007), TLVs and BEUs –Threshold Limit Values for Chemical Substances and physical Agents and Biological Exposure Indices American Conference of Governmental Industrial Hygienists ,Cincinnati,Ohio,


* * * * *
**TABLE – 1:**
**LEVELS OF AIRBORNE GLASS WOOL DUST IN SHIP RECYCLING ACTIVITIES AT ALANG (GUJARAT)**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Industry</th>
<th>Employment / Employee involve on Glass Wool Handling</th>
<th>Type of Ship being Recycled</th>
<th>Location</th>
<th>Concentration (in mg/m$^3$ )</th>
<th>PLE–TWA (in mg/m$^3$ )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Range</td>
<td>TWA Exposure of Workers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Subh Arya Steel Pvt Ltd, Plot No 5, Ship Recycling Yard, Alang</td>
<td>120/4–6</td>
<td>General Cargo</td>
<td>Removal of Glass wool from cabin</td>
<td>5.20–12.28(6)</td>
<td>7.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Collection of Glass wool in PVC Bags</td>
<td>1.32–8.03(4)</td>
<td>4.43</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>General</td>
<td>5.95–7.00(2)</td>
<td>–</td>
</tr>
<tr>
<td>2.</td>
<td>Ghasiram Gokal Chand, Plot No 8, Ship Recycling Yard, Alang</td>
<td>120/4–6</td>
<td>–</td>
<td>Collection of Glass wool in PVC Bags</td>
<td>2.00–8.66(4)</td>
<td>5.74</td>
</tr>
</tbody>
</table>

**ALANG SHIP YARD**

*Study of Impact of Glass Wool In Ship Recycling Activities at Alang (Gujarat) RLJK/DGFASLI /2012–13*
<table>
<thead>
<tr>
<th></th>
<th>Company Name</th>
<th>Plot No</th>
<th>Type of Ship</th>
<th>Glass Wool Collection</th>
<th>Range</th>
<th>Contact No</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Madhav Steel Plot No 33, Ship Recycling Yard, Alang</td>
<td>–</td>
<td>Bulker</td>
<td>Collection of Glass wool in PVC Bags</td>
<td>4.18–9.72(3)</td>
<td>7.38</td>
<td>–</td>
</tr>
<tr>
<td>7</td>
<td>Inducto Steel Ltd, Plot No 45, Ship Recycling Yard, Alang</td>
<td>140/4–6</td>
<td>Bulk Carrier</td>
<td>Removal &amp; Collection of Glass wool in PVC Bags</td>
<td>2.06–4.65(5)</td>
<td>3.47</td>
<td>–</td>
</tr>
</tbody>
</table>

*Study of Impact of Glass Wool In Ship Recycling Activities at Alang (Gujarat) RLJK/DGFA/SI /2012-13*
<table>
<thead>
<tr>
<th></th>
<th>Company Name</th>
<th>Plot No</th>
<th>Industry Type</th>
<th>Activity Details</th>
<th>Average TWA (with Number of Samples)</th>
<th>PLE - TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Alang Ship Breaking Corp. Plot No 93 Sosiya Ship Yard</td>
<td>116/5–6</td>
<td>RO RO Cargo</td>
<td>Removal &amp; Collection of Glass wool in PVC Bags</td>
<td>1.25–12.50(10)</td>
<td>5.56</td>
</tr>
<tr>
<td>10</td>
<td>Akhil Ship Breaker Pvt. Ltd Corp. Plot No 94 Sosiya Ship Yard</td>
<td>100/5–6</td>
<td>General Cargo</td>
<td>Removal &amp; Collection of Glass wool in PVC Bags</td>
<td>3.10–6.00(5)</td>
<td>4.76</td>
</tr>
</tbody>
</table>

**Abbreviation**:  
T.W.A : Time Weighted Average  
PLE - TWA : Permissible Limit of Exposure - Time Weighted Average

**Note**: Figures in brackets under column average indicates number of samples collected.

*Study of Impact of Glass Wool In Ship Recycling Activities at Alang (Gujarat) RLIK/DGFASLI /2012–13*
### Table-2

**AGE GROUP OF THE WORKERS SUBJECTED TO MEDICAL EXAMINATION**

<table>
<thead>
<tr>
<th>Age</th>
<th>No</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-25</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>25-35</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>35-45</td>
<td>20</td>
<td>36</td>
</tr>
<tr>
<td>&gt;45</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>total</td>
<td>55</td>
<td>100</td>
</tr>
</tbody>
</table>

*Study of Impact of Glass Wool In Ship Recycling Activities at Alang (Gujarat) RLJK/DGFSI /2012-13*
Table 4

LITERACY AMONG THE WORKERS

<table>
<thead>
<tr>
<th>LEVEL OF EDUCATION</th>
<th>NUMBER</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>19</td>
<td>34.5</td>
</tr>
<tr>
<td>Upto Class IV</td>
<td>12</td>
<td>21.9</td>
</tr>
<tr>
<td>Upto Class VIII</td>
<td>17</td>
<td>30.9</td>
</tr>
<tr>
<td>Secondary &amp; Above</td>
<td>07</td>
<td>12.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>55</td>
<td>100</td>
</tr>
<tr>
<td>Duration of work in years</td>
<td>Number</td>
<td>Percentage</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------</td>
<td>------------</td>
</tr>
<tr>
<td>0-5</td>
<td>32</td>
<td>58.19</td>
</tr>
<tr>
<td>5-15</td>
<td>19</td>
<td>34.55</td>
</tr>
<tr>
<td>15-25</td>
<td>03</td>
<td>05.45</td>
</tr>
<tr>
<td>&gt;20</td>
<td>01</td>
<td>01.81</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>100</td>
</tr>
</tbody>
</table>
**Table 5**

**DISTRIBUTION OF INCOME IN RUPEES**

<table>
<thead>
<tr>
<th>Income in Rupees</th>
<th>No of workers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 to 6000</td>
<td>43</td>
<td>78</td>
</tr>
<tr>
<td>6000 to 12000</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>12000 to 20000</td>
<td>1</td>
<td>02</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>55</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**Table 6**

**DISTRIBUTION OF NUMBER OF CHILDREN**

<table>
<thead>
<tr>
<th>Children</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 2</td>
<td>23</td>
<td>41.8</td>
</tr>
<tr>
<td>3 to 4</td>
<td>21</td>
<td>38.2</td>
</tr>
<tr>
<td>&gt;4</td>
<td>11</td>
<td>20.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>55</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Table 7
**DISTRIBUTION OF DEPENDANTS**

<table>
<thead>
<tr>
<th>Dependants</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4</td>
<td>22</td>
<td>40</td>
</tr>
<tr>
<td>5 to 6</td>
<td>18</td>
<td>33</td>
</tr>
<tr>
<td>Above 6</td>
<td>15</td>
<td>27</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>55</td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 8
**DISTRIBUTION OF MORBIDITY**

<table>
<thead>
<tr>
<th>Complains</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough, cold &amp; breathlessness</td>
<td>1</td>
</tr>
<tr>
<td>Joint pain</td>
<td>1</td>
</tr>
<tr>
<td>Body ache</td>
<td>1</td>
</tr>
<tr>
<td>Problem in near vision</td>
<td>1</td>
</tr>
<tr>
<td>B/L Scrotal Swelling</td>
<td>1</td>
</tr>
<tr>
<td>Hearing Difficulty</td>
<td>1</td>
</tr>
<tr>
<td>Acute pyrexia</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>07</strong></td>
</tr>
</tbody>
</table>
### Table-9A
**DISTRIBUTION OF SPIROMETRY RESULTS**

<table>
<thead>
<tr>
<th>FVC%</th>
<th>Number</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥80%</td>
<td>48</td>
<td>Normal</td>
</tr>
<tr>
<td>70-69%</td>
<td>2</td>
<td>Mild Restrictive Defect</td>
</tr>
<tr>
<td>50-59%</td>
<td>1</td>
<td>Moderate Restrictive Defect</td>
</tr>
<tr>
<td>Total</td>
<td>51</td>
<td></td>
</tr>
</tbody>
</table>

### Table-9B
**Distribution of Spirometry Result**

<table>
<thead>
<tr>
<th>FEV1/ FVC%</th>
<th>Number</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥70%</td>
<td>41</td>
<td>Normal</td>
</tr>
<tr>
<td>69-50%</td>
<td>1</td>
<td>Mild obstructive Defect</td>
</tr>
<tr>
<td>&lt;50</td>
<td>1</td>
<td>Moderate to Severe Obstructive Defect</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td></td>
</tr>
</tbody>
</table>
Table-10A:

DISTRIBUTION OF RADIOLOGICAL ABNORMALITIES CONSISTENT WITH GLASS WOOL RELATED DISORDERS IN DIFFERENT AGE GROUPS

<table>
<thead>
<tr>
<th>Age group in years</th>
<th>18 -30</th>
<th>30 – 40</th>
<th>40 - 50</th>
<th>50 &amp; above</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definite fibrosis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other Radiological Abnormality</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>1 (1.81)</td>
<td>2 (3.63)</td>
<td>0</td>
<td>3 (5.45)</td>
</tr>
</tbody>
</table>

Table-10B:

DISTRIBUTION OF RADIOLOGICAL ABNORMALITIES CONSISTENT WITH GLASS WOOL RELATED DISORDERS IN DIFFERENT EXPOSURE (LENGTH OF SERVICE) GROUPS

<table>
<thead>
<tr>
<th>Exposure group in years</th>
<th>0 – 5</th>
<th>5 – 10</th>
<th>10 -15</th>
<th>15 – 20</th>
<th>20 &amp; above</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>N =67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>67</td>
</tr>
<tr>
<td>Definite fibrosis</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Other Radiological Abnormality</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3(5.45)</td>
<td>-</td>
<td>3(5.45)</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3(5.45)</td>
<td>-</td>
<td>3(5.45)</td>
</tr>
</tbody>
</table>