

CHAPTER 2

SILICOSIS IN INDIA

2.1 Silicosis: cause, cure and prevention

Silicosis, (previously **miner's phthisis**, **grinder's asthma**, **potter's rot** and other occupation-related names) is a form of occupational lung disease caused by inhalation of crystalline silica dust, and is marked by inflammation and scarring in forms of nodular lesions in the upper lobes of the lungs. It is one of the oldest occupational disease ever known to human being. It is a type of pneumoconiosis. In medical terms, this disease is known as "Pneumonoultramicroscopicsilicovolcanoconiosis". According to the *Oxford English Dictionary*, it is "a factitious word alleged to mean 'a lung disease caused by the inhalation of very fine silica dust, causing inflammation in the lungs.'" A condition meeting the word's definition is normally called silicosis. The 45-letter word was coined to serve as the longest English word and is the longest word ever to appear in an English language dictionary. Silicosis (particularly the acute form) is characterized by shortness of breath, cough, fever, and cyanosis (bluish skin). It may often be misdiagnosed as pulmonary edema (fluid in the lungs), pneumonia, or tuberculosis.

The name *silicosis* (from the Latin *silex*, or flint) was originally used in 1870 by Achille Visconti (1836-1911), prosecutor in the Ospedale Maggiore of Milan.[3] The recognition of respiratory problems from breathing in dust dates to ancient Greeks and Romans.[4] Agricola, in the mid-16th century, wrote about lung problems from dust inhalation in miners. In 1713, Bernardino Ramazzini noted asthmatic symptoms and sand-like substances in the lungs of stone cutters. With industrialization, as opposed to hand tools, came increased production of dust.

The pneumatic hammer drill was introduced in 1897 and sandblasting was introduced in about 1904,[5] both significantly contributing to the increased prevalence of silicosis.

Silicon (Si) is the second most common element in the Earth's crust (oxygen is the most common). The compound silica, also known as silicon dioxide (SiO_2), is formed from silicon and oxygen atoms. Since oxygen and silicon make up about 75% of the Earth, the compound silica is quite common. It is found in many rocks, such as marble, sandstone, flint and slate, and in some metallic ores. Silica can be a main component of sand. It can also be in soil, mortar, plaster, and shingles. The cutting, breaking, crushing, drilling, grinding, or abrasive blasting of these materials may produce fine silica dust. Though the dust particles are present everywhere causing allergy or bronchial problems like asthma in common places also but it is the presence of high percentage of free silica in dust which cause silicosis.

Silica occurs in 3 forms: crystalline, microcrystalline (or cryptocrystalline) and amorphous (non-crystalline). "Free" silica is composed of pure silicon dioxide, not combined with other elements, whereas silicates (e.g. talc, asbestos, and mica) are SiO_2 combined with an appreciable portion of cations.

- Crystalline silica exists in 7 different forms (polymorphs), depending upon the temperature of formation. The main 3 polymorphs are quartz, cristobalite, and tridymite. Quartz is the second most common mineral in the world (next to feldspar).[13]
- Microcrystalline silica consists of minute quartz crystals bonded together with amorphous silica. Examples include flint and chert.

Amorphous silica consists of kieselgur (diatomite), from the skeletons of diatoms, and vitreous silica, produced by heating and then rapid cooling of crystalline silica. Amorphous silica is less toxic than crystalline, but not biologically inert, and diatomite, when heated, can convert to tridymite or cristobalite.

Silica flour is nearly pure SiO_2 finely ground. Silica flour has been used as a polisher or buffer, as well as paint extender, abrasive, and filler for cosmetics. Silica flour has been associated with all types of silicosis, including acute silicosis.

Silicosis is due to deposition of fine respirable dust (less than 10 micrometers in diameter) containing crystalline silicon dioxide in the form of alpha-quartz, cristobalite, or tridymite. When small silica dust particles are inhaled, they can embed themselves deeply into the tiny alveolar sacs and ducts in the lungs, where oxygen and carbon dioxide gases are exchanged. There, the lungs cannot clear out the dust by mucous or coughing.

When fine particles of silica dust are deposited in the lungs, macrophages that ingest the dust particles will set off an inflammation response by releasing tumor necrosis factors, interleukin-1, leukotriene B4 and other cytokines. In turn, these stimulate fibroblasts to proliferate and produce collagen around the silica particle, thus resulting in fibrosis and the formation of the nodular lesions.

Characteristic lung tissue pathology in nodular silicosis consists of fibrotic nodules with concentric "onion-skinned" arrangement of collagen fibers, central hyalinization, and a cellular peripheral zone, with lightly birefringent particles seen under polarized light. The silicosis nodule represents a specific tissue response to crystalline silica.[5] In acute silicosis, microscopic pathology shows a periodic acid-

Schiff positive alveolar exudate (alveolar lipoproteinosis) and a cellular infiltrate of the alveolar walls.

Classification of silicosis;-

Silicosis can be classified in different ways on the basis of severity of disease, its onset and rapidity of progression. these are;-

- 1) **Chronic Silicosis-** It takes 15-20 yrs of exposure to develop the disease. Here the free silica content of dust is low to moderate level and it is usually without any symptom unless there as complications.
- 2) **Accelerated Silicosis:** It takes 5-10 yrs to develop the disease Here the dust content free silica level is very high. In later stage it shows symptom of shortness of breath, cough, weakness and weight loss.
- 3) **Acute silicosis:** this is the most serious type and ahead to disabling condition to sufferer. Here the worker is exposed to very high concentration of dust with high free silica particles. Here the exposure may be of 2 months to 2 yrs. Acute shortness of breath, cough, weakness and weight loss are symptoms and it ultimately leads to the death of the sufferer.

The silicosis can also be defined into following 4 categories in early stage of exposure when symptoms and conspicuous signs are absent.

- 1) **Pure or nodular silicosis:-** This is collagenous nodular fibrosis caused by inhalation of silica dust having high proportion of free silica content. Initially small discrete opacities seen and in later stage, larger nodular or irregular shadows developed along with egg shell calcification of hilar lymph nodes.

- 2) **Mixed dust fibrosis:-** It is ill defined, irregular stellate fibrosis and is due to inhalation of siliceous dust containing mixture of free silica and inert mineral (e.g. iron oxide) with proportionally less silica content. Discrete small nodular or irregular opacities similar to that of fibrocaceous tuberculosis can be there.
- 3) **Diatomite pneumoconiosis:-** It is mainly diffused interstitial pulmonary fibrosis caused by siliceous sedimentary rock diatomite containing diatomaceous silica. Initial linear or round opacities and later on circumscribed homogeneous density shadow may be seen.
- 4) **Acute silicosis:-** It is silico lipo-proteinosis with diffused interstitial pulmonary fibrosis and develop rapidly most probably due to siliceous dust with unusually high free silica content, Here mature silicotic nodules are either few or absent. There may be ground glass or small rounded opacities in the lower lung field.

Diagnosis:

It is a well known fact that silicosis predisposes to the development of tuberculosis. In silicosis there may not be any symptom at initial stage but advance radiographic signs may be there. As the disease advances, there may be cough, small quantity of sputum, breathlessness, etc. but chest pain is absent. Thus, in silicosis, detectable clinical signs are normally absent unless there are some complications. The normal lung test is ineffective in diagnosing silicosis except in very advance cases. Chest radiography of the standard as prescribed by ILO is the only way to diagnose this disease. Thus, there are three key elements to the diagnosis of silicosis. First, the patient history should reveal exposure to sufficient

silica dust to cause this illness. Second, chest imaging (usually chest x-ray) that reveals findings consistent with silicosis. Third, there are no underlying illnesses that are more likely to be causing the abnormalities. Physical examination is usually unremarkable unless there is complicated disease. Also, the examination findings are not specific for silicosis. Pulmonary function testing may reveal airflow limitation, restrictive defects, reduced diffusion capacity, mixed defects, or may be normal (especially without complicated disease). Most cases of silicosis do not require tissue biopsy for diagnosis, but this may be necessary in some cases, primarily to exclude other conditions.

For uncomplicated silicosis, chest x-ray will confirm the presence of small (< 10 mm) nodules in the lungs, especially in the upper lung zones. Using the ILO classification system, these are of profusion 1/0 or greater and shape/size "p", "q", or "r". Lung zone involvement and profusion increases with disease progression. In advanced cases of silicosis, large opacity (> 1 cm) occurs from coalescence of small opacities, particularly in the upper lung zones. With retraction of the lung tissue, there is compensatory emphysema. Enlargement of the hilum is common with chronic and accelerated silicosis. In about 5-10% of cases, the nodes will calcify circumferentially, producing so-called "eggshell" calcification. In some cases, the pulmonary nodules may also become calcified. A computed tomography or CT scan can also provide a more detailed analysis of the lungs, and can reveal cavitation due to concomitant mycobacterial infection.

Prevention:

Since Silicosis is caused due to free silica particles in air which are inhaled as aerosols and get deposited in the lungs, hence monitoring and control of dust below prescribed level (threshold level of exposure) is necessary for preventing the occurrence of this disease in workers in mines and quarries. It requires

- 1) **Environmental sampling:-** numerous samples of Known volume of air from the work field atmosphere is withdrawn and are then analyzed through Gravimetric to know the percentage presence of pollutant in the air and to decided further course of action for prevention of exposure to this lethal particles .
- 2) **Wet drilling:-** it reduces generation of dry free dust reducing free air born silica particles.
- 3) **Sharp tools:-** the worker if use sharp tool instead of blunt tools for cutting, drilling etc, it will produce less dust.
- 4) **Controlled explosions:-** Minimum quantity of explosives should be used for explosion. The hole containing explosive should be covered with gunny bags or other type of cover before explosion. Explosion should be carried out in evening hours just before leaving the mines so as to avoid exposure to air born dust generated by explosion as by the time they come back to work next day, the dust will settle down to great extent or blown away by wind.
- 5) Wearing of recommended mask, shoes and goggles
- 6) Place of residence minimum two km away from the mining area
- 7) Regular health examination including pre placement examination and free medical facilities to those found exposed to silica dust.
- 8) Ventilation control
- 9) Counseling of workers and owners

Treatment

Silicosis is an irreversible condition with no cure. Treatment options currently focus on alleviating the symptoms and preventing complications. These include:

2. Stopping further exposure to silica and other lung irritants, including tobacco smoking.
3. Cough suppressants.
4. Antibiotics for bacterial lung infection.
5. TB prophylaxis for those with positive tuberculin skin test or IGRA blood test.
6. Prolonged anti-tuberculosis (multi-drug regimen) for those with active TB.
7. Chest physiotherapy to help the bronchial drainage of mucus.
8. Oxygen administration to treat hypoxemia, if present.
9. Bronchodilators to facilitate breathing.
10. Lung transplantation to replace the damaged lung tissue is the most effective treatment, but is associated with severe risks of its own.
11. For acute silicosis, bronchoalveolar lavage may alleviate symptoms, but does not decrease overall mortality.
12. Experimental treatments include:

13. Inhalation of powdered aluminium, d-penicillamine and polyvinyl pyridine-N-oxide.
14. Corticosteroid therapy.
15. The herbal extract tetrandine may slow progression of silicosis.

2.2 Magnitude of the Problem

There are very few epidemiological studies on silicosis in India where the prevalence of silicosis varies from 3.5% in ordinance factory to 54.6% in slate pencil industry. The varying prevalence in various sectors is attributed to the silica concentration in the work environment and duration of exposure to Silica. As per census 2001, of total workers 168101220, about 29508563 are at the risk of silica exposure. As per ICMR research report (1999) about 3 million workers are at risk in mine and queries, 17 lakhs in non metallic(mica , slate, glass) industries and metallic industries while 54 lakhs workers in construction work are also at risk. As per report of NIOH, 54.6% workers are suffering from silicosis in slate pencil industries of which 50% are less then 25 yrs while one of the report of WHO reveals that 55% of those died due to silicosis had mean age of 35 only.

The situation becomes more serious in view of the fact that many of these workers are minors, school going age children who are forced to work out of sheer poverty. India has the largest number of non-school going children workers in the world. Despite the country's constitution prohibiting the employment of children below the age of 14 years in factories, mines or hazardous occupations, a 2005 report commissioned by the India Committee of the Netherlands and entitled "Budhpura: Ground Zero – Sandstone Quarrying in India", estimates that out of the 100,000 quarry workers in the Bundi district, roughly 15,000 to 20,000 are children.

There are an estimated 8000 child labourers involved in making cobbles in the village of Budhpura alone in Bundi district, some of which are as young as 6 years of age. They also found that the stone quarrying and processing industry is largely in informal or unorganized sectors under hazardous working conditions where the most basic safety provisions, such as dust masks, protective shoes and gloves, are usually absent. According to the Department of Mines and Geology of the Government of Rajasthan there are 74 quarries in Budhpura but the real figure is allegedly much higher due to illegal quarrying. Thus one of the serious dimensions in the problem is existence of high level of illegal mining and factories which are un-noticed and hence unaccountable.

The magnitude of problem can also be estimate by the fact that in a village Shakarpur near Khambhat in Gujrat, only, the disease has killed 109 people in this village since 2005, the highest incidence reported in the state, according to People's Training Research Centre (PTRC), a non-profit group, which provides medical aid to patients and supports a day-care center for children of agate workers here. The workers have no social security cover nor do families get any compensation if the breadwinner dies because most of these workplaces are in unorganized sectors. As has mentioned earlier, a 1991 survey carried out by the Indian Council of Medical Research (ICMR) estimated that more than three million people, mostly coal, manganese and zinc miners, were found to be having the disease. The disease was also found among workers at quarry sites and slate and glass units. A report by the Ahmedabad-based National Institute of Occupational Health (NIOH), under ICMR, said at least 10 million people in India are at risk from silicosis. Yet, these afflicted workers remain largely invisible in the records of the labour ministry, health ministry or in state governments records. even the state like Jharkhand having rich mines shows zero silicosis cases. Apart from apathy of enforcement agencies ,

lack of awareness on part of employee as well as employer, the difficulty of keeping track is exacerbated by the fact that people with terminal illnesses leave their workplace to return to the towns and villages they hail from. Many of the workers are migrants who travel to other states for jobs, but go back home to die without knowing the cause.

Recent study titled "Co-morbidities among silicotics at Shakarpur: A follow up study" by Nayanjeet Chaudhury, Rajiv Paliwal and Ajay Phatak has once again confirmed high morbidity and mortality among agate stone workers of Shakarpur village near Khambhat town in Gujarat due to silicosis. Report found that besides the fatal disease, the workers also suffer from debilitating co-morbidities especially tuberculosis and under nutrition. With the aim to describe co-morbidities and their influence in mortality in cases of silicosis, the study used spirometry for lung function, chest X-ray, anthropometry, body fat percentage measurement, record of tuberculosis status and ILO classification of pneumoconiosis on 53 chest symptomatic patients above 15 years of age, who were followed for 30 months.

The results of the study showed that out of 53 participants (35 men), with an average duration of exposure to free silica of 16.8 years, more than half of the male workers were underweight (BMI<18.5 kg/m²) at enrollment. Thirteen participants died in less than 3 years of follow up. While 11 of them were silicosis positive out of which 10 had tuberculosis while the odds ratio for association between silicosis and tuberculosis was found to be 2.75. A majority (81.1%) of the 37 silicosis positive cases showed a mixed pattern in spirometry suggesting co-existence of restrictive and obstructive pathology. On regression analysis, TB and nutritional status were found to have strong influence on mortality. The study further found that the difference in mean BMI across males and females was significant (P<0.01). While the mean body fat percentage was highly significantly different

($P < .0001$) across two genders, the values were in normal limits for both genders as per international guidelines as defined in the methods section. Out of 13 fatalities, 11 (84%) were already positive for silicosis as per the standard X-rays of International Labour Organization. They form 29% of the total silicosis positive participants. The age at death of the participants ranges from 28 years to 60 years, with both mean and median at 40 years. This indicates that more than half of the workers died young below 40 years of age. On exploring the history of TB, it was found that 27 out of 53, that is, half of the participants had taken treatment for TB, of which, nearly a half (13) died during the follow-up period. Incidentally among the dead, the two cases negative for silicosis had history of TB. There was highly significant association between fatality and TB among the silicosis positive.

Silicosis is known to shorten substantially the lifespan of a person exposed to fine silica dust over prolonged period. In agate stone polishing industries of India, about 38% of workers develop silicosis in their lifetime. Not only workers in this industry develop silicosis due to the chronic exposure to the dust, their families and other non-occupational groups that also reside within the area develop silicosis (6.8 – 11.8 %), Silico-tuberculosis (2.8 – 6.3%), and tuberculosis (TB) (19.7 – 20.1%).”

2.3 Case studies

The cases of silicosis has been continuously reported not only in media news papers , articles from time to toime but has been focus of attention of civil societies courts and also Human right bodies. In fact, Silicosis has been taken up as serious human rights issue by NHRC and at the time of this research, there are about 72 complaints pending with Commission, some received from NGO's and independent persons, and cases where Commission has taken Suo- Motu

cognizance. Following are some of the cases pending before National Human Rights Commission.

2.3.1. Complaint by PRASAR, New Delhi (Case No.1053/30/2003-2004/NHRC)

Shri S.A. Azad, President, PRASAR, a non-governmental organization in New Delhi submitted a petition before the National Human Rights Commission on 13 June 2003 stating that on the basis of the survey conducted in Lalkuan area in the month of August 2001, silicosis was detected among the stone crushers, stone quarry workers, miners and construction workers. The petitioner sought remedy for the occupational disease of silicosis on the ground that the State Government, contractors, agents, etc., were grossly negligent towards the working conditions of workers which resulted in silicosis among many of them. It was further submitted that in the year 1992, the Supreme Court of India in M.C. Mehta vs Union of India had ordered for the closure and shifting of the stone crushing, quarrying, mining and other activities from the Lal Kuan area to Pali in Haryana. On these grounds, the petitioner requested for a grant of compensation for these workers. In support of his complaint, the petitioner had enclosed a list of 83 persons alleged to have been suffering from silicosis, apart from the list of 55 people who allegedly died due to silicosis. The complainant, Shri S.A. Azad, in November 2009 further furnished a list of 44 persons who were diagnosed as victims of radiological abnormalities in Lal Kuan area by the Centre for Occupational and Environmental Health, New Delhi, along with a list of 12 persons identified by Lala Ram Swarup Institute of Tuberculosis & Respiratory Diseases, New Delhi who died on account of silicosis. The aforementioned lists were supported with the medical and identification certificates of the victims.

The Commission after hearing the petitioners and representatives of various State Governments observed that the occupational hazard of silicosis is preventable if proper warning is given and the working conditions are properly regulated and monitored. Once the worker or other person is afflicted by silicosis, it becomes a constitutional obligation on the part of the Government to take appropriate measures for providing the necessary health care and rehabilitating the victims. The welfare of workers, especially those in the unorganized sector, should be given priority. Also the Commission on 20 May 2010 sent the aforesaid list to the Chief Secretary, Government of N.C.T. of Delhi with a request to provide information as to ,

- (i) whether any compensation has been provided to the victims mentioned in the list;
- (ii) whether the persons suffering from silicosis have been given any medical treatment and rehabilitation package by the Government of N.C.T. of Delhi.

In spite of reminders, the reply was still awaited from the Government of N.C.T. of Delhi while writing this research.

2.3.2. Complaint by Khedut Mazdoor Chetna Sangath (Case No. 300/6/5/2007-2008/NHRC)

In the given case, Shri Juwan Singh, Shri Shankar Talwade and Shri Bhim Singh associated with Khedut Mazdoor Chetna Sangath, a Trade Union of Bhil Tribals in Alirajpur District, informed the Commission on 30 July 2007 that the tribals of Alirajpur and Jhabua Districts of Madhya Pradesh who migrated to Gujarat in search of employment found work in the Districts of Baroda, Kheda, Panchmahal and Godhra, where stone is crushed. Despite being kept on work, these workers

were not given any employment letter nor a record of their attendance was kept. They were also not provided any masks which they could wear while performing their duties. These workers on contracting silicosis returned back to their native Districts from where they had initially migrated. It was reported by them that 197 persons belonging to the Districts of Alirajpur and Jhabua had already died on account of silicosis. In their complaint, they also mentioned names of 12 mineral factories located in the Districts of Panchmahal and Godhra in Gujarat where these workers had found employment. They further enclosed a list of 489 labourers who were employed in these factories out of which 164 had died and the remaining 325 were suffering from silicosis. They sought the intervention of the Commission on their complaint as no relief had been given to the poor tribals either by their employers or by the Government.

On 21 August 2007, the Commission directed its Director General (Investigation) in the NHRC to depute a team for an 'on the spot enquiry' in the matter. The team from the Investigation Division of NHRC inspected the concerned areas in Jhabua (Madhya Pradesh), Kheda, Panchmahal and Gandhi Nagar (Gujarat) and found that 96 labourers who had worked in the District of Godhra in Gujarat had died on account of silicosis. 118 labourers were suffering from silicosis in the Districts of Jhabua and Alirajpur in Madhya Pradesh. The team also submitted that the labourers being illiterate were totally ignorant about filing their compensation claims. Only three of them had filed claim cases under the ESI Act in Ahmedabad.

Based on the findings of its own team, the Commission on 13 August 2009, ordered that the list of 96 labourers who had died on account of silicosis and the other list of 118 labourers who were suffering from silicosis be sent to the respective District Magistrates of Jhabua & Alirajpur. This, the Commission felt, would not

only help in re-confirming the number of silicosis deaths but also the exact number of workers who were ailing from silicosis. The District Magistrates were also requested to inform the NHRC whether any compensation had been given to the next of kin of the deceased by the State Government. They were further requested to submit a report to the NHRC about any kind of arrangement being made by the State for the rehabilitation and medical care of the labourers suffering from silicosis as well as steps being taken by the State Government for controlling the problem of silicosis. The Chief Secretary, Government of Madhya Pradesh was also directed to depute a senior officer for providing the necessary assistance to the District Magistrates in preparation of the report to be submitted to the Commission within six weeks.

Pursuant to above directions, the District Magistrates on 8 October 2009 submitted a detailed report to the Commission informing that from the survey conducted at the District level, it was found that 259 persons had died of silicosis and 304 persons were suffering from silicosis in Jhabua and Alirajpur Districts of Madhya Pradesh.

The Commission on 25 November 2009 also decided to call over the District Collectors of Jhabua, Alirajpur (Madhya Pradesh) and Godhra (Gujarat) in NHRC for a hearing. Accordingly, on 18 December 2009, the District Collector of Godhra informed the Commission that the State Government of Gujarat had taken several measures to prevent the ailment of silicosis. For example, protective masks were being supplied to all the labourers working in the District of Godhra. The District Collectors also submitted that so far no compensation had been given to the victims of silicosis by the State of Gujarat though the ESIC was providing medical services to the labourers suffering from silicosis. Considering the fact that the persons

suffering from silicosis were residing in Jhabua and Alirajpur Districts, but working in the factories located in Gujarat, the Commission recognized it as an inter-state problem necessitating constitution of a Coordinating Committee comprising members of both the States.

The District Collectors of Jhabua and Alirajpur also submitted that the State Government of Madhya Pradesh was providing medical facilities to the workers suffering from silicosis and had taken various steps for their rehabilitation too. Thereafter, on 24 February 2010, the concerned District Collectors of Panchmahal and Godhra in Gujarat and Jhabua and Alirajpur in Madhya Pradesh also submitted their reports to the Commission. The Commission on 8 March 2010 observed that in a survey conducted by the District Magistrates of Jhabua and Alirajpur, it was found that 259 persons had died on account of silicosis. It was also available on records that these labourers were working in stone crushing factories and after contracting the occupational disease of silicosis, they returned back to their native Districts of Jhabua and Alirajpur. All these workers had died due to carelessness of the enforcement agencies of the State of Gujarat. If the Inspectorate of Factories and other enforcement officers would have taken appropriate preventive steps, the lives of the workers who died of silicosis could have been saved. The Commission was of the view that it was the duty of the State enforcement agencies to take appropriate preventive steps by directing the factory management to take such measures which could have saved the workers suffering from the ailment of silicosis. Thus, the State of Gujarat had failed to save the lives of the workers who suffered from silicosis.

The Commission further observed that this was a case of violation of human rights of persons who died on account of silicosis and the next of kins of the

deceased were entitled for compensation. Consequently, the Commission on 8 March 2010 issued a notice to the Chief Secretary of Gujarat u/s 18(a)(i) of the Protection of Human Rights Act, 1993 calling upon him to show cause as to why compensation be not recommended in favour of the next of kins, who died of silicosis.

The Commission on 11 June 2010 requested the Chief Secretaries of both the States to appear before the Commission along with their suggestions for compensating the victims of silicosis.

The Chief Secretary of Gujarat along with Principal Secretary (Labour) and other senior officers from the Government of Gujarat appeared before the Commission. The Chief Secretary of Gujarat submitted that only 238 persons as against earlier reported 259 persons, had died on account of silicosis who may be considered for compensation. Out of the remaining 21 persons, three were found to be alive, 12 names were duplicate, one had died a natural death, four persons were found untraceable and one was a three-year old child. It was further submitted that out of 238 deceased persons, 148 were from Godhra in Gujarat and were entitled for compensation from ESIC as they were eligible for benefits under the provision of ESI Act, 1948. Under this Act, the legal heirs of the deceased are entitled for a monthly pension.

It was also mentioned that 90 persons were found to have been working in Uma Minerals, Gayatri Minerals, Jyoti Minerals and Akil Metal Industries in Godhra and the workers employed there were covered under the Workmen's Compensation Act.

The Chief Secretary of Gujarat assured that the State Government was ready

to provide free legal aid and necessary support to the victims of silicosis for filing petition for compensation before competent authorities.

On the basis of the above, the Commission observed it was established that the tribals residing in Madhya Pradesh had gone to work in quartz / stone crushing factories situated in Godhra, Gujarat and after contracting the dreaded disease of silicosis they returned back to their native places and later died. It was also established that the State enforcement agencies of Gujarat had failed to adopt appropriate preventive measures, which could have saved the lives of the poor labourers. Thus, the Government of Gujarat had failed to protect the lives of workers who died of silicosis while working in stone crushing units in Gujarat and also the next of kins of the 238 persons. They were all entitled for compensation from the State Government of Gujarat.

The Commission recommended that a sum of Rs. 3,00,000/- (Rupees Three Lakhs only) each be given to the next of the kins of the 238 deceased (mentioned in the list submitted by District Collectors, Jhabua and Alirajpur) by the State Government of Gujarat.

Out of the above mentioned amount, it was also recommended that a sum of Rs. 1,00,000/- (Rupees One Lakh only) be given to the next of kins of the deceased in cash and rest of the amount of Rs. 2,00,000/- (Rupees Two Lakhs only) be kept in fixed deposit, which will be available to the next of kins of the deceased in the shape of monthly interest.

The Chief Secretary of Gujarat was asked to submit a compliance report along with the proof of payment within eight weeks. The Commission also recommended that 304 persons who were suffering from silicosis and were staying

in Madhya Pradesh be given a rehabilitation package by the State Government of Madhya Pradesh. Further, the details of package awarded to each of the victims of silicosis be communicated to the Commission within eight weeks.

Pursuant to the directions of the Commission, the Government of Madhya Pradesh has submitted an Action Taken Report in respect of the rehabilitation package granted to 304 persons who were suffering from silicosis. The Government of Gujarat has also submitted a report in which they have raised certain points and have expressed their inability to comply with the recommendations of the Commission.

In a review meeting held on 10 June 2011, the Commission again sternly conveyed to the officials of Government of Gujarat the need for implementing its directions. So far, action on the part of Government of Gujarat was pending till writing of this report.

2.3.3 A study was carried out among quartz crushing workers of Godhara, Gujrat since most of stone crushing industries are located in Gujrat. The study was carried out in two phase, including both ex-worker with mean duration of exposure of 3.18 ± 2.64 yr's as well as workers working at the time of study with mean duration of 1.36 ± 2.68 yrs. While the study of ex-workers revealed 17.9% having silicosis, 23.9% having silico-tuberculosis and 5.5% having tuberculosis while 46% were free from any respiratory ailment. On the other hand , the survey of working population with less yr of exposure revealed 94% free of any respiratory disease while 5.5% having tuberculosis and only 0.1% having silicosis. This may be due to the fact that silicosis requires longer duration of exposure to set in or may be due to healthy working condition.

2.3.4. A study conducted among slate pencil cutter of Multanpur, Madhya Pradesh including varied group of 194 slate pencil workers as occupationally exposed group, 159 subjects from community living in the vicinity of these slate pencil units but not employed in these unit and 161 subjects from village Guradia which is 5Km away from Multanpura as non-occupational group. The mean duration of exposure for the pencil cutter was taken as 17.7+/- 9.7 yrs for male and 19.5+/-8.8 yrs for female. The various clinical examinations reveals that among occupationally exposed group, 21.2% subjects had silicosis, 25.8% had silica-tuberculosis and 10.8 had tuberculosis while 42.8% were normal. Among those residing in the vicinity of these units, 12.6% had silicosis, 6.3% had silico-tuberculosis, 8.2% had features of tuberculosis while 72.9% were normal. While among the non-occupational group at village Guradia, 2.5 % showed nodular opacities at chest X-ray, 1.9 % showed features of nodular opacities with tuberculosis while 11.8% showed feature of tuberculosis, rest were normal.