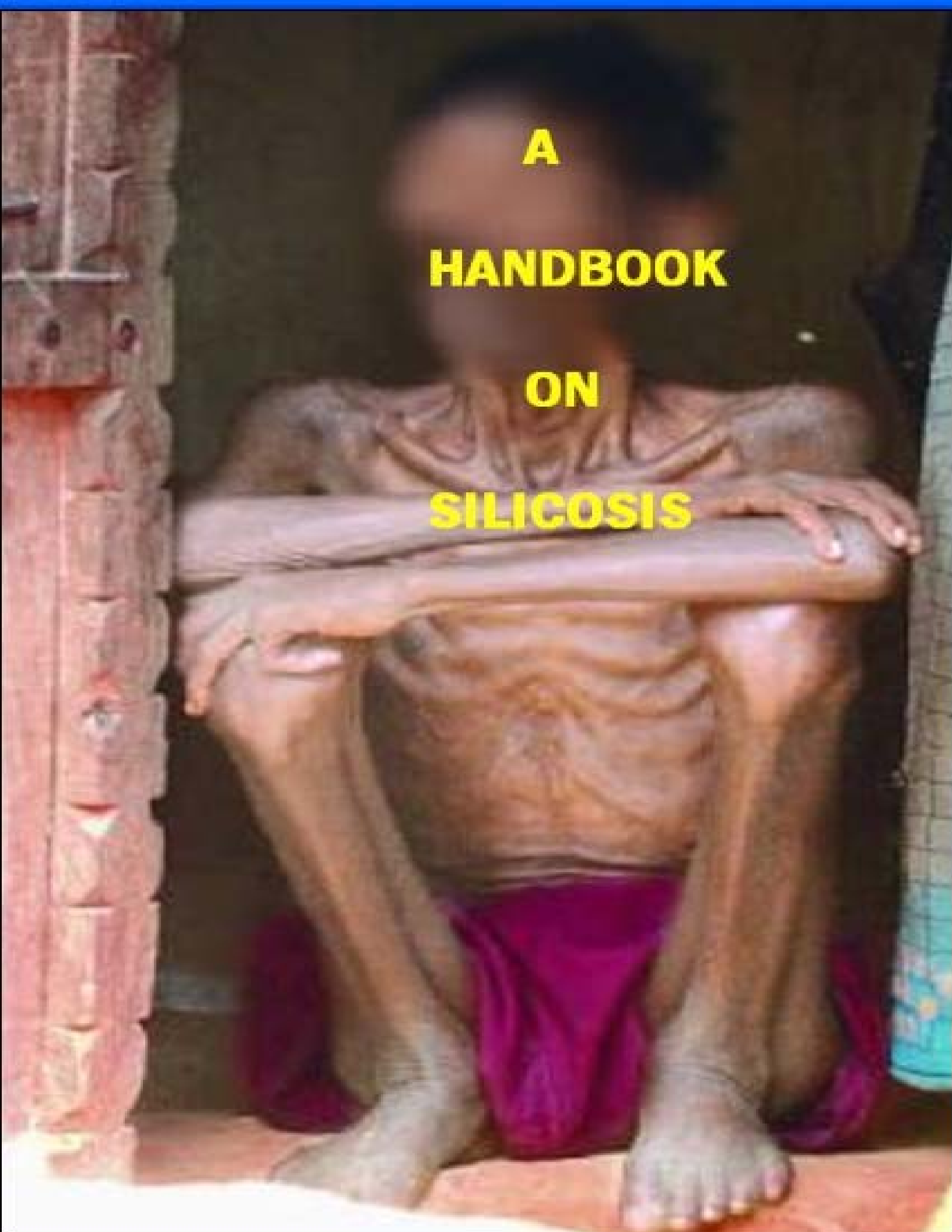


**A  
HANDBOOK  
ON  
SILICOSIS**





**Silica dust can scar your lungs making it impossible to breathe easily.**

One of the oldest known occupational diseases, silicosis is caused by the inhalation of silica dust. The full name of the illness is 45 letters long (the longest word in the English language) –pneumonoultramicroscopicsilicovolcanokoniosis. Since silica is abundant in the earth's crust, many occupations pose the threat of silica dust inhalation. Although silicosis is fatal and has no cure, it can be prevented if the inhalation of silica dust is minimized. Silica dust of two to five micron size, when inhaled, travels up to the alveoli of the lungs. Sizes larger than this are filtered through the nose or thrown out by cilia in the windpipe. Though highly toxic, silica dust has no smell and offers no warning to the worker. Following are the stages if the silica based on the years of exposure:

**Chronic**: after >10 years of exposure

**Accelerated**: 5-10 years from 1st exposure; rapid progression; may not be on chest radiograph

**Acute**: symptoms within weeks to 5 yrs.; high concentrations; fibrosis may not be present

**Symptoms of Silicosis:**

- Shortness of breath; possible fever.
- Fatigue; loss of appetite.
- Chest pain; dry, nonproductive cough.
- Respiratory failure, which may eventually lead to death.

## **SOURCES OF EXPOSURE:**

Though some operations have been recognized as dangerous operations and special measures have been laid down for them, there is need to review all the industrial activities and make a comprehensive list of operations.

### **Occupations with Potential Exposure to crystalline silica**

Abrasive blasters	Diatomaceous earth	Oil purifiers
Abrasive makers	calciners	Oilstone workers
Agriculture	Electronic equipment	Optical equipment
Auto garage workers	makers	makers
Brick layers	Enamellers	Paint mixers
Brick makers	Farming	Polishing soap makers
Buffers	Quartz workers	Porcelain workers
Burhstone workers	Refractory makers	Pottery workers
Carborundum makers	Road constructors	Pouncers-felt that
Casting cleaners,	Rock crushers	Pulp stone workers
foundry	Rock cutlers	Quarry workers
Cement makers Fettleers	Rock drillers	Sourcing soap workers
Flint workers	Rock grinders	Silica brick workers
Foundry workers	Rock screeners	Silicon alloy makers
Furnace liners	Rubber compound	Silver polishers
Fused quartz workers	mixers	Slate workers
Glass makers	Sand cutters	Smelters
Glaze mixers, pottery	Sand pulverisers	Sodium silicate makers
Granite workers	Sand blasters	Spacecraft workers
Grinding wheel makers	Sand paper makers	Stone bed rubbers
Grindstone workers	Sandstone grinders	Stone cutters
Hard rock miners	Sawyers	Stone planers
Insecticide makers	Jewelers	Street sweepers
Insulators	Jte workers	Subway construction
Cement mixers	Kiln liners	workers
Ceramic makers	Lithographers	Tile makers
Chemical glass	Masons	Tooth paste makers
makerschippers	Metal buffers	Tube mill liners
Coal miners	Metal burnishers	Tumbling barrel workers
Construction workers	Metal polishers	Tunnel construction
Cosmetic makers	Miners	workers
Cutlery makers	Mortar makers	Whetstone workers
	Motormen	Wood filler workers

### **Activities that could put workers at risk (Category wise):**

#### **Manufacturing**

Metal casting  
Glass products  
Ceramics, clay, and pottery  
Asphalt paving material  
Cut stone and stone products  
Abrasives  
Paint and rubber products  
Filtered foods and beverages

#### **Construction**

Chipping, hammering, and drilling rock  
Crushing, loading, hauling, and dumping rock  
Abrasive blasting  
Sawing, hammering, drilling, grinding, and chipping masonry or concrete  
Demolition of concrete or masonry structures  
Dry sweeping or using pressurized air to blow concrete, rock, or sand dust

#### **Agriculture**

Onion harvesting, topping, sorting, grading, and bagging  
Potato harvesting, sorting, grading, washing and bagging  
Sand used in agriculture chemicals

**These occupations largely affecting the workers as well as their surroundings like the family near to it, environment, women and children.**

### **INDICATIONS OF THE MAGNITUDE OF THE PROBLEM IN INDIA:**

- In India, a prevalence of 55% was found in one group of workers, many of them very young, engaged in the quarrying of shale sedimentary rock and subsequent work in small, poorly ventilated sheds. Studies on silicotic pencil workers in Central India demonstrated high mortality rates; the mean age at death was 35 years and the mean duration of the exposure was 12 years.  
(Sources: WHO 2000 Fact Sheet;  
<http://www.who.int/mediacentre/factsheets/fs238/en/index.html>)
- Nearly 50% of the workers who made silica powder from quartz stone had radiographic signs of silicosis or tuberculosis in a study of ex-silica mill workers, 90% of these workers had worked less than five years.
- 68% of former stone crusher mill workers in Lal Kuan had silicosis, silico-tuberculosis or tuberculosis

- Road building has generated more than 12,000 stone crushing units employing 500,000 workers, and in many cases families.

## **National Institute of Occupational Health (NIOH)**

(Source: <http://www.icmr.nic.in/000004/achievements1.htm>)

Database says that: Radiological evidence of silicosis was observed in 54.6% slate pencil workers. About 50% of the workers suffering from silicosis were below 25 years of age and had worked for less than 7 years.

NIOH carried out detailed clinico-radiological survey of agate workers which showed that the problem of silicosis was most severe among the agate grinders. The prevalence of silicosis in male and female agate grinders was 39.8% and 34.2% respectively. About 19% of the male agate grinders and 22% of female agate grinders developed silicosis within five years. The overall prevalence of tuberculosis amongst male and female agate grinders was 37.4% and 40.3% respectively. The mean "total" and "respirable" dust concentrations during agate grinding were 25.4 (14.5 - 35.1) and 2.74 (1.73 - 4.04) mg/M<sup>3</sup> respectively, which are much higher than the prescribed limits. The free silica contents of the dust were 60%.

Quartz powder is widely used in the industry for making glass, ceramics and potteries, as chemical filters, fillers etc. In almost all the states of the country, thousands of workers are engaged in quartz grinding. Quartz grinding is one of the deadliest occupations causing exposure to almost 100% free silica leading to silicosis in a matter of few months. Studies in quartz crushing units revealed evidence of silicosis in 12% workers. More than 90% of these workers were exposed for less than 3 years. Some cases of silicosis were observed in workers exposed for less than 1 year.

**According to NIOH it is estimated that about 3 million people working in various types of mines, ceramics, potteries, foundries, metal grinding, stone crushing, agate grinding, slate pencil industry etc., are occupationally exposed to free silica dust and are at potential risk of developing silicosis**

### **PREVENTION:**

#### **Order of Control measures for silica dust:**

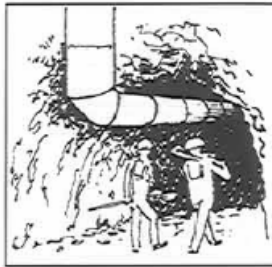
##### **1. Engineering Measures (Primary requirement):**

**Use safe machinery and tools (equipment fitted with water attachments to suppress dust or dust removal devices)**

- Fully enclose dusty processes
- **Use substitutes:** The best way to eliminate exposure is to use materials that don't contain crystalline silica. This is an "engineering" approach to hazard control.

With an engineering approach, you eliminate hazards by selecting tools and equipment and by designing work processes that are hazard free. Materials that don't expose workers to crystalline silica include the following: aluminum oxide, aluminum shot, ambient polycarbonate, apricot pits, corn cobs, cryogenic polycarbonate, emery, garnet, glass beads, melamine plastic, novaculite, and polycarbonate, silicon carbide, stainless cast shot, stainless cut wire, steel grit, steel shot, urea plastic, walnut shells, wheat grain, white aluminum oxide, zircon.

- **Use dust-containment systems.** Other ways to eliminate exposure include installing dust-collection systems on machines that generate dust or using enclosed cabinets with gloved armholes to do hazardous tasks.
- Use local exhaust ventilation or dust collection equipment to suck dust away from the operator
- Use tools fitted with extraction (vacuum) devices
- Use non-electrical tools fitted with a water attachment to suppress dust (such as on pneumatic power saws, jackpicks, jack hammers, scabbling picks, and so on)
- High pressure water jets are not efficient dust suppressors and should not be used for this purpose
- Fit water applicators onto the machinery rather than being hand held
- Wet down muck piles



Extraction ventilation.



Water coil attachment to suppress dust on jackpicks and scabbling picks, and watersprays fitted to rockbreakers.



Cabs fitted with air-filtration (not ordinary air-conditioners - they do not trap very fine dust).

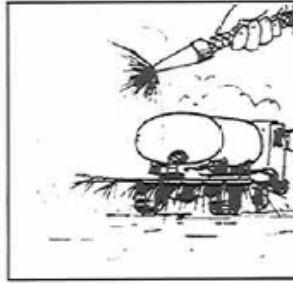
(Source: How to prevent silicosis,

[http://www.workcover.nsw.gov.au/Documents/Publications/AlertsGuidesHazards/ConstructionElectricalPlumbing/dust\\_in\\_the\\_workplace\\_how\\_to\\_prevent\\_silicosis\\_0351.pdf](http://www.workcover.nsw.gov.au/Documents/Publications/AlertsGuidesHazards/ConstructionElectricalPlumbing/dust_in_the_workplace_how_to_prevent_silicosis_0351.pdf))

## 2. **Administrative Measures (Primary requirement):**

### **Follow safe procedures**

- Do not dry sweep areas, use wet suction sweepers
- Wet down dusty work areas and processes
- Standardize work where necessary
- Limit overall exposure to dust
- Regular check up of the proper functioning of the equipments
- Immediate repairing of the equipments



Wetting down work areas so dust doesn't become airborne (a fine spray is best).



Warning signs.



Dust level testing and monitoring.

(Source: How to prevent Silicosis, [http://www.workcover.nsw.gov.au/Documents/Publications/AlertsGuidesHazards/ConstructionElectricalPlumbing/dust\\_in\\_the\\_workplace\\_how\\_to\\_prevent\\_silicosis\\_0351.pdf](http://www.workcover.nsw.gov.au/Documents/Publications/AlertsGuidesHazards/ConstructionElectricalPlumbing/dust_in_the_workplace_how_to_prevent_silicosis_0351.pdf))

### 3. Personal Protective equipment (Secondary requirement):

#### Use respiratory (breathing) protection

Use:

- An airline hood respirator (it is good for very high dust levels)



Disposable dust mask (for low to medium dust levels).



Cartridge respirator (for low to medium dust levels).



THIS TYPE FILTERS THE AIR. Battery powered respirator (for medium dust levels)



THIS TYPE SUPPLIES CLEAN AIR. Airline hood respirator (for very high dust levels).

(Source: How to prevent silicosis, [http://www.workcover.nsw.gov.au/Documents/Publications/AlertsGuidesHazards/ConstructionElectricalPlumbing/dust\\_in\\_the\\_workplace\\_how\\_to\\_prevent\\_silicosis\\_0351.pdf](http://www.workcover.nsw.gov.au/Documents/Publications/AlertsGuidesHazards/ConstructionElectricalPlumbing/dust_in_the_workplace_how_to_prevent_silicosis_0351.pdf))

Regular checks must be done to see if the equipment needs repairs or replacement. And it must be cleaned regularly.

## Consultation and training

Consultation and training allows employees and their representatives to contribute towards the resolution of health and safety problems at work. Induction and training must be provided to all employees and their supervisors who may be exposed to crystalline silica during their work. Make sure workers know about silicosis, silica-dust hazards, and how to control their exposure. Their training should cover the following:

- ✓ The health effects of exposure to crystalline silica.
- ✓ The importance of effective controls, safe work practices, and personal hygiene.
- ✓ How to use material safety data sheets (MSDSs) for silica, masonry products, and abrasives. (See the Hazard Communication Standard for more information on material safety data sheets.)
- ✓ The purpose of boundaries or signs that identify work areas containing crystalline silica dust.
- ✓ How to safely handle, label, and store hazardous materials
- ✓ How to use and care for personal protective equipment

## **LEGAL PROVISIONS:**

### **Regulatory Authorities for Occupational Disease: Silicosis**

To ensure that in industries and factories, etc. steps are taken to prevent exposure to dust (and other hazards) and for worker-protection, most countries have incorporated such requirements into legislations, mandating supervised control of working environment.

**SILICOSIS** was made Notifiable under the Factories Act, and since 1959 made compensable under the Workmen's Compensation Act and also under the Employees' State Insurance (ESI) Act.

**A Notifiable Disease means:** If a worker in a factory, etc., contracts any of the Notifiable diseases (mentioned in The Factories Act 1948, Schedule 3, see section 89 and 90) then the concerned manager shall send a notice to the Chief Inspectorate of Factories. Similarly: if a doctor attached to an industrial establishment/factory or otherwise attending to a worker suspect's him/her to be suffering from some Notifiable Disease, then he/she should immediately notify the Chief Inspectorate. It is expected that such notifications will draw the attention of the management and the government to the incidence of work-related problems they will then take adequate steps to eliminate them.

Section 10 of the Act lays down that a State Government may appoint qualified medical practitioners as 'certifying surgeons' to discharge the following duties:

- a) Examination and certification of young persons and examination of persons engaged in 'hazardous occupation'.
- b) Exercising medical supervision where the substances used or new manufacturing processes adopted may result in a likelihood of injury to the workers.

c) Exercising medical supervision in case of young persons to be employed in work likely to cause injury etc.

Chapter IX, Section 89 (2) reads as follows:

(2) If any medical practitioner attends on a person who is or has been employed in a factory and who is or is believed by the medical practitioner to be, suffering from any disease specified in the third schedule, the medical practitioner shall without delay send a report in writing to the office of the Chief Inspector stating:

- I. The name and full postal address of the patient
- II. The disease which he believes the patient to be suffering from and
- III. The name and address of the factory in which the patient is or was last employed.

(3) Where the report under section (2) is confirmed to the satisfaction of the chief Inspector, by the certificates of a certifying surgeon or otherwise, that the person is suffering from a disease specified in the schedule, he shall pay to the medical practitioner such as an arrear at Land Revenue from occupier of the factory in which the person contracted the disease.

(4) If any medical practitioner fails to comply with the provisions of sub-section (2) he shall be punishable with fine which may extend to one thousand rupees.

Section 41C: This section of The Factories Act, 1948, specifies responsibility of the occupier in relation to hazardous processes:

- To maintain accurate and up to date medical record of the workers;
- To appoint qualified, experienced and competent supervisors to supervise handling of hazardous substances;
- Pre-employment and post-employment medical examination of workers, at regular intervals.

Section 41F: Permissible limits of exposure of chemical and toxic substances have been prescribed under the Second Schedule. These limits are applicable, whether the industry is hazardous or not.

Under the Workmen's Compensation Act and ESI Act, workers are entitled to compensation from their employers for occupational injuries and diseases (in under section 3, schedule 3).

**Inspectorate**: Each state has an Inspectorate under the chief Inspectorate of Factories, to see that labor laws are being observed. It has inspectors with medical and engineering qualifications. Their duty is to inspect the factories in their area of jurisdiction periodically and keep records of the working conditions, factory-hygiene, occupational injuries and diseases. They can also powers to prosecute offending employers. In absence of such inspectors, the District Magistrate is empowered to take similar action.

**Directorate-General of mines safety (DGMS):** Similarly, there exists the Directorate-General of Mines safety-DGMS- whose function is to ensure implementation of the relevant welfare and safety laws, such as Mines Act, in mines and quarries.

**Workmen's Compensation Commissioner:** For purposes of compensation, the affected worker should file a claim the Workmen's Compensation Commissioner, who after suitable enquiry decides the case.

**Apart from such legal measures, the government has set up institutions like:**

1. National Institute of Occupational Health (NIOH), Ahmedabad, and its regional centers at Kolkata and Bangalore.
2. Industrial Toxicology Research Centre, Lucknow, and its Occupational Health Centre at Kanpur.
3. Central Labor Institute, Bombay and its regional centers at Kanpur, Kolkata and Madras.
4. The Labor Department, Ministry of Labor is also the main regulatory body.
5. Central Pollution Control Board is also the concerned authority to check this issue on silica dust.
6. Employees' State Insurance (ESI) Court, for compensation benefit.

#### **NEW DEVELOPMENTS:**

1. The notice has been issued under Section 85 of the Factories Act 1948 by the States, directed by National Human Rights Commission (NHRC) that less than 10 labourers are also come under the purview of the Act .
2. National Human Rights Commission has become the co-petitioner in the PIL of People's Rights and Social Research Centre (PRASAR) and Others vs. Union of India and others to Supreme Court and taking all required action under their objectives. Like National Human Rights Commission (NHRC) has recommended providing immediate medical relief to silicosis victims through the concerned authorities and in case of those persons, who died because of silicosis, may provide for compensation through the concerned authorities.
3. Supreme Court order: In the PIL of People's Rights and Social Research Centre (PRASAR) and Others vs. Union of India and others, Supreme Court has mentioned in his first order that Central pollution control board, will give full support to co- petitioner National human rights commission in the silicosis survey regarding silicosis. Ministry of Health and Ministry of labor has also considered extending their support and providing the confirmed name for compensation.
4. The Chief Minister of Delhi, Ms. Sheila Dixit convened a meeting in Delhi Secretariat on October 24, 2005 to discuss the prevalence of silicosis in the Lal Kuan area. After talking to all the concerned persons and the victims, the Chief Minister has agreed to the following long-term demands of the people of the area:
  - a) A multi purpose community centre for the treatment of occupational diseases to be set up at Tejpur near Lal Kuan and a mobile medical van

with one doctor, one attendant and one nurse will visit the area four days a week for the treatment of silicosis and other occupational diseases and will distribute free medicines.

- b) The Social Welfare Department and Divisional Commissioner's office have been asked to coordinate a joint intervention for physical survey of the affected people and bring them into Antyodaya scheme which will include granting of pensions for the silicosis victims.
- c) The Social Welfare Department and the Health Department will also assist the affected people to improve their skills for alternative livelihood opportunities for the people of Lal Kuan.
- d) The Delhi Government has announced a rehabilitation package for silicosis patients of Lal Kuan, New Delhi. A health survey has also been conducted in Lal Kuan by a team constituted by the Government through the Centre for Occupational and Environmental Health, Maulana Azad Medical College, Delhi.
- e) The Government has also agreed to explore the feasibility of compensation to Silicosis victims under the Workmen's Compensation Act or other Act/Rules and has directed individual workers suffering from Silicosis to file claims for compensation before the Labour Commissioner.

### **RECOMMENDATIONS:**

1. Implementation of engineering controls and containment methods such as blast-cleaning machines and cabinets, wet drilling, or wet sawing of silica-containing materials to control the hazard and protect adjacent workers from exposure.
2. Development of simple guidance for employers to put controls in place to reduce silica exposures.
3. Administrative measures ensured regularly for safe functioning specially by the industries or occupier.
4. Silicosis Surveillance Systems.
5. Legal provisions must be functional at every stage for easy access.
6. Training and awareness of stakeholders on silicosis.
7. Recognize when silica dust may be generated and plan ahead to eliminate or control the dust at the source. Awareness and planning are keys to prevention of silicosis.
8. Do not use silica sand or other substances containing more than 1% crystalline silica as abrasive blasting materials. Substitute less hazardous materials.
9. Routinely maintain dust control systems to keep them in good working order.
10. Practice good personal hygiene to avoid unnecessary exposure to other worksite contaminants such as lead.
11. Wear disposable or washable protective clothes at the worksite.

12. Shower (if possible) and change into clean clothes before leaving the worksite to prevent contamination of cars, homes, and other work areas.
13. Conduct air monitoring to measure worker exposures and ensure that controls are providing adequate protection for workers.
14. Use adequate respiratory protection when source controls cannot keep silica exposures below the minimum amount permissible according to the Act.
15. Provide periodic medical examinations for all workers who may be exposed to respirable crystalline silica.
16. Post warning signs to mark the boundaries of work areas contaminated with respirable crystalline silica.
17. Provide workers with training that includes information about health effects, work practices, and protective equipment for respirable crystalline silica.
18. Report all cases of silicosis to State health departments.

### KEY TERMS

**Accelerated silicosis-**

A form of silicosis that shows symptoms within five to 10 years.

**Acute silicosis-**

A form of silicosis that develops in workers exposed to very high levels of crystalline silica. Symptoms may appear within a few weeks of an initial exposure.

**Chronic silicosis -**

The most common form of silicosis. Workers usually don't show symptoms for 10 years or more after an initial exposure.

**Crystalline-**

Having a very structured molecular arrangement.

**Exposure control -**

A means of eliminating or reducing workplace hazards. Examples include engineering, work-practice, and administrative controls.

**Free crystalline silica -**

Pure crystalline silica that is chemically uncombined.

**Material safety data sheet (MSDS) -** Printed material that describes a hazardous chemical in accordance with the Hazard Communication Standard.

**Mineral -**

Naturally occurring crystalline solids, usually made from oxygen, silicon, sulfur, and any of six common metals or metal compounds.

**Permissible exposure limit (PEL) -** The maximum amount of airborne crystalline silica dust that one can be exposed to during a full work shift.

**Quartz -**

The most common type of crystalline silica.

**Respirable dust -**

Dust that contains particles small enough (about 3.5 microns) to enter the gas-exchange region of the human lung.

**Silicosis -**

A disease that results from exposure to high levels of respirable silica dust and characterized by scarred lung tissue.

**Tridymite-**

A form of crystalline silica found in volcanic rocks and in fired silica bricks.

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**CAMPAIGN FOR PREVENTION OF SILICOSIS**

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