# DETECTION OF SILICOSIS AMONG STONE MINE WORKERS FROM DHOLPUR DISTRICT

FEBRUARY 2014

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# REPORT ON

# DETECTION OF SILICOSIS AMONG STONE MINE WORKERS FROM DHOLPUR DISTRICT

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***CERTIFICATE***

*This is to certify that this report on "Detection of Silicosis among Stone Mine Workers from Dholpur District" is based on the results and findings of evaluation of Chest Radiographs of stone mine workers from Dholpur District of Rajasthan submitted to NIMH by Dang Vikas Sanstha an associate of Association for Rural Advancement through Voluntary Action & Local Involvement (ARAVALI), a Rajasthan State Government initiated NGO. The chest radiographs of workers have been evaluated as per the ILO Classification of Chest radiographs of Pneumoconiosis 2000 as per the standard practice.*

Date :

Place : Nagpur

(Dr. P. K. Sishodiya)

Director

## TABLE OF CONTENTS

## *Executive Summary*

National Institute of Miners' Health has detected 222 cases of silicosis among stone mine workers of Karauli District in Rajasthan in collaboration with Dang Vikas Sansthan (DVS) an associate of ARAVALI (Association for Rural Advancement through Voluntary Action & Local Involvement), a non-government organization initiated by the Government of Rajasthan. The detailed report was submitted to Directorate General of Mines Safety (DGMS), District Collector, Ministry of Mines, Ministry of Labour and Employment and other agencies. Meetings were held with district administration and other stake holders and a rehabilitation and relief programme has been initiated including ex-gratia payment by state government and treatment of affected workers.

In the meeting of stakeholders attended by the District Collector and Chief Medical Officer, Dholpur district, it was decided that cases suspected to be suffering from silicosis from Dholpur will be referred to NIMH for diagnosis. DVS as facilitator collected 157 chest x-rays of stone mine workers from 14 villages of Dholpur District and referred to NIMH for evaluation of detection of Silicosis. The x-rays were evaluated as per ILO classifications of radiographs for Pneumoconiosis, 2000. 3 x-rays of women having no history of work in stone mines and 16 x-rays found to be of poor quality were not considered for evaluation.

The findings shows that out of the 138 x-rays evaluated, 53 ( 38.4 %) had evidence of silicosis of which 4 (7.5 %) developed large opacities suggestive of Progressive Massive Fibrosis (PMF). X-rays of 74 (53.6%) persons were Normal and x-rays of 11 persons (8 %) showed radiological evidence of Pulmonary Tuberculosis. Detailed analysis of result showed that the x-rays of the persons having work exposure of less than 10 yrs did not show evidence of silicosis. The prevalence of silicosis in persons having work exposure between 11 to 20 yrs, 21 to 30 years and more than 30 years showed increasing trend of 29 %, 45.5 % & 56.5 % respectively. The occurrence and profusion of pneumoconiotic opacities due to silicosis was directly related to the number of years of work in stone mines. Therefore, based on the evaluation of results

of chest radiographs, it can be said that a large proportion of the persons working in stone mines of Dholpur may be suffering from silicosis and some with PMF with or without associated pulmonary tuberculosis.

There is immediate need for starting an intervention programme to provide treatment to the persons affected with silicosis and conducting a comprehensive study involving all persons engaged in stone mining to determine prevalence of silicosis in the area. There is also need to train local doctors in diagnosis of silicosis as large numbers of cases are misdiagnosed as cases of Pulmonary Tuberculosis. The mine owners and workers also need to be educated and made aware of health hazards of stone dust and preventive measures required to be taken.

**REPORT ON DETECTION OF SILICOSIS AMONG STONE MINE WORKERS FROM DHOLPUR DISTRICT**

## 1.0 BACKGROUND

National Institute of Miners' Health (NIMH) in collaboration with ARAVALI (Association for Rural Advancement through Voluntary Action & Local Involvement), a Rajasthan State initiated Non-Governmental Organisation (NGO) has been engaged in detection of Silicosis in Karauli District of Rajasthan since 2011. ARAVALI while implementing its Family Livelihood Resource Centres (FLRC) Programme in the area observed that persons with history of employment in stone mines had very high prevalence of debilitating respiratory diseases which directly affected their family livelihood. The NGO suspected many persons affected by respiratory diseases with history of work in stone mines may be suffering from silicosis. They approached National Institute of Miners' Health (NIMH) for advice. The institute after preliminary enquiry in the area advised detailed medical examination of persons affected.

ARAVALI conducted medical examination of 101 persons of Karauli area who had been suffering from various respiratory symptoms and had history of work in stone mines. The records of medical examination including chest radiographs were submitted to National Institute of Miners' Health for evaluation. NIMH carried out detailed analysis of the medical records and the chest radiographs were evaluated in accordance with ILO Classification of Radiographs for Pneumoconiosis, 2000. Out of 101 subjects, radiographs of 93 subjects were considered for further analysis. The results of evaluation of medical records of 93 subjects with history of work in stone mines showed evidence of silicosis in 73 (78.5%) subjects and 16 (21.9%) of them had developed Progressive Massive Fibrosis. 53 (57%) of these had silicosis of category 2 or higher indicating advance stage of the disease. Since conduct of the study 16 persons have succumbed to the disease. The study confirmed that prevalence of advanced stage of silicosis and progressive massive fibrosis is high among manual stone mine worker in Karauli Area and prevalence being directly proportional to years of work in stone mines. Longer the duration of work, higher is the occurrence and advancement of silicosis and PMF.

The Report of study was sent to Directorate General of Mines Safety (DGMS), District Collector and other officials, Karauli, Ministry of Mines, GOI, Ministry of Labour and Employment, GOI, Secretary, National Human Right Commission, Aravali and Dang Vikas Sanstha. DGMS conducted an enquiry into the matter. The District Administration initiated steps for rehabilitation and organized treatment camps for silicosis victims. Also Silicosis awareness programmes have been organized by Dang Vikas Sanstha and district administration. State government has set up medical boards for certification of silicosis. An ex-gratia of Rs 3 Lakhs each has been paid to families of 5 workers died of silicosis.

The Rajasthan Environment and Health Administration Board in its 6$^{th}$ meeting held on 30.05.2013 under chairmanship of Principal Secretary (Finance), has decided ex-gratia payment of Rs. 1.00 lakh for silicosis affected person and Rs.3.00 lakhs for family of person died of silicosis to be paid from Rehab Cess Fund. The Board has allocated Rs.100 Lakhs for the purpose. The State Government has identified 5 districts as priority area for detection of silicosis. Several meetings of stakeholders in Silicosis Prevention & Control Programme under the Chairmanship of the District Collector, Karauli have been held and a rehabilitation and relief Programme "KHULI SAANS" has been launched in 13 panchayats of Karauli area.

Since the first report on detection of silicosis in Karauli area and consequent action takes by district and state authorities, there has been increased awareness among workers and population in general. The institute is receiving requests for conducting detailed study on prevalence of silicosis in the area.

ARAVALI further sent chest x-rays of 314 stone mine workers from about 40 villages of Karauli district for detection of silicosis. NIMH carried out evaluation of the chest radiographs in accordance with ILO Classification of Radiographs for Pneumoconiosis, 2000. Out of 314 subjects, radiographs of 298 subjects were considered for further analysis. The results showed evidence of silicosis in 149 (50%) subjects and 20 (13.4%) of them had developed Progressive Massive Fibrosis.

In the meeting of stakeholders attended by the District Collector and Chief Medical Officer, Dholpur district, it was decided that cases suspected to be suffering from silicosis from Dholpur will be referred to NIMH for diagnosis. Therefore DVS as

facilitator has collected 157 chest x-rays of stone mine workers from 20 villages of Dholpur District for evaluation for detection of Silicosis. ***The present study "Detection of Silicosis among stone mine workers from Dholpur District" is based on these 157 chest radiographs referred to NIMH for evaluation and opinion.***

## 2.0 INTRODUCTION

Stone quarrying and crushing are carried out in many parts of India and majority of these mines are located either in remote area or rural areas adjacent to the cities. A large number of persons are employed in unorganized small scale stone mines and crushing units. Most stone mines are seasonal and operated by small entrepreneurs with daily employment ranging from 5-20 workers though there are mines employing more than 100 persons. The working conditions in stone mines are far from satisfactory and rarely comply with health and safety standards. Stone quarrying and crushing operations give rise to large amount of fine dust containing free silica in the range of 20 -70% depending on the nature of stone. The workers are exposed to high levels of free silica which causes silicosis. Exposure to silica dust is also known to predispose to Pulmonary Tuberculosis, Chronic Airflow Limitation, Lung Cancer, Renal Diseases, etc. Many studies have been conducted in past to determine prevalence of silicosis amongst stone quarry workers in India, it may be stated from these studies that prevalence of silicosis among the stone quarry workers range from 12 % to 50%. There is a general lack of education and awareness about occupational diseases among workers, employers and even local medical practitioners. It is not uncommon that most cases of silicosis are treated with anti-tubercular drugs without much response.

One such major stone mining area is Dholpur district of Rajasthan. Dholpur district is the smallest district situated in north-east corner of Rajasthan and is bounded in the north by Bharatpur (Raj.) and Agra (U.P.) districts, in South by Muraina (U.P.) and Gwalior (M.P.) districts and in the west by Karauli district. The district has four Panchayat Samities, viz. Basedi, Bari, Dholpur and Rajakhera . The mineral wealth of

the district is constituted mainly by sandstone & limestone. A total of 87 mining leases are existing in the district.

Dholpur district is known for its unique Sandstone. In general Dholpur sandstone is fine to medium grained, compact, resistant to acid, available in different shades and colours and can be easily dressed and chiseled. It takes good polish at cut surface. The colour of the sandstone depends on the constituents of the cementing material. The famous Dholpur sandstone is being used in Rajasthan as well as in neighbouring states since centuries as building and dimensional stone. The famous historical buildings like Rashtrapati Bhawan, Red Forts of Agra and Delhi, Vidhansabha Bhawan, Jaipur and many other forts are built by the Dholpur sandstone. It is being used in roofing, flooring, panelling, beams; pillars, door and window sills, cladding, wall fencing, making of statue, perforated windows, jalies and carved decorative articles.

Details of the important sandstone localities of the district are given below.

| | **Tehsil** | **Village** |
|---|---|---|
| 1. | Bari | Kankrai, Dhimri, Tanoti, Totpur, Naksonda, Richhai, Chilaghund, Bhola Ka Pura, Birpur, Basai, Dang, Khanpur Gurjar, Bijauli, Maidana, Barauli Ka Pura, Talab Sahi, Janura. |
| 2. | Baseri | Kachchhanpura, Khidarpur, Angai, Thawa, Dhond, Bidarpur, Tilawa, Birja, Dhor, Nandanpur, Tajpur, Sar Mathura, Badarea, Chand, Kharagpura. |

The deposits mentioned above have splittable and blockable sandstone. The blocks of 8'x4'x3' and even bigger size can be excavated. In general, Dholpur Sandstone contains 98.20% $SiO_2$, 0.840% $Fe_2O_3$, 0.32% $Al_2O_3$, 0.28% CaO, MgO is absent and loss on ignition is nil. Physically this sandstone has 2.40 kg/$m^3$ density, 1.20% Water absorption, 208 kg/$cm^2$ Modulus of Rupture and 460 kg/$cm^2$ compressive strength.

A total of 64 leases of sandstones are in operation in the district.

**Masonry Stone:** The sandstone which is hard and compact but does not has splittability, is used as masonry stone in the form of Khanda, Gitty & boulders. The leases of Khanda, Gitty, boulders & Bajari are distributed throught the district. It is

also supplied to the neighbouring parts of M.P. and U.P. States. The prominent deposits are listed below:

| | Tehsil | Village |
|---|---|---|
| 1. | Dholpur | Chandpura, Narpura, Bhilgaon, Surajpura, Bishnoda, Kotra, Panch Gaon, Purani Chhawani. |
| 2. | Rajakhera | Pahari, Mairana. |
| 3. | Sepau | Rundh-Rajaura. |

There are 22 working leases for masonry stone existing in the district.

The Mineral Administration in the district is looked after by Mining Engineer, Dholpur under supervision of the Superintending Mining Engineer, Bharatpur and Addl. Director, Mines, Jaipur Zone.(1)

## 3.0 STUDIES ON SILICOSIS

Many studies have been conducted in past to determine the prevalence of silicosis amongst the stone quarry workers in the country. Sikand and Pamra (1949) were probably the first to report cases of silicosis in surface workers in India. They recorded that 52.4% of stone cutters and 12.5% of stone breakers suffered from silicosis in stone mines and crushers near Delhi. They also reported higher incidence of tuberculosis among these workers.(2) A Study conducted in 1992-94 by Desert Medicine Research center, Jodhpur, to find out the pattern and predictors of mortality amongst sandstone workers showed that radiological opacities suggestive of silicosis were seen in 9.9% radiographs and radiological signs of pulmonary tuberculosis were seen in 15.6 % of radiographs. Prevalence of both conditions increased with duration of work. (3)

An environmental and epidemiological survey carried out in stone quarry workers by NIOH Ahmedabad, revealed evidence of silicosis in 22.4% workers. About 32% workers showed radiological evidence of tuberculosis. Majority of the cases of silicosis were detected among workers who had worked for over 10 years. The mean total dust concentrations in two quarries were 3.38 and 3.72 mg/$M^3$ and respirable dust concentrations in two quarries were 0.80 and 0.85 mg/$M^3$ respectively. the free

silica content in dust was estimated to be about 70%.[4] In a review article "occupational health research in India" it is suggested that the prevalence of silicosis amongst stone quarry workers was 21% and that in stone crusher was 12%.[5]

An environmental and medical survey in sand stone mines located in lalitpur district of Uttar Pradesh revealed that the total and respirable dust concentration during the process of stone cutting were 22.4 mg/$m^3$ and 1.6 mg/$m^3$ respectively. Examination of 125 stone cutters showed that the prevalence of silicosis and tuberculosis were 22% and 48% respectively. The average duration of dust exposure for development of silicosis was 12 to 15 years. The total and respirable dust levels after installation of the control device, which operates on the principle of enclosure, were 3.4 mg/ $m^3$ and 0.8 mg/ $m^3$ respectively.[6]

A study by Gramin Vikas Vigyan Samiti (GRAVIS), Jodhpur in collaboration with Society for Participatory Research in Asia (PRIA), Delhi in 1994, found that about 10% of mine workers examined suffered from silicosis. Another study conducted in 1996, in sandstone mines in Jodphur, showed that out of the 288 workers examined, 14% were found to be suffering from severe silicosis, and 28% were found to be suffering from silicosis of less severity.[7]

In a survey conducted by Center for Occupational and Environmental Health, New Delhi in Lal-Kuan area of New Delhi to assess health status of resident who had worked in stone crushers and quarries, showed that approximately 39% of the subjects examined were suspected to be suffering from Silicosis, or Silico- tuberculosis while the number of subjects with tuberculosis was 29%.[8]

## 4.0 SILICOSIS [9]

Silicosis is caused by inhalation of airborne dust of Silicon Dioxide or Silica in the crystalline form also known as quartz. In metal mines, workers are exposed to high concentration of silica dust almost at every stage of mining operation. However, drilling, blasting, loading – unloading of ore, crushing, etc. are some of the dustiest operations and thus, workers in metal mines are at the higher risk of developing silicosis. Occurrence of silicosis is directly related to the degree of exposure to silica

dust and higher in the exposure more in the chance of developing silicosis. Silicosis is generally seen in sub-acute and chronic form after exposure to silica dust for many years. However, very heavy exposure to silica dust is known to cause acute silicosis.

## 4.1 Pathogenesis

The precise pathogenesis of silicosis is not completely understood. The studies suggest that interactions between pulmonary alveolar macrophages and silica particles play a major role in the pathogenesis of silicosis. Surface properties of the silica particles appear to promote macrophage activation. These cells then release chemotactic factors and inflammatory mediators that elicit cellular responses by polymorphonuclear leukocytes, lymphocytes, and additional macrophages. Fibroblast-stimulating factors are also released which promote hyalinization and collagen deposition. The resulting pathologic lesion is the hyaline nodule which contains a central acellular zone with free silica surrounded by whorls of collagen and fibroblasts and an active peripheral zone composed of macrophages, fibroblasts, plasma cells and additional free silica.

The precise properties of the silica particles that evoke pulmonary response are not known. The nature and extent of biologic response is related to the intensity of exposure to silica dust but the surface characteristics of the dust also appear to be important. There is growing evidence that freshly fractured silica may be more toxic than aged silica-containing dusts perhaps because of reactive radical groups on the cleavage planes of the freshly fractured moiety. This may offer a pathogenic explanation for the more frequent observation of cases of advanced disease in sandblasters and rock drillers, in whom exposure to recently fractured silica is particularly intense.

## 4.2 Clinical Features

Silicosis is a largely asymptomatic disease till the onset of Progressive Massive Fibrosis (PMF). There may be no symptoms even though the radiographic appearances may suggest fairly advanced silicosis. Dyspnoea on exertion is the most frequent and directly related symptom, although it is rarely complained of in the

absence of complicating diseases such as tuberculosis or bronchitis. The severity of dyspnoea increases with the progress of disease. Slight unproductive cough may be present at initial stages, however, the quantity of sputum increases later on. The symptoms usually resemble chronic bronchitis. Excessive sputum production is due to bronchial catarrh due to chronic dust exposure and sometimes due to secondary bacterial infection. Chest pain and haemoptysis are invariably due to tuberculosis.

Silicosis can also occur in acute form with heavy exposure to quartz dust over a short period. Acute silicosis develops within few months after inhalation of massive quantities of fresh silica dust. It generally presents as diffuse progressive irregular fibrosis of lower zones with few typical nodular shadows of silicosis. The radiological appearance is almost similar to pulmonary edema. There may also be acute enlargement of hilar lymph nodes. The histological findings are similar to pulmonary alveolar proteinosis. Acute silicosis presents as severe dyspnea and associated weight loss. The diseases is rapidly progressive and death is invariably due to severe hypoxemic ventilatory failure.

### 4.3 Chest Radiography

Chest radiography is the most important tool for the diagnosis of silicosis. There is direct relationship between degree of exposure to dust and severity of radiographic changes. In the initial stage, there is 'reticulation' of lung fields due to thickening of peri-vascular and inter-communicating lymphatics. However, the radiographic diagnosis of silicosis can only be made after appearance of nodules particularly in upper and middle zones of lungs. The silicotic nodules initially are 2-5 mm in diameter, homogenous in density and usually bilaterally symmetrical. The nodules increase in number and size to "r" type and eventually cover most parts of the lungs.

Silicotic opacities tend to increase even after cessation of exposure to silica dust and sometimes calcification is seen in small nodules. There may also be Kerley B Lines at bases and thickening of inter- lobar fissure and pleura. Eggshell calcification of hilar lymph nodes when present is almost pathognomonic of silicosis. At later stage, the silicotic nodules frequently unite and conglomerate to form large shadows of Progressive Massive Fibrosis (PMF). These shadows initially have a multi-nodular

appearance but later on consolidate into contracted dense fibrotic masses often surrounded by bullae. The cavitation of shadows may occur with or without tuberculosis infection. There is invariably extensive pulmonary fibrosis close to the PMF lesions.

### 4.4 Lung Function Tests

Simple silicosis is rarely associated with lung function abnormalities except at the advance stage. However, there may be mixed type of lung function abnormalities due to exposure to dust. In cases of acute silicosis, restrictive type of lung function abnormalities may be seen. In late stages of progressive massive fibrosis there will always be severe mixed type of lung function abnormalities.

### 4.5 Complications of Silicosis

Pulmonary tuberculosis is the most frequent and an important complication of silicosis, presumably due to reactivation of previously existing quiescent lesions. There may also be infection due to atypical mycobacteria. The other complication of silicosis include pneumothorax associated with combination of fibrosis and bullae, increased frequency of scleroderma and tendency for renal failure. Recent studies have suggested that the silica dust may be carcinogenic and there may be increased incidence of lung cancer among silicotics. There is also some evidence to suggest that silica dust exposure may increase the incidence of ischemic heart diseases.

### 4.6 Prognosis

The prognosis in silicosis depends on the degree of exposure and the rate of development of silicosis. Acute silicosis invariably carries very poor prognosis and majority of the patient die within few months. Silicosis occurring at late stage is less debilitating till the onset of progressive massive fibrosis. Development of progressive massive fibrosis at any stage invariably carries poor prognosis.

## 5.0 STATUTORY REQUIREMENTS UNDER MINES ACT, 1952 AND RECOMMENDATIONS OF CONFERENCES ON SAFETY IN MINES

The Mines act, 1952 and Mines Rules, 1955 provide the statutory requirements for medical examination of workers and detection of notified diseases. The Conferences on Safety in Mines have further recommended detailed medical examination and classification of chest radiographs as per ILO classification. The important provisions are listed below.

### 5.1 Mines Act, 1952 [10]

***Section 25 Notice of Diseases***

Mine management is required to submit notice of occurrence of notified diseases under section 25 of Mines Act, 1952.

The said section requires that:-

1. Where any person employed in a mine contracts any disease notified by Central Government as a disease connected with mining operations, the owner, agent or manager of the mine, shall send notice thereof to the Chief Inspector.

2. If any medical practitioner attends on a person who is or has been employed in a mine and who is or is believed by the medical practitioner to be suffering from any disease notified under sub-section (1), the medical practitioner shall send a report in writing to the Chief Inspector stating

    a) the name and address of the patient.
    b) the disease from which the patient is or is believed to be suffering.
    c) The name and address of the mine in which the patient is or was last employed.

Following diseases have been notified as the diseases connected with mining operations for the purpose of sub-section (1) of Section 25 of the Mines Act, 1952:-

- Silicosis
- Pneumoconiosis
- Manganese Poisoning - Nervous type
- Asbestosis
- Cancer of lung or the stomach or the pleura and peritoneum (i.e.mesothelioma)

The Central Govt. vide notification S.O.399 (E) dated 21/2/2011 has further notified following diseases connected with the mines operation.[11]

- Noise Induced Hearing Loss
- Contact dermatitis caused by direct contact with chemicals
- Pathological manifestations due to Radium or Radioactive substances

## 5.2 Mines Rules, 1955 [12]

***Rule 29 B: Initial and Periodical Medical Examination***

The Rule provides for;

(a) Initial medical examination of every person to be employed in the mine.

(b) Periodical medical examination, once every five years of persons employed in the mines.

(c) In case of the persons engaged in the process of mining or milling of asbestos, periodical medical examination shall be done at least once in every twelve months and every such examination shall include all the tests except the X-ray examination, which shall be carried out once in every three years.

(d) The periodical medical examination or the x-ray examination or both, shall be conducted at more frequent intervals if the examining authority deems it necessary to confirm a suspected case of a dust related disease.

The routine initial or periodical medical examination should include -

General physical examination,
A full size postero-anterior chest radiograph,
Lung Function Tests (Spirometry)

Central Government has notified;

Initial medical examination of every person seeking employment in mines and periodical medical examination once in five years of the following categories:-

(i) persons employed below ground in a mine:
(ii) persons employed in open cast workings of manganese mine or an asbestos mine:
(iii) persons engaged in operation of draglines, shovels, dozers, scrapers, dumpers, power drills, boring machines, locomotives winding engines, air compressors and other machinery installed or deployed on the surface or in the open cast workings in a mine:
(iv) persons engaged in crushing, grinding, dressing, processing, screening, or sieving of minerals, ores or stone or in any operation incidental thereto in a mine**.**

**I. Rule 29C**

The medical examinations to be conducted by a medical officer appointed by the mine.

**II. Rule 29D**

The rule describes the procedure to be followed for conduct of medical examination including notice of medical examination to the examinee in Form - M

**III. Rule 29E**

The rule describes the action required to be taken in case a person fails to submit himself for medical examination.

**IV. Rule 29F**

Initial and periodical medical examination of persons to be conducted in accordance with standards laid down in Form - P or Form - P I.

**V. Rule 29G (1)**

All medical examination records along with job details depicting occupational dust exposure profile of the person shall be retained till the person is in employment and ten years thereafter.

**VI. Rule 29H**

Every candidate for medical examination to handover three passport size photographs at the time of medical examination.

**VII. Rule 29I**

No woman shall, without her consent, be medically examined by a male medical practitioner except in presence of another woman

**VIII. Rule 29J**

Where a person is declared medically unfit on medical examination, he may file an appeal with the manager for medical re-examination by Appellate Medical Board.

**IX. Rule 29K**

The Appellate Medical Board shall consist of

a. Inspector of Mines (Medical), Member Secretary
b. One Physician
c. One Radiologist

**X. Rule 29L**

The Appellate Medical Board shall examine a person in accordance with standard laid down in Form – P or PI and issue certificate in Form – S.

**XI. Rule 29M**

Medically unfit person not to be employed in mines.

**XII. Rule 29N**

If as a result of any medical examination a person is found to have any disease notified under section 25 of Mines Act, the provisions of Workman Compensation Act shall become applicable.

**XIII. Rule 29O**

The full cost of every medical examination under the rules shall be borne by the owner of the mine.

**XIV. Rule 29P**

Every mine shall submit an annual return about number of medical examinations conducted by it in form T.

## 5.3 Recommendations of VII$^{th}$, VIII$^{th}$ and IX$^{th}$ Conferences on Safety in Mines

Important recommendations of VII$^{th}$, VIII$^{th}$ and IX$^{th}$ National Conferences on Safety in Mines on Occupational Health Services and Medical Surveillance.

(i) There is a need for creation of Occupational Health Services in each mining company working mechanized mines.

(ii) Occupational Health Services shall have sufficient technical personnel with specialized training and experience in Occupational Medicine, Industrial Hygiene, Ergonomics, Occupational Health Nursing, etc. They should keep themselves up-to-date with progress in the scientific and technical knowledge necessary to perform their duties. Occupational Health Services should, in addition, have necessary administrative personnel, equipment and appliances for carrying out the assigned functions.

(iii) (i) Management of every mechanised mine should, in consultation with experts of the Occupational Health Services, prepare a scheme for:

(a) Identification of operations and activities where factors hazardous to health of persons at work exist or may arise during the course of work.

(b) Monitoring the levels or values of different factors which may affect health of persons.

(c) Specifying the various control measures necessary for keeping the levels / values within the permissible limits.

(d) Health surveillance.

(e) Health education.

(f) First – aid training.

(iv) There should be at least one medical officer properly trained in Occupational Health in each area who should also be associated with Periodical Medical Examinations.

(v) At least one medical officer engaged in medical examinations should be trained in use of ILO Classification of Radiographs for Pneumoconiosis.

(vi) Adequate facilities for X-rays and Lung Function Tests should be provided at each medical examination centre.

(vii) Health surveillance record shall be properly maintained.

(viii) If the profusion of any type of pneumoconiotic opacities in chest radiograph is 1/0 or above as per ILO Classification, the case shall be certified and notified as pneumoconiosis.

(ix) One of the medical examination of every person should be arranged within one year of his superannuation.

(x) To monitor the progress of profusion in certified cases of pneumoconiosis medical examination should be conducted at shorter intervals.

## 5.4 Recommendations of X$^{th}$ Conference on Safety in Mines Relating to Occupational Health and Hygiene (13)

The X$^{th}$ National Conference on Safety in Mines held in Delhi on 26$^{th}$ and 27$^{th}$ November, 2007 has made comprehensive recommendations on Occupational Health Surveillance and other occupational health and hygiene issues. Some of the important recommendations are;

**Review of Status of Implementation of Recommendations of the 9$^{th}$ Conference on Safety in Mines**

- The recommendations of DGMS (Tech) Circular No.18 of 1975 shall be implemented forthwith. (Protection of workers against Noise & Vibration in Working Environment.)

- Audiometry should be introduced, as a part of mandatory medical examination, for persons seeking employment in mines and for persons engaged in Operations / areas where noise level exceeds 90 dB(A).

**Occupational Health Surveillance in Mining Industry**

- All chest radiographs of Initial and Periodical Medical Examinations in private mines shall be classified for detection, diagnosis and documentation of pneumoconiosis in accordance with ILO classification for pneumoconiosis.

- The PME Medical Officer in every PME centre of private mines shall be trained in occupational health and use of ILO classification for pneumoconiosis.

- Each mining company operating mechanized mines shall set up an Occupational Diseases Board consisting of one occupational Health Physician, one radiologist and one general physician.

**Occupational Health Surveillance and Notified Diseases.**

Noise mapping should be made mandatory of various work places in the mine premises based on the various machines being used in concerned mines along with personal noise dosimetry of individual workmen exposed to noise level above 85 db(A)

Vibration studies of various mining machinery required to be done before their introduction in mining operations as per ISO standards.

Ergonomical assessment of all latest machines, before their introduction into mining operation as per ISO standards. Ergonomical assessment should include:

* Assessment of work process.
* Assessment of working Aids/tools
* Assessment of working posture

Potability tests of drinking water supplied to the mine employees, to be made mandatory once in a year irrespective of its source, preferably after Rainy seasons, the sample of water should be collected from the points of consumption

Initial medical examination shall be made mandatory for all mining employees whether permanent, temporary or contractual, before they are engaged in any mining job.

The frequency of periodic medical examinations should be brought down from existing five years to three years for the mining employees above 45 years of age. This should be implemented in three years.

Standards of medical examinations for both Initial and Periodic should be modified as mentioned below in order to ensure early diagnosis of more diseases caused or get aggravated due to employment in mines.

(a) In addition to measurement of blood pressure, detailed cardiovascular assessment of employees should be done. This should include 12 leads electrocardiogram and complete lipid profile.

(b) Detailed neurological examinations including testing of all major superficial and deep reflexes and assessment of peripheral circulation to diagnose vibrational syndromes.

(c) In addition to routine urine, fasting and post-parandial blood sugar should be included for early diagnosis of diabetes mellitus.

(d) Serum Urea and Creatinine should be included for assessment of Renal function.

(e) Hematological tests like Total count, Differential count, percentage of Hemoglobin and Erythrocyte Sedimentation Rate should be included to diagnose Blood Dyscrasias.

Special tests should be included in the PME for employees exposed to specific health hazard;

(a) For employees exposed to manganese, special emphasis should be given to behavioral and neurological disturbances such as speech defect, tremor, impairment of equilibrium, adiadochokinesia H2S and emotional changes.

(b) For persons exposed to lead, PME should include blood lead analysis and delta aminolevulinic acid in urine, at least once in a year.

(c) Employees engaged in food handling and preparation and handling of stemming material activities should undergo routine stool examination once in every six months and sputum for AFB and chest radiograph once in a year.

(d) Employees engaged in driving/ HEMM operation jobs should undergo eye refraction test at least once in a year.

(e) Employees exposed to ionizing radiation should undergo Blood count at least once in a year.

It is proposed to include following diseases in the list of Notified diseases under Section 25 (1) of Mines Act, 1952:

(a) All other types of Pneumoconiosis including Coal workers pneumoconiosis, Silicosis and Asbestosis. This includes Siderosis & Berillyosis.

(b) Noise induced hearing loss.

(c) Contact Dermatitis caused by direct contact with chemicals.

(d) Pathological manifestations due to radium or radioactive substances.

For smaller mines where PME facilities are not existing, medical examinations can be done through other competent agencies.

## 6.0 STATUTORY PROVISIONS UNDER WORKMEN COMPENSATION ACT, 1923. [14]

**Section 3 Employer's Liability for compensation:**

A. (2) If a workman employed in any employment specified in Part A of Schedule III contracts any disease specified therein as an occupational disease peculiar to that employment, or if a workman whilst in the service of an employer in whose service he has been employed for a continuous period of not less than six months (which period shall not include a period of service under any other employer in the same kind of employment) in any employment specified in Part B of Schedule III, contracts any disease specified therein as an occupational disease peculiar to that employment, or if a workmen, whilst in the service of one or more employers in an employment specified in Part C of Schedule III for such continuous period as the Central Government may specify in respect of each such employment, contracts any disease specified therein as an occupational disease peculiar to that employment, the contracting of the disease shall be deemed to be an injury by accident within the meaning of this section and, unless the contrary is proved the accident shall be deemed to have arisen out of, and in the course of the employment :

[Provided that if it is proved –

**(a)** That a workman whilst in the service of one or more employers, in any employment specified in Part C of Schedule III, has contracted a disease specified therein as an occupational disease peculiar to that employment during a continuous period which is less than the period specified under this sub-section for that employment, and

**(b)** That the disease has arisen out of and in the course of the employment, the contracting of such disease shall be deemed to be an injury by accident within the meaning of this section :

Schedule III, Part C

| | | |
|---|---|---|
| 1. | Pneumoconioses caused by sclerogenic mineral dust (Silicosis, anthracosilicosis, asbestosis) and silico-tuberculosis : provided that silicosis is an essential factor in causing the resultant incapacity or death. | All work involving exposure to the risk concerned. |
| 2. | Bagassosis | All work involving exposure to the risk concerned. |
| 3. | Broncho-pulmonary diseases caused by cotton flax hemp and sisal dust (Byssinosis) | All work involving exposure to the risk concerned. |
| 4. | Extrinsic allergic alveolitis caused by the insulation of organic dusts. | All work involving exposure to the risk concerned. |
| 5. | Broncho-pulmonary diseases caused by hand metals. | All work involving exposure to the risk concerned. |

**Model Draft Rules – Workmen's Compensation (Occupational Diseases) Rules, 1961.**

The Central Government had also formulated Model Draft Rules – Workmen's Compensation (Occupational Diseases) Rules, 1961. However these rules were ratified by few states only and could not come into force in majority of the states. The relevant provisions of the rules are reproduced below;

(e) "Pneumoconiosis" means silicosis or coal miners pneumoconiosis or asbestosis or bagassosis or any of those diseases accompanied by pulmonary tuberculosis;.

**(5) Medical conditions under which pneumoconiosis may be considered to be an occupational disease-**

(1) The diagnosis of pneumoconiosis shall be carried out with all the necessary technical guarantees. Proof of the degree of development of the pathological or anatomical changes in the respiratory and cardiac systems shall be furnished by the radiographic record and other laboratory records, which shall be accompanied by the report of a full clinical examination, including a report of the industrial history of the person concerned, the record of all occupations in which he has been employed, the nature of the harmful dusts to which he was exposed and the duration of such exposure.

(2) For entitlement to compensation, silicosis and coal miners' pneumoconiosis shall fulfil the following radiological and clinical conditions:

(a) The radiological examination of the workmen must reveal –

(i) The appearance of generalised micronodular or nodular fibrosis covering a considerable part of both lung fields whether accompanied or not by signs of pulmonary tuberculosis: or

(ii) In addition to a marked accentuation of the pattern of both lungs, the appearance of one or several pseudotumoral fibrotic formations, whether accompanied or not by signs of pulmonary tuberculosis; or

(iii) The appearance of both of these types of fibrotic lesions at once, whether accompanied or not by signs of pulmonary tuberculosis;

(b) Serial radiological pictures taken over a period during periodical medical examinations shall, as far as possible, be considered in making definite diagnosis in cases where doubt exists;

(c) Radiological interpretation shall be based on the standard International classification laid down by the International Labour Organisation (Geneva Classification).

(d) The clinical examination of the workman concerned must reveal a decrease or deterioration of the respiratory function or cardiac function, or a deterioration of the state of general health, caused by the pathological processes specified above.

**(6) Evaluation of disablement –**

(1) The evaluation of disablement shall be made by reference to the physical (anatomical, physiological, and functional) and mental capacity for the exercise of the necessary functions of a normally occupied life which would be expected in a healthy person of the same age and sex. For such assessment, recognised cardio-respiratory function tests shall be used to assess the degree of cardio-respiratory function impairment.

(2) It shall be determined whether the disablement is temporary or permanent and also the percentage loss of function as it pertains to the loss of working capacity for receiving compensation.

(3) Assessment of disablement shall be proportionate to the loss of earning capacity, total disablement being taken to be 100% loss of earning capacity.

## 7.0 OBJECTIVES:

The main objectives of the study includes

1. To evaluate chest radiographs of persons with history of work in stone mines referred to NIMH for detection of silicosis
2. To suggest measures for management and rehabilitation, if any

## 8.0 MATERIALS & METHODS:

Dang Vikas Sansthan (DVS) collected chest x-rays of 157 persons **[ Annexure -1]** from 20 villages having history of work in stone mines and / or had been suffering from various respiratory symptoms. The chest x-rays of 157 persons were sent to NIMH and were evaluated by three specialists experienced in evaluation of chest radiographs as per ILO classifications of radiographs for Pneumoconiosis, 2000. ***On scrutiny it was found that 3 women did not have any history of work in mines and there x-rays were found to be normal, hence were not considered for further evaluation.***

## 9.0 RESULTS:

### 9.1 The Study Population

The age wise distribution of the subjects is given in table-1.

Table - 1

| Age Group | Male | Female | Total |
|---|---|---|---|
| **20-30** | **4** | **0** | **4** |
| **31-40** | **54** | **0** | **54** |
| **41-50** | **61** | **0** | **61** |
| **51-60** | **28** | **0** | **28** |
| **>60** | **6** | **1** | **7** |
| **Total** | **153** | **1** | **154** |

The table-2 shows distribution of person according to history of work in stone mines.

Table - 2

| Years of work | Male | Female | Total |
|---|---|---|---|
| **< 10** | **2** | **0** | **2** |
| **11-20** | **74** | **1** | **75** |
| **21-30** | **50** | **0** | **50** |
| **> 30** | **27** | **0** | **27** |
| **TOTAL** | **153** | **1** | **154** |

*Evaluation of records showed that out of 154 persons 110 had completed DOTS (Directly Observed Treatment, Short Course) therapy.*

### 9.2 Chest X-ray:

The chest radiographs of 154 subjects were evaluated as per ILO classification of Radiographs of Pneumoconiosis, 2000 under standardized condition.[15]
Each radiograph was classified for film quality, type of opacities, profusion of opacities, extent and other abnormalities. The findings were noted in a standardized radiograph reading sheet.

#### *9.2.1 Technical Quality*

The technical quality was evaluated as below:

1. Good
2. Acceptable, with no technical defects likely to impair classification of the radiograph for pneumoconiosis
3. Acceptable, with some technical defects but still adequate for classification purpose.
4. Unacceptable for classification purpose.

Table 3 shows the distribution according to the technical quality of radiographs

Table - 3

| Quality of Film | Number |
|---|---|
| **1** | **0** |
| **2** | **11** |
| **3** | **127** |
| **4** | **16** |
| **Total** | **154** |

16 chest x-rays which were of quality 4 or unreadable were not acceptable for evaluation and hence excluded from further analysis. **Remaining 138 chest x-rays were considered for evaluation.**

### *9.2.2 Small Opacities:*

Profusion of small opacities was determined by comparison with standard radiographs and recorded as one of the categories: **0. 1, 2 or 3.**

| Increasing profusion of small opacities >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Categories | 0 | | | 1 | | | 2 | | | 3 | | |
| Subcategories | 0/- | 0/0 | 0/1 | 1/0 | 1/1 | 1/2 | 2/1 | 2/2 | 2/3 | 3/2 | 3/3 | 3/+ |

Shapes and size was determined by comparison with standard radiographs. The predominant shapes and size was recorded using two of the following letters: **p, q, r, s, t or u.**

Out of 138 radiographs evaluated as per the ILO Classification 2000, the distribution of profusion on 12 point scale was as follows;

| | |
|---|---|
| Category 0 (0/-, 0/0, 0/1) | **85 (No evidence of silicosis )** |
| Category 1 – subcategory: | **1/0 – 07 (suspected cases of silicosis)** |
| | **1/1 – 15 (silicosis)** |
| | **1/2 – 06 (silicosis)** |
| Category 2 - subcategory: | **2/1 – 03 (silicosis)** |
| | **2/2 -- 10 (silicosis)** |
| | **2/3 – 03 (silicosis)** |
| Category 3 - subcategory: | **3/2 – 05 (silicosis)** |
| | **3/3 -- 04 (silicosis)** |

Category 0 refers to absence of small opacities or the presence of small opacities that are less than category 1

**Category 1: 1/0 - refers to suspected cases of silicosis (07)**
**1/1 and above - refers to silicosis (46)**

The finding of classification of pneumoconiotic opacities are summarized in table-4 as per major category classification

Table - 4

| **Category** | **Number of Subject** |
|---|---|
| Category - 0 | **85*** |
| Category - 1 | **28** |
| Category - 2 | **16** |
| Category - 3 | **9** |
| Total | **138** |

***Includes 11 cases with radiological evidence of Pulmonary Tuberculosis but no Pneumoconiotic opacities**

Majority of small rounded opacities were of type “r” i.e. opacities with diameter exceeding 3 mm and up to about 10 mm

Figure 1: Bar chart showing the number of cases as per major categories of Silicosis

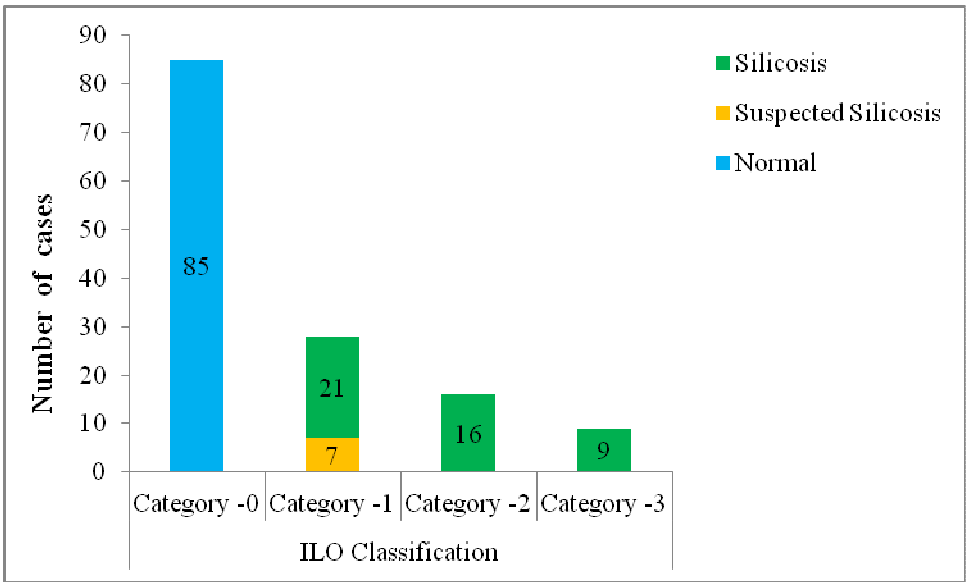


Fig-2 and Fig-3 shows the photograph of chest radiograph of subjects with category 3 silicosis and category 3 silicosis with tuberculosis respectively.

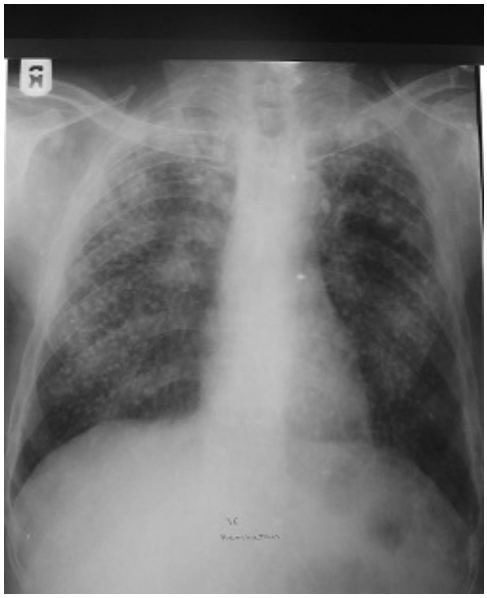

Fig-2: Chest radiograph with category 3 silicosis

Fig-3: Chest radiograph with category 3 silicosis with tuberculosis

### *9.2.3 Large Opacities:*

A large opacity is defined as an opacity having the longest dimension exceeding
10 mm.

Fig-4: Chest radiograph showing Silicosis with PMF

**Category A:** One large opacity having the longest dimension up to about 50 mm, or Several large opacities with the sum of their longest dimensions not exceeding about 50 mm

**Category B:** One large opacity having the longest dimension exceeding 50 mm but not exceeding the equivalent area of the right upper zone, or several large opacities with the sum of their longest dimensions exceeding 50 mm but not exceeding the equivalent area of the right upper zone

**Category C:** One large opacity which exceeds the equivalent area of the right upper zone, or several large opacities which, when combined, exceed the equivalent area of the right upper zone

**The chest radiographs of 04 workers showed large opacities suggestive of Pulmonary Massive Fibrosis (PMF).** Fig-4 shows the photograph of chest radiograph of silicosis with Progressive Massive Fibrosis. The distribution of cases is given in table-5

Table - 5

| Sr. No | Type of Large Opacity | Number of subjects |
|---|---|---|
| 1 | **Category A** | **2** |
| 2 | **Category B** | **2** |
| 3 | **Category C** | **0** |
| | **Total** | **4** |

The further analysis of result showed that occurrence and profusion of pneumoconiotic opacities due to silicosis and progressive massive fibrosis were directly related to the number of years of work in stone mine

The distribution of cases of silicosis and progressive massive fibrosis along with number of subjects according to the years of work in mines is given in Table-6

Table – 6

| Years of work | Silicosis | PMF | Total Number of Subjects |
|---|---|---|---|
| **< 10** | **0** | **0** | **2** |
| **11-20** | **20 (29%)** | **0** | **69** |
| **21-30** | **20 (45.5%)** | **2 (4.5)** | **44** |
| **> 30** | **13 (56.5%)** | **2 (8.7)** | **23** |
| **Total** | **53 (38.4)** | **04 (2.9)** | **138** |

Note: - The numbers in parenthesis indicates % of subjects suffering from silicosis and PMF

Table-7 shows distribution of category of silicosis according to number of years of service in mines.

Table - 7

| Years of work | Category 1 | Category 2 | Category 3 | Total Number of cases of Silicosis |
|---|---|---|---|---|
| **< 10** | **0** | **0** | **0** | **0** |
| **11-20** | **12** | **6** | **2** | **20** |
| **21-30** | **12** | **5** | **3** | **20** |
| **> 30** | **4** | **5** | **4** | **13** |
| **Total** | **28** | **16** | **09** | **53** |

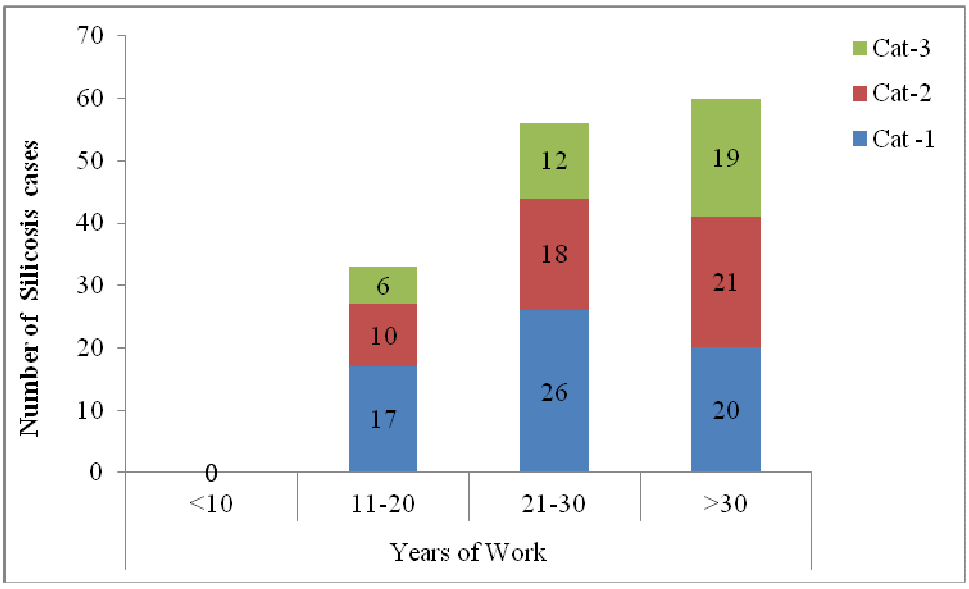


Figure 5: Stacked bar chart showing distribution of category of silicosis according to number of years of service in mines.

Table-8 shows distribution of cases of progressive massive fibrosis according number of years of service in mines.

Table - 8

| Years of work | Category A | Category B | Category C | Total Number of cases of PMF |
|---|---|---|---|---|
| **< 10** | **0** | **0** | **0** | **0** |
| **11-20** | **0** | **0** | **0** | **0** |
| **21-30** | **1** | **1** | **0** | **2** |
| **> 30** | **1** | **1** | **0** | **2** |
| **Total** | **2** | **2** | **0** | **4** |

9.2.4 Other important radiological findings:

Other important findings in chest radiographs include 11 cases having radiological evidence of Pulmonary Tuberculosis. In 15 subjects there was evidence of silicosis associated with pulmonary tuberculosis, henceforth termed as Silico-tuberculosis.

## 10.0 DISCUSSION:

The results of evaluation of chest x-rays of 157 subjects **[ Annexure - 2]** submitted by ARAVALI to National Institute of Miners' Health show that many subjects who had worked in stone mines had radiological evidences of silicosis. Of the 138 chest radiographs evaluated as per ILO classification, 53 (38.4%) showed evidence of silicosis and 04 (7.5 %) of them had developed Progressive Massive Fibrosis. As is evident from table-4, 25 subjects had silicosis of category 2 or higher indicating advance stage of the disease. The cases of Progressive Massive Fibrosis were of category A or B.

Table 6, 7 and 8 show the occurrence and stage of silicosis and Progressive Massive Fibrosis are directly related to years of work in stone mines. Longer the duration of work, higher is the occurrence and advancement of silicosis. As expected, silicosis mostly developed after 10 years of working in the mine. The prevalence of silicosis increased with increasing number of years of work in mines, as seen in the study, 29 % of persons developed silicosis who had work history of 11-20 years. 45.5 % of persons developed silicosis having work history between 21-30 years and the highest 56.5 % of persons developed silicosis who had worked for more than 30 years in stone mines.

It is known that silicosis tends to predispose to tuberculosis and may be a contributing factor towards high prevalence of tuberculosis. It is also observed that 11(8 %) of the subjects had radiological evidence of pulmonary tuberculosis and 15 (10.9 %) have Silicotuberculosis.

Overall based on the evaluation of results of chest radiographs of persons having history of work in stone mines, it can be concluded that a large proportion of them suffer from silicosis and some of them from advance stage of Progressive Massive Fibrosis, invariably complicated by associated pulmonary tuberculosis. Majority of these cases were diagnosed as pulmonary tuberculosis and are repeatedly given anti-tuberculosis treatment with little response.

The present study cannot be considered as representative of prevalence of silicosis and PMF in stone workers of the Dholpur District as the study population has not been selected considering epidemiological study point of view. The actual prevalence of silicosis may vary considerably as it does not include persons working in mine who do not suffer from any respiratory symptoms at present. It also does not take into account those who may have died due to silicosis and PMF. Therefore, a large scale epidemiological study is required to determine prevalence of silicosis among the stone mines workers in this area.

## 11.0 SUMMARY & CONCLUSION

Silicosis remains the most important occupational lung disease for the persons employed in mines. Though, reliable statistics of prevalence of silicosis in Indian mines are not available, it is estimated that a significant proportion of workers may be suffering from silicosis more so in small scale and unorganized mines. In Rajasthan, stone mining is being carried out in Jodhpur, Bharatpur, Dholpur and many other districts. In Karauli area, ARAVALI, one of the Government of Rajasthan NGO has been working on the livelihood project. It had observed that many of the workers engaged in stone mining have been suffering from respiratory problems and being treated as cases of tuberculosis with very little response. In the meeting of stakeholders attended by the District Collector and Chief Medical Officer, Dholpur district, it was decided that cases suspected to be suffering from silicosis from Dholpur will be referred to NIMH for diagnosis. National Institute of Miners' Health evaluated the chest radiographs of 154 subjects with the history of work in stone mines submitted by DVS. Evaluation of chest x-rays have showed that 38.4 % of subjects have evidence of silicosis of which 7.5 % had Progressive Massive Fibrosis. Majority of the subjects were suffering from advance stage of silicosis. It is also observed that 8 % of persons had radiological evidence of pulmonary tuberculosis and 10.9 % of subjects with silicosis had associated tuberculosis.

On the basis of evaluation of chest radiographs, it is evident that many workers engaged in stone mining in the area may be suffering from silicosis and associated tuberculosis. As majority of these workers belong to the poorest of poor class, the

livelihood of the persons is affected due to occurrence of silicosis and pulmonary tuberculosis. There is urgent need for devising an intervention programme for providing medical services and rehabilitation of these persons including compensation for occurrence of silicosis as silicosis is a compensable disease under Workmen Compensation Act. All cases of silicosis also need to be notified to the enforcement agency i.e. Directorate General of Mines Safety as required under Mines Act, 1952.

In this regard, the DGMS (Tech) (S&T) Circular No. 01 of 2010 on "Respirable Dust Measurement and Control to prevent Pneumoconiosis in Mine" and DGMS (Tech) (S&T) Circular No. 01 of 2011 on "Guidelines on Occupational health Survey (Medical Examination) of persons working at places or operations/processes prone to generate airborne dust" which also includes the recommendation of National Human Right commission on "Preventive, Remedial, Rehabilitative and Compensation aspects of Silicosis" with the aim to significantly reduce the prevalence of Pneumoconiosis/ Silicosis by 2015 and to totally eliminate Pneumoconiosis/ Silicosis at workplace by 2030 in line with ILO/WHO Global Programme on Elimination of silicosis are significant. However, it will remain a distant dream without a concerted effort by all concerned.

## 12.0 RECOMMENDATIONS

1. There is immediate need for starting an intervention programme to provide treatment to the persons affected with silicosis.

2. A comprehensive study involving all persons engaged in stone mining should be carried out to determine prevalence of silicosis in the area.

3. The persons affected with silicosis need to be compensated as provided under Workmen Compensation Act, 1923.

4. All cases of silicosis should be notified to Directorate General of Mines Safety, as provided under Mines Act, 1952.

5. A detailed study on airborne dust levels and suitable dust control measures should be carried to reduce dust exposure to persons engaged in stone mining.

6. The mine owners and workers need to be educated and made aware of health hazards of stone dust and preventive measures required to be taken.

7. A special drive needs to be launched for detection and treatment of persons suffering from Pulmonary Tuberculosis in stone mines.

8. All persons engaged in stone mines should undergo periodic medical examination regularly.

9. An effective rehabilitation programme should be undertaken for persons suffering from silicosis.

10. There is need to train local doctors in diagnosis of silicosis as large number of cases are misdiagnosed as cases of Pulmonary Tuberculosis.

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# Annexure - 1

**Details of records of individual persons**

| Sr. No. | Patient Name | Father's Name | X-ray No. | Age | Sex | Address | Name of Mine | Mine Work Exposure | Anti TB treatment |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Bhagvansingh | Roopa | 1 | 52 | M | Dompura | Dompura | 35 | DOTS Completed |
| 2 | Mahendra | Dooji | 2 | 45 | M | Dompura | Dompura | 25 | DOTS Completed |
| 3 | Mukesh | Mabasi | 3 | 38 | M | Dhanera | Dompura | 21 | No |
| 4 | Roosan | Dooji | 4 | 48 | M | Dompura | Dompura | 20 | No |
| 5 | Motilal | Bhika | 5 | 35 | M | Dompura | Dompura | 18 | No |
| 6 | Rambhajan | Bhagri | 6 | 35 | M | Dompura | Dompura | 18 | No |
| 7 | Roosan | Mangla | 7 | 48 | M | Dompura | Dompura | 26 | DOTS Completed |
| 8 | Siyaram | Roopa | 8 | 44 | M | Dompura | Dompura | 30 | DOTS Completed |
| 9 | Ramesh | Mangla | 9 | 50 | M | Dompura | Dompura | 32 | DOTS Completed |
| 10 | Rambabu | Roopa | 10 | 38 | M | Dompura | Dompura | 22 | No |
| 11 | Devisingh | Bheeka | 11 | 50 | M | Dompura | Dompura | 30 | DOTS Completed |
| 12 | Murari | Harilal | 12 | 35 | M | Dompura | Dompura | 16 | DOTS Completed |
| 13 | Ramphool | -- | 13 | 45 | M | Konesa | Konesa | 20 | DOTS Completed |
| 14 | Indarsingh | Harilal | 14 | 35 | M | Dompura | Dompura | 14 | No |
| 15 | Kelashi | Chirmoli | 15 | 40 | M | Konesha | Konesha | 20 | DOTS Completed |
| 16 | Ramratan | Girvar | 16 | 65 | M | Konesha | Konesha | 40 | DOTS Completed |
| 17 | Roosan | Jingar | 17 | 60 | M | Dompura | Dompura | 45 | DOTS Completed |
| 18 | Sayam | Sarvan | 18 | 37 | M | Dompura | Dompura | 18 | DOTS Completed |
| 19 | Ramcharan | Dooji | 19 | 52 | M | Konesha | Dompura | 30 | DOTS Completed |
| 20 | Badri | Tulshiram | 20 | 60 | M | Konesha | Dompura | 40 | DOTS Completed |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 21 | Jagveer | Gangaram | 21 | 37 | M | Kareua ka pura | Dompura | 16 | DOTS Completed |
| 22 | Pooran | Mukandi | 22 | 45 | M | Dompura | Dompura | 22 | DOTS Completed |
| 23 | Roosan | Mukandi | 23 | 47 | M | Dompura | Dompura | 30 | DOTS Completed |
| 24 | Vijaysingh | Doojiram | 24 | 40 | M | Dompura | Dompura | 20 | DOTS Completed |
| 25 | Bharoshi | Gungaram | 25 | 65 | M | Dompura | Dompura | 40 | DOTS Completed |
| 26 | Ramswroop | Hariya | 26 | 43 | M | Dompura | Dompura | 20 | DOTS Completed |
| 27 | Chuttan | Hateela | 27 | 65 | M | Dompura | Dompura | 35 | DOTS Completed |
| 28 | Parmal | Hariya | 28 | 42 | M | Dompura | Dompura | 20 | DOTS Completed |
| 29 | Saroop | Phodaliya | 29 | 60 | M | Dompura | Dompura | 35 | DOTS Completed |
| 30 | Deendayal | Vishnaram | 30 | 40 | M | Dompura | Dompura | 20 | DOTS Completed |
| 31 | Lalriya | Karni | 31 | 57 | M | Dompura | Dompura | 40 | DOTS Completed |
| 32 | Mansingh | Gopi | 32 | 37 | M | Dompura | Dompura | 20 | DOTS Completed |
| 33 | Jaisingh | Gangaram | 33 | 51 | M | Rjapur | Rjapur | 22 | DOTS Completed |
| 34 | Babu | Mukandi | 34 | 48 | M | Dompura | Dompura | 30 | DOTS Completed |
| 35 | Ramkhiladi | Hariya | 35 | 58 | M | Dompura | Dompura | 40 | DOTS Completed |
| 36 | Charansingh | Bhabuti | 36 | 35 | M | Dompura | Dompura | 18 | No |
| 37 | Pooran | Phodaliya | 37 | 50 | M | Dompura | Dompura | 30 | DOTS Completed |
| 38 | Horilal | Dulli | 38 | 55 | M | Dompura | Dompura | 35 | DOTS Completed |
| 39 | Virju | Gillaram | 39 | 45 | M | Dompura | Dompura | 25 | DOTS Completed |
| 40 | Rameshwar | Matol | 40 | 55 | M | Chingapura | Chingapura | 32 | DOTS Completed |
| 41 | Ramesh | Matol | 41 | 50 | M | Chingapura | Chingapura | 27 | DOTS Completed |
| 42 | Chirangi | Bansi | 42 | 60 | M | Konesha | Konesha | 47 | DOTS Completed |
| 43 | Aadram | Sanua | 43 | 42 | M | Konesha | Konesha | 17 | DOTS Completed |
| 44 | Raysingh | Basdev | 44 | 40 | M | Konesha | Konesha | 13 | No |
| 45 | Babulal | Majle | 45 | 55 | M | Konesha | Konesha | 25 | DOTS Completed |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 46 | Jagdeesh | Sauna | 46 | 50 | M | Konesha | Konesha | 30 | DOTS Completed |
| 47 | Ramesh | Motiram | 47 | 55 | M | Konesha | Konesha | 30 | DOTS Completed |
| 48 | Ramlal | Budda | 48 | 52 | M | Badagav | Konesha | 19 | DOTS Completed |
| 49 | Ramdas | Parmal | 49 | 40 | M | Chinapura | Chingapura | 22 | DOTS Completed |
| 50 | Satveer | Shivcharan | 50 | 35 | M | Badagav | Chingapura | 18 | DOTS Completed |
| 51 | Harichand | Ramshwroop | 51 | 40 | M | Konesha | Konesha | 20 | DOTS Completed |
| 52 | Rajveer | Chiranji | 52 | 35 | M | Konesha | Konesha | 16 | No |
| 53 | Kamalsingh | Lalsingh | 53 | 35 | M | Pavenee | Pavenee | 11 | No |
| 54 | Shivcharan | Pothi | 54 | 45 | M | Gourdhanpura | Aagai | 18 | DOTS Completed |
| 55 | Chotu | Bhullan | 55 | 58 | M | Beejoli | Beejoli | 26 | No |
| 56 | Johoree | Budda | 56 | 48 | M | Dhanera | Dhanera | 25 | DOTS Completed |
| 57 | Manpal | Khachera | 57 | 55 | M | Konesa | Konesa | 27 | DOTS Completed |
| 58 | Bhabuti | Laxman | 58 | 70 | M | Bhedekapura | Dompura | 45 | DOTS Completed |
| 59 | Ramdayal | Sankar | 59 | 50 | M | Bhedekapura | Bhedekapura | 30 | DOTS Completed |
| 60 | Devisingh | Bharosi | 60 | 35 | M | Bhedekapura | Bhedekapura | 20 | DOTS Completed |
| 61 | Eswarlal | Doojiram | 61 | 60 | M | Bhedekapura | Bhedekapura | 40 | DOTS Completed |
| 62 | Roosan | Matola | 62 | 42 | M | Bhedekapura | Bhedekapura | 32 | DOTS Completed |
| 63 | Dorga | Sankar | 63 | 57 | M | Bhedekapura | Bhedekapura | 45 | DOTS Completed |
| 64 | Jitendra | Bhikaram | 64 | 38 | M | Bhedekapura | Bhedekapura | 18 | No |
| 65 | Ramphool | Kesori | 65 | 36 | M | Bhedekapura | Bhedekapura | 18 | No |
| 66 | Chironji | Sonaram | 66 | 55 | M | Bhedekapura | Bhedekapura | 45 | DOTS Completed |
| 67 | Narayana | Babulal | 67 | 38 | M | Bhedekapura | Bhedekapura | 20 | DOTS Completed |
| 68 | Udaiman | Buddu | 68 | 41 | M | Dhanera | Dhanera | 25 | DOTS Completed |
| 69 | Jagdish | Buddu | 69 | 55 | M | Dhanera | Dhanera | 30 | DOTS Completed |
| 70 | Vijendra | Buddu | 70 | 45 | M | Dhanera | Dhanera | 25 | DOTS Completed |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 71 | Visal | Devilal | 71 | 45 | M | Konesa | Konesa | 30 | DOTS Completed |
| 72 | Mavasi | Ramhet | 72 | 58 | M | Dhanera | Dhanera | 30 | DOTS Completed |
| 73 | Niroti | Phodaliya | 73 | 42 | M | Dompura | Dompura | 42 | DOTS Completed |
| 74 | Sumera | Hariya | 74 | 52 | M | Dompura | Dompura | 35 | DOTS Completed |
| 75 | Shivnarayan | Bhikaram | 75 | 40 | M | Dompura | Dompura | 20 | DOTS Completed |
| 76 | Shivram | Bhabuti | 76 | 29 | M | Dompura | Dompura | 23 | DOTS Completed |
| 77 | Bhogiram | Amol | 77 | 70 | M | Bhedekapura | Bhedekapura | 45 | DOTS Completed |
| 78 | Mangilal | Naneka | 78 | 45 | M | Khurdiya | Khurdiya | 27 | No |
| 79 | Shivsingh | Motilal | 79 | 29 | M | Bhedekapura | Bhedekapura | 15 | No |
| 80 | Omprakash | Khuba | 80 | 36 | M | Bhedekapura | Bhedekapura | 20 | No |
| 81 | Petambai | Shrilal | 81 | 35 | F | Dompura | Dompura | 0 | DOTS Completed |
| 82 | Rajendra | Chirmoli | 82 | 45 | M | Bhedekapura | Bhedekapura | 30 | DOTS Completed |
| 83 | Kumarpal | Samnta | 83 | 45 | M | Khosla | Khosla | 17 | No |
| 84 | Munna | Ramdayal | 84 | 31 | M | Khosla | Khosla | 11 | No |
| 85 | Suresh | Ramdayal | 85 | 32 | M | Khosla | Khosla | 13 | No |
| 86 | Ramdayal | Bhullan | 86 | 48 | M | Khosla | Khosla | 19 | DOTS Completed |
| 87 | Mukesh | Ramoli | 87 | 33 | M | Jhinnakapura | Jhinnakapura | 33 | No |
| 88 | Sugan | Chirongi | 88 | 42 | M | Jhinnakapura | Jhinnakapura | 18 | No |
| 89 | Durgsingh | Rameswar | 89 | 38 | M | Jhinnakapura | Jhinnakapura | 12 | No |
| 90 | Babu | Chirongi | 90 | 43 | M | Jhinnakapura | Jhinnakapura | 18 | DOTS Completed |
| 91 | Badree | Seriya | 91 | 51 | M | Jhinnakapura | Jhinnakapura | 19 | DOTS Completed |
| 92 | Mukyar | Pooran | 92 | 38 | M | Jhinnakapura | Jhinnakapura | 14 | DOTS Completed |
| 93 | Munna | Dhannu | 93 | 44 | M | Jhinnakapura | Jhinnakapura | 17 | DOTS Completed |
| 94 | Vijaysingh | Kusiya | 94 | 41 | M | Dompura | Dompura | 25 | DOTS Completed |
| 95 | Bhagwandas | Ramchand | 95 | 43 | M | Dhanera | Dhanera | 17 | No |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 96 | Bhawar | Pachya | 96 | 40 | M | Dhanera | Dhanera | 19 | No |
| 97 | Harphool | Sabaliya | 97 | 58 | M | Dadrooni | Dadrooni | 40 | No |
| 98 | Bhagban | Govin | 98 | 38 | M | Dhanera | Dhanera | 17 | No |
| 99 | Ramlakhan | Govinda | 99 | 37 | M | Dhanera | Dhanera | 18 | DOTS Completed |
| 100 | lakkhe | Bhanta | 100 | 38 | M | Dompura | Dompura | 16 | No |
| 101 | Chirmoli | Sanua | 101 | 58 | M | Konesa | Konesa | 28 | DOTS Completed |
| 102 | Chotya | Sanua | 102 | 55 | M | Konesa | Konesa | 22 | DOTS Completed |
| 103 | Bhorisingh | Rajaram | 103 | 32 | M | Konesa | Konesa | 11 | No |
| 104 | Hotamsingh | Bhagrilal | 104 | 45 | M | Dompura | Dompura | 26 | DOTS Completed |
| 105 | Babulal | Chirmoli | 105 | 45 | M | Dompura | Dompura | 25 | DOTS Completed |
| 106 | Devicharan | Lalriya | 106 | 42 | M | Dompura | Dompura | 25 | DOTS Completed |
| 107 | Basudev | Mukandi | 107 | 45 | M | Dompura | Dompura | 26 | DOTS Completed |
| 108 | Navalsingh | Shivnarayan | 108 | 38 | M | Konesa | Konesa | 13 | No |
| 109 | Moharsingh | Dooji | 109 | 88 | M | Konesa | konesa | 43 | DOTS Completed |
| 110 | Laxman | Bhorya | 110 | 42 | M | Konesa | konesa | 16 | No |
| 111 | Amarsingh | Murli | 111 | 38 | M | Bhavanpura | Bhavanpura | 38 | DOTS Completed |
| 112 | Parikkhat | Pothi | 112 | 48 | M | Godhnapura | Godhnapura | 19 | DOTS Completed |
| 113 | Vijendra | Khargjet | 113 | 48 | M | Konesa | Konesa | 19 | No |
| 114 | Ramveer | Kirodi | 114 | 41 | M | Godhnapura | Godhnapura | 18 | DOTS Completed |
| 115 | Rayphool | Poothi | 115 | 41 | M | Godhnapura | Godhnapura | 17 | No |
| 116 | Patiram | Dooji | 116 | 45 | M | Godhnapura | Godhnapura | 23 | No |
| 117 | Pooran | Babu | 117 | 39 | M | Godhnapura | Godhnapura | 13 | No |
| 118 | Shreelal | Karani | 118 | 41 | M | Dompura | Dompura | 15 | DOTS Completed |
| 119 | Ramgovind | Khachera | 119 | 30 | M | Konesa | Konesa | 13 | DOTS Completed |
| 120 | Shivsingh | Khachera | 120 | 42 | M | Konesa | Konesa | 20 | DOTS Completed |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 121 | Babu | Kharjeet | 121 | 45 | M | Konesa | Konesa | 25 | DOTS Completed |
| 122 | Eswarlal | Khachera | 122 | 55 | M | Konesa | Konesa | 27 | DOTS Completed |
| 123 | Omprakash | Ramdayal | 123 | 48 | M | Konesa | Konesa | 25 | DOTS Completed |
| 124 | Shreelal | Mangilal | 124 | 38 | M | Chandpura | Chandpura | 38 | DOTS Completed |
| 125 | Ramdayal | Dooji | 125 | 55 | M | Dompura | Dompura | 28 | DOTS Completed |
| 126 | Shreenivash | Ramdayal | 126 | 40 | M | Konesa | Konesa | 20 | DOTS Completed |
| 127 | Rambabu | Basdev | 127 | 32 | M | Konesa | Konesa | 10 | No |
| 128 | Kalyan | Basdev | 128 | 25 | M | Konesa | Konesa | 10 | DOTS Completed |
| 129 | Basdev | Ramhet | 129 | 45 | M | Dompura | Dompura | 18 | DOTS Completed |
| 130 | Ramcharan | Mukandi | 130 | 47 | M | Dompura | Dompura | 20 | DOTS Completed |
| 131 | Rmji | Karni | 131 | 45 | M | Dompura | Dompura | 19 | DOTS Completed |
| 132 | Lalaram | Bhimaram | 132 | 45 | M | Dompura | Dompura | 22 | DOTS Completed |
| 133 | Bablu | Sayamlal | 133 | 32 | M | Jindapura | Jindapura | 12 | DOTS Completed |
| 134 | Hero | Bhagvandas | 134 | 32 | F | Dhanera | Dhanera | 13 | No |
| 135 | Bachan | Mangi | 135 | 39 | M | Dhanera | Dhanera | 15 | No |
| 136 | Dinesh | Kangaliya | 136 | 38 | M | Jindapura | Jindapura | 18 | DOTS Completed |
| 137 | Amarlal | Pothiram | 137 | 32 | M | Dhanera | Dhanera | 13 | No |
| 138 | Damodar | Lohore | 138 | 45 | M | Dhanera | Dhanera | 22 | DOTS Completed |
| 139 | Veerbal | Babulal | 139 | 34 | M | Jindapura | Jindapura | 13 | No |
| 140 | Bhagvansingh | Johoree | 140 | 45 | M | Godhnapura | Godhnapura | 19 | DOTS Completed |
| 141 | Sayamlal | Ramkishan | 141 | 41 | M | Jindapura | Jindapura | 21 | DOTS Completed |
| 142 | Halke | Ramcharan | 142 | 38 | M | Dhanera | Dhanera | 20 | DOTS Completed |
| 143 | Charansingh | Babulal | 143 | 36 | M | Jindapura | Jindapura | 12 | DOTS Completed |
| 144 | Suresh | Ramcharan | 144 | 37 | M | Dhanera | Dhanera | 13 | No |
| 145 | Ramkesh | Ramcharan | 145 | 33 | M | Dhanera | Dhanera | 11 | No |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 146 | Shreebai | Ramcharan | 146 | 74 | F | Dhanera | Dhanera | 0 | No |
| 147 | Bhavarbai | Jagdesh | 147 | 35 | F | Konesa | Konesa | 0 | No |
| 148 | Ramprasad | Ramcharan | 148 | 42 | M | Dhanera | Dhanera | 11 | DOTS Completed |
| 149 | Sayamveer | Motiram | 149 | 36 | M | Dhanera | Dhanera | 15 | No |
| 150 | Sayamu | Phodaliya | 150 | 39 | M | Dhanera | Dhanera | 16 | No |
| 151 | Kallu | Phodaliya | 151 | 38 | M | Dhanera | Dhanera | 16 | No |
| 152 | Kalyan | Chirmoli | 152 | 39 | M | Dhanera | Dhanera | 21 | No |
| 153 | Ramphool | Dooji | 153 | 43 | M | Dhanera | Dhanera | 25 | DOTS Completed |
| 154 | Charan | Bharosi | 154 | 43 | M | Dhanera | Dhanera | 28 | DOTS Completed |
| 155 | Moji | Phodyaram | 155 | 45 | M | Dhanera | Dhanera | 32 | DOTS Completed |
| 156 | Ramesh | Phodyaram | 156 | 43 | M | Dhanera | Dhanera | 25 | DOTS Completed |
| 157 | Pooran | Ramcharan | 157 | 46 | M | Dhanera | Dhanera | 22 | DOTS Completed |

# Annexure - 2

**Details of x-rays findings and diagnosis of individual persons**

| Sr. No. | Patient Name | X-ray No. | Age | Sex | Name of Mine | Mine Work Exposure | X-ray Findings | | | | | Results |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Quality | Small Opacity | | Large Opacity | Other Abnormality | |
| | | | | | | | | Shape & Size | Profusion | | | |
| 1 | Bhagvansingh | 1 | 52 | M | Dompura | 35 | 3 | q/q | 1/1 | | tb | Silicotuberculosis |
| 2 | Mahendra | 2 | 45 | M | Dompura | 25 | 3 | q/q | 1/2 | | pi | Silicosis |
| 3 | Mukesh | 3 | 38 | M | Dompura | 21 | 3 | | 0/0 | | | Within Normal Limits |
| 4 | Roosan | 4 | 48 | M | Dompura | 20 | 3 | q/q | 1/1 | | | Silicosis |
| 5 | Motilal | 5 | 35 | M | Dompura | 18 | 3 | | 0/0 | | | Within Normal Limits |
| 6 | Rambhajan | 6 | 35 | M | Dompura | 18 | 3 | | 0/0 | | tb | Old healed TB |
| 7 | Roosan | 7 | 48 | M | Dompura | 26 | 3 | | 0/0 | | | Within Normal Limits |
| 8 | Siyaram | 8 | 44 | M | Dompura | 30 | 2 | | 0/0 | | | Within Normal Limits |
| 9 | Ramesh | 9 | 50 | M | Dompura | 32 | 3 | | 0/0 | | | Within Normal Limits |
| 10 | Rambabu | 10 | 38 | M | Dompura | 22 | 2 | | 0/0 | | pi | Within Normal Limits |
| 11 | Devisingh | 11 | 50 | M | Dompura | 30 | 3 | q/q | 1/1 | | pi, ca? | Silicosis |
| 12 | Murari | 12 | 35 | M | Dompura | 16 | 3 | | 0/0 | | | Within Normal Limits |
| 13 | Ramphool | 13 | 45 | M | Konesa | 20 | 3 | | 0/0 | | tb | Old healed TB |
| 14 | Indarsingh | 14 | 35 | M | Dompura | 14 | UR | | | | | Repeat X-ray |
| 15 | Kelashi | 15 | 40 | M | Konesha | 20 | 3 | q/q | 1/0 | | | Suspected Silicosis |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | Ramratan | 16 | 65 | M | Konesha | 40 | 3 | r/r | 3/3 | | ax, cn | Silicosis |
| 17 | Roosan | 17 | 60 | M | Dompura | 45 | 3 | q/r | 2/2 | | tb, em | Silicotuberculosis |
| 18 | Sayam | 18 | 37 | M | Dompura | 18 | UR | | | | | Repeat X-ray |
| 19 | Ramcharan | 19 | 52 | M | Dompura | 30 | 3 | | 0/0 | | tb | Old healed TB |
| 20 | Badri | 20 | 60 | M | Dompura | 40 | 3 | r/q | 2/3 | | ax, tb | Silicotuberculosis |
| 21 | Jagveer | 21 | 37 | M | Dompura | 16 | UR | | | | | Repeat X-ray |
| 22 | Pooran | 22 | 45 | M | Dompura | 22 | 3 | q/r | 1/1 | | tb | Silicotuberculosis |
| 23 | Roosan | 23 | 47 | M | Dompura | 30 | 3 | | 0/0 | | pi | Within Normal Limits |
| 24 | Vijaysingh | 24 | 40 | M | Dompura | 20 | 2 | | 0/0 | | | Within Normal Limits |
| 25 | Bharoshi | 25 | 65 | M | Dompura | 40 | 3 | r/r | 2/2 | | tb | Silicotuberculosis |
| 26 | Ramswroop | 26 | 43 | M | Dompura | 20 | UR | | | | | Repeat X-ray |
| 27 | Chuttan | 27 | 65 | M | Dompura | 35 | 3 | q/r | 2/2 | B | tb | Silicosis with PMF |
| 28 | Parmal | 28 | 42 | M | Dompura | 20 | 2 | | 0/0 | | | Within Normal Limits |
| 29 | Saroop | 29 | 60 | M | Dompura | 35 | UR | | | | | Repeat X-ray |
| 30 | Deendayal | 30 | 40 | M | Dompura | 20 | UR | | | | | Repeat X-ray |
| 31 | Lalriya | 31 | 57 | M | Dompura | 40 | 3 | | 0/0 | | | Within Normal Limits |
| 32 | Mansingh | 32 | 37 | M | Dompura | 20 | 3 | | 0/0 | | | Within Normal Limits |
| 33 | Jaisingh | 33 | 51 | M | Rjapur | 22 | UR | | | | | Repeat X-ray |
| 34 | Babu | 34 | 48 | M | Dompura | 30 | 3 | r/q | 3/2 | | bu, ax, pi | Silicosis |
| 35 | Ramkhiladi | 35 | 58 | M | Dompura | 40 | 3 | | 0/0 | | tb | Old healed TB |
| 36 | Charansingh | 36 | 35 | M | Dompura | 18 | UR | | | | | Repeat X-ray |
| 37 | Pooran | 37 | 50 | M | Dompura | 30 | 3 | q/q | 1/0 | | tb | Suspected Silicosis |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38 | Horilal | 38 | 55 | M | Dompura | 35 | 3 | r/r | 3/3 | | ax | Silicosis |
| 39 | Virju | 39 | 45 | M | Dompura | 25 | 3 | | 0/0 | | | Within Normal Limits |
| 40 | Rameshwar | 40 | 55 | M | Chingapura | 32 | 3 | r/r | 3/2 | | ax | Silicosis |
| 41 | Ramesh | 41 | 50 | M | Chingapura | 27 | 3 | r/r | 1/1 | | | Silicosis |
| 42 | Chirangi | 42 | 60 | M | Konesha | 47 | 3 | r/r | 2/3 | A | ax | Silicosis with PMF |
| 43 | Aadram | 43 | 42 | M | Konesha | 17 | 3 | q/q | 1/0 | | | Suspected Silicosis |
| 44 | Raysingh | 44 | 40 | M | Konesha | 13 | 2 | | 0/0 | | | Within Normal Limits |
| 45 | Babulal | 45 | 55 | M | Konesha | 25 | UR | | | | | Repeat X-ray |
| 46 | Jagdeesh | 46 | 50 | M | Konesha | 30 | 3 | q/q | 1/1 | | di, bu, tb | Silicotuberculosis |
| 47 | Ramesh | 47 | 55 | M | Konesha | 30 | 3 | q/q | 2/2 | | | Silicosis |
| 48 | Ramlal | 48 | 52 | M | Konesha | 19 | 3 | | 0/0 | | | Within Normal Limits |
| 49 | Ramdas | 49 | 40 | M | Chingapura | 22 | 3 | | 0/0 | | | Within Normal Limits |
| 50 | Satveer | 50 | 35 | M | Chingapura | 18 | 3 | | 0/0 | | | Within Normal Limits |
| 51 | Harichand | 51 | 40 | M | Konesha | 20 | 3 | | 0/0 | | | Within Normal Limits |
| 52 | Rajveer | 52 | 35 | M | Konesha | 16 | 3 | r/r | 1/2 | | | Silicosis |
| 53 | Kamalsingh | 53 | 35 | M | Pavenee | 11 | 3 | | 0/0 | | | Within Normal Limits |
| 54 | Shivcharan | 54 | 45 | M | Aagai | 18 | 3 | r/q | 3/2 | | ax | Silicosis |
| 55 | Chotu | 55 | 58 | M | Beejoli | 26 | 3 | | 0/0 | | | Within Normal Limits |
| 56 | Johoree | 56 | 48 | M | Dhanera | 25 | 3 | r/r | 3/3 | A | ax | Silicosis with PMF |
| 57 | Manpal | 57 | 55 | M | Konesa | 27 | 3 | r/r | 2/2 | | tb | Silicotuberculosis |
| 58 | Bhabuti | 58 | 70 | M | Dompura | 45 | UR | | | | | Repeat X-ray |
| 59 | Ramdayal | 59 | 50 | M | Bhedekapura | 30 | 3 | q/q | 1/2 | | tb | Silicotuberculosis |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | Devisingh | 60 | 35 | M | Bhedekapura | 20 | 3 | | 0/0 | | | Within Normal Limits |
| 61 | Eswarlal | 61 | 60 | M | Bhedekapura | 40 | UR | | | | | Repeat X-ray |
| 62 | Roosan | 62 | 42 | M | Bhedekapura | 32 | 3 | q/q | 1/1 | | tb | Silicotuberculosis |
| 63 | Dorga | 63 | 57 | M | Bhedekapura | 45 | 3 | | 0/0 | | | Within Normal Limits |
| 64 | Jitendra | 64 | 38 | M | Bhedekapura | 18 | 3 | | 0/0 | | tb | Old healed TB |
| 65 | Ramphool | 65 | 36 | M | Bhedekapura | 18 | 3 | | 0/0 | | | Within Normal Limits |
| 66 | Chironji | 66 | 55 | M | Bhedekapura | 45 | 3 | r/r | 3/2 | | | Silicosis |
| 67 | Narayana | 67 | 38 | M | Bhedekapura | 20 | 3 | | 0/0 | | | Within Normal Limits |
| 68 | Udaiman | 68 | 41 | M | Dhanera | 25 | 3 | q/q | 1/1 | | | Silicosis |
| 69 | Jagdish | 69 | 55 | M | Dhanera | 30 | 3 | q/q | 1/1 | | | Silicosis |
| 70 | Vijendra | 70 | 45 | M | Dhanera | 25 | UR | | | | | Repeat X-ray |
| 71 | Visal | 71 | 45 | M | Konesa | 30 | 2 | | 0/0 | | | Within Normal Limits |
| 72 | Mavasi | 72 | 58 | M | Dhanera | 30 | 3 | | 0/0 | | tb | Old healed TB |
| 73 | Niroti | 73 | 42 | M | Dompura | 42 | 3 | | 0/0 | | | Within Normal Limits |
| 74 | Sumera | 74 | 52 | M | Dompura | 35 | 3 | | 0/0 | | | Within Normal Limits |
| 75 | Shivnarayan | 75 | 40 | M | Dompura | 20 | 3 | | 0/0 | | | Within Normal Limits |
| 76 | Shivram | 76 | 29 | M | Dompura | 23 | 3 | | 0/0 | | | Within Normal Limits |
| 77 | Bhogiram | 77 | 70 | M | Bhedekapura | 45 | 3 | r/r | 1/1 | | | Silicosis |
| 78 | Mangilal | 78 | 45 | M | Khurdiya | 27 | 3 | q/q | 1/1 | | di, tb | Silicotuberculosis |
| 79 | Shivsingh | 79 | 29 | M | Bhedekapura | 15 | 3 | r/r | 1/1 | | tb | Silicotuberculosis |
| 80 | Omprakash | 80 | 36 | M | Bhedekapura | 20 | 3 | | 0/0 | | | Within Normal Limits |
| 81 | Petambai | 81 | 35 | F | Dompura | 0 | 3 | | 0/0 | | | Within Normal Limits |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 82 | Rajendra | 82 | 45 | M | Bhedekapura | 30 | 3 | | 0/0 | | | Within Normal Limits |
| 83 | Kumarpal | 83 | 45 | M | Khosla | 17 | 3 | | 0/0 | | | Within Normal Limits |
| 84 | Munna | 84 | 31 | M | Khosla | 11 | 3 | | 0/0 | | | Within Normal Limits |
| 85 | Suresh | 85 | 32 | M | Khosla | 13 | 3 | | 0/0 | | | Within Normal Limits |
| 86 | Ramdayal | 86 | 48 | M | Khosla | 19 | 3 | | 0/0 | | | Within Normal Limits |
| 87 | Mukesh | 87 | 33 | M | Jhinnakapura | 33 | 3 | | 0/0 | | | Within Normal Limits |
| 88 | Sugan | 88 | 42 | M | Jhinnakapura | 18 | 3 | | 0/0 | | | Within Normal Limits |
| 89 | Durgsingh | 89 | 38 | M | Jhinnakapura | 12 | 3 | | 0/0 | | | Within Normal Limits |
| 90 | Babu | 90 | 43 | M | Jhinnakapura | 18 | 3 | q/q | 1/2 | | tb | Silicotuberculosis |
| 91 | Badree | 91 | 51 | M | Jhinnakapura | 19 | 3 | q/q | 1/2 | | | Silicosis |
| 92 | Mukyar | 92 | 38 | M | Jhinnakapura | 14 | 3 | | 0/0 | | | Within Normal Limits |
| 93 | Munna | 93 | 44 | M | Jhinnakapura | 17 | 3 | r/r | 2/2 | | ax, tb, em | Silicotuberculosis |
| 94 | Vijaysingh | 94 | 41 | M | Dompura | 25 | 3 | r/r | 2/3 | | ax, tb | Silicotuberculosis |
| 95 | Bhagwandas | 95 | 43 | M | Dhanera | 17 | 3 | q/r | 1/1 | | pi | Silicosis |
| 96 | Bhawar | 96 | 40 | M | Dhanera | 19 | 3 | q/q | 2/2 | | | Silicosis |
| 97 | Harphool | 97 | 58 | M | Dadrooni | 40 | UR | | | | | Repeat X-ray |
| 98 | Bhagban | 98 | 38 | M | Dhanera | 17 | 3 | | 0/0 | | | Within Normal Limits |
| 99 | Ramlakhan | 99 | 37 | M | Dhanera | 18 | 3 | | 0/0 | | | Within Normal Limits |
| 100 | lakkhe | 100 | 38 | M | Dompura | 16 | 3 | | 0/0 | | | Within Normal Limits |
| 101 | Chirmoli | 101 | 58 | M | Konesa | 28 | 3 | r/q | 3/2 | B | ax, tb, cg | Silicosis with PMF |
| 102 | Chotya | 102 | 55 | M | Konesa | 22 | 3 | | 0/0 | | tb | Old healed TB |
| 103 | Bhorisingh | 103 | 32 | M | Konesa | 11 | 3 | | 0/0 | | | Within Normal Limits |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 104 | Hotamsingh | 104 | 45 | M | Dompura | 26 | 3 | q/q | 1/1 | | | Silicosis |
| 105 | Babulal | 105 | 45 | M | Dompura | 25 | UR | | | | | Repeat X-ray |
| 106 | Devicharan | 106 | 42 | M | Dompura | 25 | 3 | | 0/0 | | | Within Normal Limits |
| 107 | Basudev | 107 | 45 | M | Dompura | 26 | 3 | | 0/0 | | | Within Normal Limits |
| 108 | Navalsingh | 108 | 38 | M | Konesa | 13 | 3 | | 0/0 | | | Within Normal Limits |
| 109 | Moharsingh | 109 | 88 | M | konesa | 43 | 3 | | 0/0 | | | Within Normal Limits |
| 110 | Laxman | 110 | 42 | M | konesa | 16 | 3 | | 0/0 | | | Within Normal Limits |
| 111 | Amarsingh | 111 | 38 | M | Bhavanpura | 38 | 3 | | 0/0 | | | Within Normal Limits |
| 112 | Parikkhat | 112 | 48 | M | Godhnapura | 19 | 3 | q/q | 1/0 | | | Suspected Silicosis |
| 113 | Vijendra | 113 | 48 | M | Konesa | 19 | 3 | r/r | 2/2 | | ax | Silicosis |
| 114 | Ramveer | 114 | 41 | M | Godhnapura | 18 | 3 | | 0/0 | | | Within Normal Limits |
| 115 | Rayphool | 115 | 41 | M | Godhnapura | 17 | 3 | | 0/0 | | | Within Normal Limits |
| 116 | Patiram | 116 | 45 | M | Godhnapura | 23 | 3 | | 0/0 | | | Within Normal Limits |
| 117 | Pooran | 117 | 39 | M | Godhnapura | 13 | 3 | | 0/0 | | | Within Normal Limits |
| 118 | Shreelal | 118 | 41 | M | Dompura | 15 | 3 | q/q | 2/1 | | | Silicosis |
| 119 | Ramgovind | 119 | 30 | M | Konesa | 13 | 3 | r/r | 1/2 | | tb | Silicotuberculosis |
| 120 | Shivsingh | 120 | 42 | M | Konesa | 20 | 3 | | 0/0 | | | Within Normal Limits |
| 121 | Babu | 121 | 45 | M | Konesa | 25 | 3 | r/r | 2/2 | | ax | Silicosis |
| 122 | Eswarlal | 122 | 55 | M | Konesa | 27 | 3 | q/r | 2/1 | | | Silicosis |
| 123 | Omprakash | 123 | 48 | M | Konesa | 25 | 3 | q/q | 1/1 | | cg, es | Silicosis |
| 124 | Shreelal | 124 | 38 | M | Chandpura | 38 | 2 | | 0/0 | | tb | Old healed TB |
| 125 | Ramdayal | 125 | 55 | M | Dompura | 28 | 3 | | 0/0 | | tb | Old healed TB |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 126 | Shreenivash | 126 | 40 | M | Konesa | 20 | 3 | r/r | 2/1 | | | Silicosis |
| 127 | Rambabu | 127 | 32 | M | Konesa | 10 | 3 | | 0/0 | | | Within Normal Limits |
| 128 | Kalyan | 128 | 25 | M | Konesa | 10 | 3 | | 0/0 | | | Within Normal Limits |
| 129 | Basdev | 129 | 45 | M | Dompura | 18 | 3 | q/q | 1/0 | | | Suspected silicosis |
| 130 | Ramcharan | 130 | 47 | M | Dompura | 20 | 3 | r/r | 3/3 | | ax | Silicosis |
| 131 | Rmji | 131 | 45 | M | Dompura | 19 | 3 | q/r | 2/2 | | cg, ax | Silicosis |
| 132 | Lalaram | 132 | 45 | M | Dompura | 22 | 3 | | 0/0 | | | Within Normal Limits |
| 133 | Bablu | 133 | 32 | M | Jindapura | 12 | 2 | | 0/0 | | | Within Normal Limits |
| 134 | Hero | 134 | 32 | F | Dhanera | 13 | 3 | | 0/0 | | | Within Normal Limits |
| 135 | Bachan | 135 | 39 | M | Dhanera | 15 | 3 | | 0/0 | | | Within Normal Limits |
| 136 | Dinesh | 136 | 38 | M | Jindapura | 18 | 3 | | 0/0 | | | Within Normal Limits |
| 137 | Amarlal | 137 | 32 | M | Dhanera | 13 | 3 | | 0/0 | | | Within Normal Limits |
| 138 | Damodar | 138 | 45 | M | Dhanera | 22 | UR | | | | | Repeat X-ray |
| 139 | Veerbal | 139 | 34 | M | Jindapura | 13 | 2 | | 0/0 | | | Within Normal Limits |
| 140 | Bhagvansingh | 140 | 45 | M | Godhnapura | 19 | 3 | | 0/0 | | cg | Within Normal Limits |
| 141 | Sayamlal | 141 | 41 | M | Jindapura | 21 | 2 | | 0/0 | | pi | Within Normal Limits |
| 142 | Halke | 142 | 38 | M | Dhanera | 20 | 3 | | 0/0 | | | Within Normal Limits |
| 143 | Charansingh | 143 | 36 | M | Jindapura | 12 | 3 | | 0/0 | | | Within Normal Limits |
| 144 | Suresh | 144 | 37 | M | Dhanera | 13 | 3 | | 0/0 | | | Within Normal Limits |
| 145 | Ramkesh | 145 | 33 | M | Dhanera | 11 | 3 | | 0/0 | | | Within Normal Limits |
| 146 | Shreebai | 146 | 74 | F | Dhanera | 0 | 3 | | 0/0 | | | Within Normal Limits |
| 147 | Bhavarbai | 147 | 35 | F | Konesa | 0 | 3 | | 0/0 | | fr | Within Normal Limits |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 148 | Ramprasad | 148 | 42 | M | Dhanera | 11 | 3 | | 0/0 | | | Within Normal Limits |
| 149 | Sayamveer | 149 | 36 | M | Dhanera | 15 | 3 | | 0/0 | | | Within Normal Limits |
| 150 | Sayamu | 150 | 39 | M | Dhanera | 16 | 2 | | 0/0 | | tb, bu | Old healed TB |
| 151 | Kallu | 151 | 38 | M | Dhanera | 16 | 3 | q/q | 1/0 | | | Suspected silicosis |
| 152 | Kalyan | 152 | 39 | M | Dhanera | 21 | 3 | | 0/0 | | | Within Normal Limits |
| 153 | Ramphool | 153 | 43 | M | Dhanera | 25 | 3 | | 0/0 | | | Within Normal Limits |
| 154 | Charan | 154 | 43 | M | Dhanera | 28 | UR | | | | | Repeat X-ray |
| 155 | Moji | 155 | 45 | M | Dhanera | 32 | 3 | q/q | 1/0 | | | Suspected silicosis |
| 156 | Ramesh | 156 | 43 | M | Dhanera | 25 | 3 | | 0/0 | | | Within Normal Limits |
| 157 | Pooran | 157 | 46 | M | Dhanera | 22 | 3 | | 0/0 | | tb | Old healed TB |

**0/0 -----  Within Normal Limits**

**1/0 -----  Suspected Silicosis**

**1/1 and Above ---  Silicosis**

**UR - Unacceptable for classification purposes**

**Symbols:**

**ax** -coalescence of small opacities

**bu** - bulla (e)

**cn** - calcification in small pneumoconiotic opacities

**cg** - calcified non-pneumoconiotic nodules or nodes

**di** - marked distortion of an intrathoracic structure

**ef** - pleural effusion

**em** -emphysema

**es** - eggshell calcification of hilar or mediastinal lymph nodes

**px** - pnemothorax

**tb** - tuberculosis

**od -** other disease or other significant abnormality