A Risk Assessment Study on Occupational Hazards in Cement Industry

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Abstract *- Cement industry plays a vital role in infrastructure development in India. It is also associated with few environmental impacts which may lead to health hazards when unnoticed. This study aims at identifying the major hazards in cement industry and provide guidelines for management to reduce the risk associated and to maintain the health of the employees. In order to study the health issues I considered Chettinad Cement Corporation Ltd, Puliyur, Karur, Tamilnadu. The required data are collected through direct investigation and interaction with workers. Not only the physical health issues but also the noise exposure levels and ergonomics of workers are studied. Finally guidelines and suggestions on how to control health problems and make a better workplace to the employees are given to the management.*

Key Words: Occupational health, Risk assessment, Major hazards, Safety measures, Ergonomics, etc.

1. INTRODUCTION

Chettinad cement factory is one of the leading cement manufacturers in South India. They provide accurate blends of quality materials including Portland cement and blended cement etc., The Puliyur branch consist of more than 100 employees and around 42 employee works per shift with a total of 3 shifts per day. I have studied the incident reports of past few years and also the process involved in the manufacturing of cement. Thus from the collected data the following analysis and inferences were made which would help to mitigate occurrence of accidents or health issues to the employees. The risk assessment study involves identification of hazards, their effects, exposure limits of workers to chemicals/hazards, surveillance of worker's occupational health and safety etc.

2. OBJECTIVE OF THE STUDY

The main objectives of the Risk Assessment Studies are as given below:

- To define and assess emergencies, including risk impact assessment.
- To control and contain incidents.
- To safeguard employees and people in vicinity.
- To minimize damage to property and environment.
- To inform the employees, the general public and the authority about the hazards / risk assessed, safeguards provided, residual risk if any and the role to be played in them in the event of emergency.
- To be ready for mutual aid if need is arise to help neighbouring unit. Normal jurisdiction of an OEP in the own premises only, but looking to the time factor in arriving the external help or off - site emergency plan agency, the jurisdiction must be extended outside the extent possible in case of emergency occurring outside.
- To inform authorities and mutual aid centres to come for help.
- To affect rescue and treatment of casualties. To count injured.
- To identify and list any death.
- To inform and help relatives.
- To secure the safe rehabilitation of affected areas and to restore normalcy.
- To provide authoritative information to the media.
- To preserve records, equipment, etc., and to organize investigation into the cause of emergency and preventive measures to stop its recurrences.
- To ensure safety of the workers before personnel re - enter and resume work.
- To work out a plan with all provisions to handle emergencies and to provide for emergency preparedness and the periodical rehearsal of the plan.

3. METHODOLOGY

The philosophy and methodology of study is as follows:

- Provide the information required to identify major hazard installations;
- Carry out hazard assessment;
- Report to the authorities on the results of the hazard assessment;
- Set up an emergency plan;
- Take measures to improve plant safety.

In order to fulfill the above responsibility, the Management must be aware of the nature of the hazard, of the events that cause accidents and of the potential consequences of such accidents. This means that in order to control a major hazard successfully, the Management must have answers to the following questions:

1. Do toxic, explosive or flammable substances in our facility constitute a major hazard?
2. Which failures or errors can cause abnormal conditions leading to a major accident?
3. If a major accident occurs, what are the consequences of a fire, an explosion or a toxic release for the employees, people living outside the factory, the plant or the Environment?
4. What can Management do to prevent these accidents from happening?
5. What can be done to mitigate the consequences of an accident?

4. HAZARD IDENTIFICATION

4.1 Major Hazards

Hazard is the associated term with material, which is a measure or the likely hood of the human working with ,or studying the material in question. All the probable potential hazard is classified under different heads.

1. Fire hazards
2. Toxic gas release hazards
3. Explosion hazards
4. Corrosion hazards

4.1.1 Fire Hazards

Since the Stone Age term „fire" is associated with fear. It is very dangerous if occurs in uncontrolled manner. It should be clearly understood that when a liquid is used having flash point below the normal ambient temperature, it could, in suitable circumstances, liberate a sufficient quantity of vapour to give rise to flammable mixtures with air.

4.1.2 Toxic Hazards

Toxic substances affect in three ways by ingestion, adsorption & inhalation which are describe below.

4.1.3 Corrosion Hazards

Corrosion is a chemical reaction-taking place at the surface of metal.

Eye Contact:

Air born dust may cause immediate or delayed irritation or inflammation

Inhalation (chronic):

Some studies show that exposure to respirable crystalline silica (without silicosis) or that the disease silicosis may be associated with the increased incidence of several autoimmune disorders such as scleroderma (thickening of the skin), systemic lupus erythematosus, rheumatoid arthritis and diseases affecting the kidneys. Silicosis increases the risk of tuberculosis.

Ingestion:

Internal discomfort or ill effects are possible if large quantities are swallowed.

4.1.4 Explosion Hazards

Release of energy in rapid and uncontrolled manner gives rise to explosion.

Table -1: Exposure limits

S.No	CHEMICALS	ACGIH TLV-TWA (MG/M3)
1	Portland Cement	10 mg total dust/m^3
2	Calcium Sulfate dehydrate (gypsum)	10 mg total dust/m^3
3	Crystalline Silica	0.05 mg respirable quartz/m^3
4	Calcium carbonate	10 mg total dust/m^3

Inhalation:

Move person to fresh air. Seek medical attention for discomfort or if coughing or other symptoms.

Ingestion:

Do not induce vomiting. If conscious, have person drink plenty of water. Seek medical attention.

Exposure Controls and Personal Protection

Exposure Controls:

- Control of dust through implementation of good housekeeping and maintenance.
- The bag filters will be installed to control dust emission.
- Use of PPE, as appropriate (e.g. masks and respirators)

5. OTHER SAFETY MEASURES

Work place environment monitoring will be carried out regularly and records will be maintained. The monitoring of cement dust and silica in the work place will be carried out.

- Good house keeping will be implemented in the plant.
- First aid box will be provided.
- The industry will provide adequate lighting facility inside the plant premises.
- General dilution ventilation will be provided to control dust levels below applicable exposure limits.
- Fire extinguishers will be provided to withstand the fire or explosion condition.

- Pre-employment and periodical medical examination of workers will be done by government approved medical practitioners and the details will be recorded as per the Regulations.
- The industry will prepare on-site emergency plan.
- In case any emergency, arrangement of ambulance van will be done from Guwahati.
- Two main gates will be provided for entry and exit of the workers.
- Work place environment monitoring for cement dust and silica will be carried out.

6. OCCUPATIONAL HEALTH OF THE WORKERS

Health hazards associated with the occupation are called occupational hazards. In Cement industry the major sources of emission are:

1. Raw material handling: Total Dust or Suspended Particulate Matter.
2. Raw Mill Section: Total Dust or Suspended Particulate Matter.
3. Cement Grinding Unit: Total Dust or Suspended Particulate Matter.

All precautions would be taken to avoid foreseeable accident like spillage, fire and explosion hazards and to minimize the effect of any such accident and to combat the emergency at site level in case of emergency. Some of the preventive safety measures to minimize the risk of accident with respect to Technical Safety, Organizational Safety and Personal Safety are listed below:

- The factory will take all reasonably practicable measures to minimize the risk of such accident in compliance with the legal obligation under the relevant safety.
- All building plans and installations are as per relevant acts and duly approved by competent government authorities.
- Process and Equipment will be designed by qualified and experienced professionals and fabricated to applicable national / international codes with stage wise inspection.
- Safety features such as fire extinguisher and suitable Personal Protective Equipment (PPE) shall be provided. Regular operations and testing of fire extinguishers shall be carried out.
- Periodic inspection and testing of pressure vessels, equipment, machineries and equipment handling substances.
- Training of workers and Staff for fire fighting, work permit system, first aid, safe handling of materials and integrating safety, in all activities.
- Accident / Incident reporting system and information of employees about the same for better awareness.
- Suitable notices / boards displayed at several locations indicating appropriate hazards warning as well as DOs and DON"T for ensuring operational and personal Safety for information of workers / staff and visitors.

For the safety of the workers, personal protective equipment like hand gloves, helmets, safety shoes, goggles, aprons etc. & Ear protecting devices like earplugs/earmuffs will be provided. Nose mask will be provided at places, where there is possibility of dust generation.

7. NOISE EXPOSURE

7.1 Sources:

Grinding mills, Compressors, Fans, Blowers, Material handlers, Crushers and DG sets

7.2 Effects:

Hearing impairment, Hypertension, Ischemic heart disease, Annoyance, Sleep disturbance

7.3 Attenuation and Conservation:

Tools for assessing noise levels A successful noise control program that focuses on engineering control of noise requires the institution of a hearing conservation plan and the use of proper monitoring equipment, surveys, maps, and modeling.

A thorough hearing conservation plan should be established where noise exposure exceeds a 85-dBA time weighted average for eight hours. A good program consists of the following components:

- Noise measurement and analysis
- Engineering control of noise sources where feasible
- Administrative controls and personal protection where noise control is not feasible
- Audiometric testing
- Employee training and education
- Record keeping
- Evaluation

7.4 Control Measures:

- Introducing good acoustic design for the new production line
- Adopting proper scheduling of construction activities
- Scheduling noisy activities during the daytime periods
- Operating well-maintained mechanical equipment on-site
- Ensuring that equipment that may be intermittent in use should be shut down between work periods or should be throttled down to a minimum

- Installing rubber coating in dumpers and entry chutes
- Using personnel protection gear such as earplugs, muffs, etc.
- Developing a greenbelt around the quarry area
- Controlling air-flow generated noise by adopting adequate sizing of inlet/outlet ducts

7.5 Administrative or work practice controls to offset heat effects:

- Provide accurate verbal and written instructions, annual training programs, and other information about heat stress
- Acclimatize workers by exposing them to work in a hot environment for progressively longer periods.
- Replace fluids by providing cool water or any cool liquid (except alcoholic and caffeinated beverages) to workers and encourage them to drink small amounts frequently, e.g., one cup every 20 minutes. Ample supplies of liquids should be placed close to the work area.
- Personal monitoring can be done by checking the heart rate, recovery heart rate, and oral temperature.

8. ERGONOMICS

Ergonomics is the term applied to the field that studies and designs the human-machine interface to prevent illness and injury and to improve work performance. It attempts to ensure that jobs and work tasks are designed to be compatible with the capabilities of the workers.

8.1 Source:

Some physical agents play an important role in ergonomics such as Force, Acceleration and Thermal factors. Force is an "important causal agent in injuries from lifting. Other Important ergonomic considerations include work duration, repetition, contact stresses, postures, and psychosocial issues.

8.2 Work-Related Musculoskeletal Disorders:

Work-related musculoskeletal disorders (MSDs) are an important occupational health problem that can be managed using an ergonomics health and safety program. The term musculoskeletal disorders refers to chronic muscle, tendon, and nerve disorders caused by repetitive exertions, rapid motions, high forces, contact stresses, extreme postures, vibration, and/or low temperatures. Other commonly used terms for work-related musculoskeletal disorders include cumulative trauma disorders (CTDs), repetitive motion illnesses (RMIs), and repetitive strain injuries (RSIs). Some of these disorders fit established diagnostic criteria such as carpal tunnel syndrome or tendinitis. Other musculoskeletal disorders may be manifested by nonspecific pain. Some transient discomfort is normal consequence of work and is unavoidable, but discomfort that persists from day to day or interferes with activities of work or daily living should not be considered an acceptable outcome of work.

8.3 Control Strategies:

The incidence and severity of MSDs are best controlled by an integrated ergonomics program. Major program elements include:

- Recognition of the problem,
- Evaluation of suspected jobs for possible risk factors.
- Identification and evaluation of causative factors,
- Involvement of workers as fully informed active participants, and
- Appropriate health care for workers who have developed musculoskeletal disorders.

General programmatic controls should be implemented when risk of MSDs is recognized. These include:

- Education of workers, supervisors, engineers, and managers;
- Early reporting of symptoms by workers; and
- Ongoing surveillance and evaluation of injury, health and medical data, Job-specific controls are directed to individual jobs associated with MSDs. These include engineering controls and administrative controls. Personal protection may he appropriate under some limited circumstances.

8.4 Control Measures:

Among engineering controls to eliminate or reduce risk factors from the job, the following may be considered:

- Using work, methods engineering, e.g., time study, motion analysis, to eliminate unnecessary motions and exertions.
- Using mechanical assists to eliminate or reduce exertions required to hold tools and work objects.
- Selecting for designing tools that reduce force requirements, reduce holding time, and improve postures.
- Providing user-adjustable workstations that reduce reaching and improve postures.
- Implementing quality control and maintenance programs that reduce unnecessary forces and exertions, especially associated with non-value added work.

Administrative controls reduce risk through reduction of exposure time and sharing the exposure among a larger group of workers. Examples include:

- Implementing work standards that permit workers to pause or stretch as necessary but at least once per hour.
- Re-allocating work assignments (e.g., using worker rotation or work enlargement) so that a worker does not spend an entire work shift per forming high-demand tasks.

Due to the complex nature of musculoskeletal disorders, there is no "one size fits all" approach to reducing the incidence and severity of cases. The following principles apply to selecting actions:

- Appropriate engineering and administrative controls will vary from industry to industry and company to company.
- Informed professional judgment is required to select the appropriate control measures.

Work-related MSDs typically require periods of weeks to months for recovery. Control measures should be evaluated accordingly to determine their effectiveness.

9. OCCUPATIONAL HEALTH SURVEILLANCE OF THE WORKER

- Pre - employment medical check up at the time of employment.
- Periodical medical check up shall be done for all employees as:
  - <30 Once in five years
  - 31-40 Once in four years
  - 41-50 Once in two years
  - Above >50 years once every year
- First aid training shall be given to the employees.
- Monitoring of occupational hazards like noise, Heat, chemical (Raw materials & Product) exposure shall be carried out at frequent intervals, the records of which shall be documented.

10. CONCLUSIONS

From the above study it is found that total dust or suspended particulate matter form the main source of emission which may create severe health issues to the employees. To control the exposure level personal protective equipment like mask, respirators etc, must be provided to the employees. To control the noise exposure levels earplugs, muffs etc, can be provided to employees who are subjected to high sound level. Appropriate engineering and administrative control must be ensured to have improved ergonomics in the factory. Though the company have ISO 14001/2004 certifications in the above mentioned suggestions will help the management to mitigate serious occupational health hazards and also reduce the compensation for workers through occurrence of accidents or health hazards.

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