

Safety Management System for Cement Industry

M.Ravi¹, K.S.Shriraam², V.K.Senthilkumar³, V.Vasanthraj⁴

¹Assistant professor, Department of Mechatronics Engineering K. S. Rangasamy College of Technology, Tamilnadu, India.

^{2,3,4} PG Scholars, Industrial Safety Engineering, K. S. Rangasamy College of Technology, Tamilnadu, India.

Abstract: Due to rapid industrialization, industrial workers are exposed to several types of hazards and accidents, every year lakh of workers are injured due to mechanical, chemical, electrical and radiation hazards and it leads to partial or total disablement. So in recent years greater attention is given to health and safety to protect the workers from the hazards present in the industry. The purpose of this study is to evaluate the safety performance in cement industry. Cement workers are prone to the hazards and this has potential to cause injury or illness. Because the nature of work, the working condition, the environment in which the employee exposed are entirely different. Due to the heavy dust exposure the employees become victims of pulmonary disease. So the employee has to be safe guarded by providing welfare, safety, training and performance appraisal measure to improve their efficiency and productivity. This paper work intended to evaluate the safety performance of cement industries.

Keywords: safety audit, HIRA, Cement industries hazards, Safety culture, Accident reporting, at risk behavior.

I. Introduction

Cement Industry is one of the largest industries of the world and occupies predominant place as one of the basic industries for development and its employment generation capacity. India entered into the Cement Era in 1914, when the Indian Cement Company Ltd started manufacturing Cement in Porbandar in Gujarat. However, even before that a small cement factory was established in Madras in 1904 by a company named South India Industrial Ltd. Indian Cement Company Ltd produced only one type of cement which was designed by the British standard committee as "Artificial Portland Cement". Cement is used globally for construction, and its raw materials are lime, silica and alumina. Cement is a binding agent that gives hardness and binds different construction materials together and it is a major constituent of concrete. Cement is an essential component of infrastructure development and most important input of construction industry, particularly in the government's infrastructure and housing programs, which are necessary for the country's socioeconomic growth and development. It is also the second most consumed material on the planet. The Indian cement industry is the second largest producer of cement in the world.

II. Hazards of Cement Production

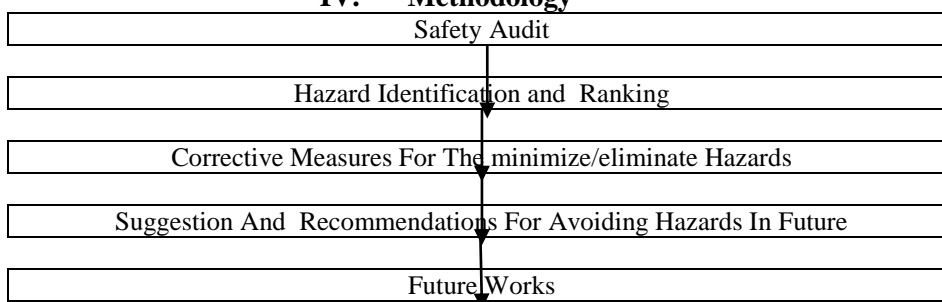
The manufacturing of cement is a long process and at every stage of its production, the environment is affected in one way or another. Carbon emissions, water pollution, and release of heavy metals in the air are common problems associated with manufacturing of cement. Fine cement dust is major pollutant and irritant that not only affects the health of people, but also harms plants. Chronic diseases and respiratory disorders are observed in people who work in a cement industry and are exposed to the cement constituent and cement dust. The setting of cement is a long term process and it is alkaline in nature, which may lead to lung and skin disorders because of the excessive heat normally released during setting and curing. Ensuring healthy and safe working conditions for employees and contractors is a fundamental key to corporate social responsibility, and one of the most important issues for the cement industry. Exposure to cement dust can irritate eyes, nose, throat and the upper respiratory systems. Skin contact may result in moderate irritation to thickening/ cracking of skin to severe skin damage from chemical burns. Silica exposure can lead to lung injuries including silicosis and lung cancer. Exposure to wet concrete can result with long sleeves and full length pants, waterproof boots and eye protection. Unguarded machinery used in the manufacturing process can lead to worker injuries. Workers may be hit by falling objects from conveyor belt systems, elevators or concrete block stacking equipment. Improper lifting, awkward postures and repetitive motions can lead to sprains, strains and other musculoskeletal disorders.

III. Litreature Review

Karl-Christian Nordby (2016) et al have examined the relationships and established conversion factors between total dust Respirable, thoracic and inhalable aerosol fractions measured by parallel personal sampling on workers from the production department of cement plants. The median ratio between the observed results of

the Respirable “total dust” and inhalable fractions relative to the thoracic aerosols fraction were 0.5, 2.4, and 5.9 respectively. Chaib Rachid (2015) et al has presented a case study about Safety and health at work in Algeria cement plant. Occupational safety and health has become public health priority in industrialized countries and a primary concern in the context of human resource management and in particular high risk industries. This work is an opportunity to initiate a goal approach to prevention in cement plant whose purpose is to improve working condition by technical, organizational, and human solution to improve the health and safety of employee while engaging in the process of continuous improvement. A.M.Tungu (2014) has assessed changes in respiratory health among cement workers and unexposed controls after 1 year in a factory implementing a health and safety campaign with the main aim to increase use of personal protective equipment. The prevalence of respiratory symptoms among cement workers was reduced after 1 year of follow-up following an intervention campaign to improve use of personal protective equipment. Meenesh Kummari Tomar (2014) has studied Health, Safety and Environment related problems in the cement industry. Data is being collected for different activities and processes of cement manufacturing. Questionnaires and checklists were being used for the study. Occupational, health and safety aspects were being monitored in the industry. Industry is well equipped with all the necessary PPE’s required by the workers. Syed Sana Mehraj (2013) et al has said cement industry production is being recognized to play a hazardous role in the imbalance of the environment and producing air pollutants in the form of various oxides particulate matter as well as heavy metals which pose a serious threat to living world including humans, plants, animals, live stock etc. The main route of entry of the cement dust particles in the body is the respiratory tract and gastrointestinal tract by inhalation or swallowing.

IV. Methodology



4.1 SAFETY AUDIT

Safety auditing is a core safety management activity, providing a means of identifying potential problems before they have an impact on safety. Periodically safety audit and inspection is conducted periodically on India cements for different sections namely

1. Lifting tools and tackles – once in a year
2. Pressure vessels – once in six months
(Specifically for pressure vessel they conduct ultrasonic test – once in Four years).
3. Belt convey – once in a year
4. Building stability – once in three year
5. Safety belt – once in six months
6. Passenger lifts – once in 6 months
7. Factory license & Fire license – once in a year
8. HSDS license – one time license.

4.2 Hazard Identification and Ranking

In cement industry various hazards were find out during auditing. Various hazards were sort out in various areas and required measure need to eliminate the hazards was recommended to the management.

4.3 Limestone Yard

Lime stone were stored in the yard which placed at left corner end of the cement industry. Huge lime stone were stored in the yard for the cement manufacturing process. Heavy trucks are running in the yard for loading and unloading the lime stone. Enormous amount of dust were present in the yard. During transportation lime stone from the yard to the crusher dust will be high. The dust in the yard cannot be controlled, instead of controlling the dust water can be sprayed in droplet form to avoid the spread if dust in the atmosphere. Yard storage area have uneven floor which cause the heavy truck to get upset while transportation. Necessary nose

mask and hard hat must be issued to the workers working in the lime stone yard. Trucks drivers must attend the training program and should know the operation of the vehicle.

4.4 Crusher Area

Crusher area present next to the lime stone yard. The lime stone were place in the crusher by the trucks, by lifting up the truck carrier. Vibration and noise was high in the crusher area which can't be avoided, instead of that required ear muff and hard hat should be provided to the workers. The barrier guard near the crusher is damaged and it is in dangerous condition, which needs to be replaced. The lime stone powder was spilled over the crusher area which will fly when heavy air passed it creates the dusty environment.

4.5 Conveyor Belt

The conveyor belt which used for transporting the cement from one to another place has spillage over the area near the silo. The spillage needs to be cleaned in short time period, over spillage of material will cause problem in maintenance time and it will cover the floor area which creates hazardous environment near the conveyor area. The conveyor areas before the silo has low lighting were the area is not clearly visible. Adequate lighting must be done in the area for the clear vision.

4.6 Silo

Enormous amount dust was present around the silo area which causes the dusty environment. The electrical line installed in the silo has damaged line which kept in opened condition. The joint made on the wire kept open which has not taped or insulated.

4.7 Kiln

Conveyor which installed in the kiln area has the damaged guarding which needs to be replaced. The joint made in the guard and the conveyor has loosed and it gets off from the conveyor.

4.8 Coal Mill

The hand rails in the coal mill are in damaged condition the steps of the hand rail have to be replaced with the new one. The damaged parts have placed over the walk path which needs to be removed immediately.

4.9 Cooler Area

The cooling area has many pipeline connection, many joints were made on the pipelines. The joint the cooling tower line has water leakage which flows over the pipeline.

4.10 Packaging House

In packaging house lighting has done poorly. Adequate lighting needs to be done. Vibration is high in the packing machine; dust will fly over the packing area. Required personal protective equipment must be issued to the workers and awareness about the hazards of dust must be thought to the workers.

4.11 Coal Yard

Coal yard has placed next to the packing area. The coal has been stored in the open area in fine powder form. The transportation of coal is done using heavy trucks. Dust is a major hazard placed on the coal yard.

V. Result and Discussion

5.1 Corrective Measures for the Minimize/Eliminate Hazards

The dust present in the lime stone and coal area are unavoidable, the workers are requested to wear the nose mask, goggles and hard hat while working. In packing area the floors mats are recommend to reduce the vibration produced by the machine, adequate lighting has recommended installing on the packing area. Nose mask and hand gloves are PPE suggested while working. The safety signs and warning signs are recommended to place on the railway track area and marking in the electrical line are needs to be done in the conveyor areas. The spillage in the conveyor belts are avoided by changing the angle of the conveyor belts. Housekeeping must be done weekly once in the conveyor areas to reduce the deposition of cement under the conveyor belt. The pipe fitting in the cooler area must be checked and during maintenance time necessary changes must be made on the cooler area. Damaged hand rails needs to be replaced with the new one. Damaged floorings also need to be reconstructed to avoid the human falls. Adequate lighting must be done on the required areas. Floor mats can be installed in the crusher areas to reduce the vibration effect produced by the crusher.

5.2 Suggestion And Recommendations For Avoiding Accidents In Future

Dust is one of the major hazards in the cement industry. To control the dust necessary steps had been taken. Dust monitoring system had been installed inside the company and the output screens have been placed on the entrance of the company. Based on the dust emission I had recommended the company to provide the nose mask and single strap dust mask for the employees working in the packing section, crushing area and dispatch area. Crushing and lime stone quarry area has a noise hazard. Safety helmet and nose mask had been issued by the management for workers safety. I recommended the management to provide the ear plug to the employee working in the crushing area and ear to the employee working in the quarry area. Conveyor belt areas have a raw materials spillage hazard. Monthly maintenance need to be done once in a month. Modification in the design of the conveyor belt had been recommended to avoid the spillage hazard.

VI. Conclusion

This paper has said about the safety management system in the cement industry. Recommendation had said for the hazards present in the cement industry and also to prevent the employees from the hazards present in the cement industry. Proper safety training for the usage of personal protective equipment had given to the employees for safeguarding themselves from the hazards present in the working environment.

VII. Future Work

Recommendations had given to avoid hazards in the cement industry and to protect the employees from the hazards. After the management conformation the changes need to be done to reduce or eliminate the hazards in the plant areas.

Reference

- [1] Akanksha Sharma et al “Oral Health Status of Cement Factory Workers, sirohi, Rajasthan, India” published by Journal of Health Research and Reviews – 2017.
- [2] Hilde P.Noto et al “Relationship Between Personal Measurements of Total Dust, Respirable, Thoracic, and Inhalable Aerosol Fractions in the Cement Production Industry” published by Oxford University - 2016.
- [3] Chaib Rachid et al “Preserving and Improving the Safety and Health at Work: Case of Hamma Bouziane Cement Plant (Algeria)” published by Elsevier - 2015.
- [4] A.M.Tungu et al “Reduction in Respiratory Symptoms among Cement Workers: A Follow-up Study” published by Oxford University - 2014.
- [5] Meenesh Kumari Tomar “Study of Occupational Health, Safety, and Environment Aspects in Major Cement Manufacturing Industry (Ultratech Cement Limited)” published by Journal of Environmental and Health Science - 2014.
- [6] Wei Chen et al “Pollutants Generated by Cement Production in China, their Impacts, and the Potential for Environmental Improvement” published by Elsevier - 2014.
- [7] Naema Elhosary et al “Evaluation of Oxidative Stress and DNA Damage in Cement and Tannery Workers in Egypt” published by Informa Healthcare Inhalation Toxicology pg no 289 – 298 2014.
- [8] Syed Sana Mehraj et al “Cement Factories and Human Health” published by IJCRR - 2013.
- [9] Dong-Hee Koh et al “Dust Exposure and the Risk of Cancer in Cement Industry Workers in Korea” published by American Journal of Industrial Medicine 56 (276 – 281) - 2013.
- [10] Sultan Ayoub Meo et al “Effect of Duration of Exposure to Cement Dust on Respiratory Function of Non-Smoking Cement Mill Workers” published by International Journal of Environmental Research and Public Health - 2013.
- [11] Quynh Anh Nguyen and Luc Hens “Environmental Performance of Cement Industry in Vietnam: the Influence of ISO 14001 Certification” published by Elsevier – 2013.
- [12] Mina Shirvani et al “Investigating Different Factors Influencing Job Satisfaction: a Case Study of Cement Industry” published by Growing Science Ltd – 2013.
- [13] Masoud Birjandi et al “The Relationship between the Quality of Work Life and Organizational Commitment of the Employees of Darab Cement Company: Case Study in Iran” published by International Journal of Economics, Business, and Finance Vol 1 no 7 (154 – 164) – 2013.
- [14] N.Hamidi et al “The Effect of Integrated Management System on safety and productivity Indices: Case Study; Iranian Cement Industries” published by Elsevier - 2012.
- [15] Hafiz Omer Ahmed and Abdelridha A.Abdullah “Dust Exposure and Respiratory Symptoms Among Cement Factory Workers in the United Arab Emirates” published by National Institute of Occupational safety and Health – 2012.

- [16] Zhang Canfeng et al “Comprehensive Control of Noise Occupational Hazard in Cement Plant” published by Elsevier – 2012.
- [17] Muhammad Aslam et al “Assessment of Radiological Hazards of Naturally Occurring Radioactive Materials in Cement Industry” published by Radiation Protection Dosimetry – 2012.
- [18] Shahnaz Tabatabaei et al “General Health, Stress Associated to the Work and Job Satisfaction of Hormozgan Cement Factory Employees in Iran” published by Elsevier – Social Behavioural Sciences (1897 – 1901) – 2011.
- [19] Joaquim Rovira et al “Monitoring Environmental Pollutants in the Vicinity of a Cement Plant: a Temporal Study” published by Arch Environ Contam Toxicol – 2011.
- [20] Opas Piansoongnern et al “Talent Management in Thai Cement Companies: A Study of Strategies and Factors Influencing Employee Engagement” published by African Journal of Business Management vol 5 (1578 – 1583) - 2011.