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Research

Occupational Health and Safety Evaluation of Brick Kiln and Construction Concrete Block (BK and CCB) Plant and Proposed Control Measures: A Case Study of BK and CCB Factory Pakistan

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ABSTRACT

Brick Kiln and Construction Concrete Block (BK and CCB) factories play a pivotal and dynamic role in infrastructure development in Pakistan. Currently, there are more than 1.3 million workers associated with BK and CCB. It is also linked with few occupational health and safety impacts which may lead to health hazards when ignored. Work in BK and CCB factories is associated with a high risk for musculoskeletal disorders and everlasting diseases as well. Within the study about symptomatic evaluation was conducted to decide the magnitude and sorts of serious injuries and distress among the BK and CCB factory workers and recognized the foremost problematical area related exercises and work variables that might have included the rate of these complaints. The study's goals were to pinpointing the key hazards in the BK and CCB factories and provide advice for management to reduce the risk associated and to maintain the health and safety of the employees. For analysis 300 workers from 22 Brick Kiln and 25 Concrete Block factories in District Karak and Bannu remote district of Khyber-Pakhtunkhwa were taken. In total 16 of the workers does not respond and 224 participant were found complaining of discomfort and in range of pain, they suffer due to several reasons. The highest level of pain found is eye swell due to BK and CCB dust which is 40.32 percent followed by throat irritation 20.16 percent. Similarly, 22.40 percent discomfort complain is recorded in a moderate level of foot finger followed by 20.16 percent in the lower back. And finally, the highest severe pain was recorded in eye swell which is 17.92 percent followed by a foot finger of 17.92 percent. In the last, an assessment report with control measures was handover to the management for improvement.

Keywords: Risk assessment; Major hazards; Occupational health; Ergonomics; Safety measures

INTRODUCTION

The ILO estimates that approximately 2.3 million females and males almost the world accede to work-related accidents or diseases every year; this resembles over 6000 demises every single day. Internationally, there are about 340 million occupational calamities and 160 million sufferers of work-related complaints yearly [1]. Work-related wellbeing and security have gotten to be an open wellbeing need in created nations and the most concern, especially in high-risk [2-4]. BK and CCB manufacturing is one of the foremost broadly utilized development materials on the soil. Since BK and CCB have been utilized commonly, its wellbeing impacts have ended up an imperative issue both for representatives and the environment [5]. In expansion to the different wellbeing dangers, BK and CCB specialists are particularly uncovered to dust which causes lung work disability, stomach, musculoskeletal clutters, etc. at different generation prepare such as manual taking care of, pulverizing, crude fabric crushing, mixing, oven burning in BK and CCB industry [6]. Subsequently, certifying solid and secure working conditions for workers and temporary workers may be a principal key to trade social commitment and is one of the most extremely vital things for the BK and CCB industry [7]. Due to the improvement and populace boom, the rate of BK and CCB

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houses and lofts is expanded coming about in more requests for building materials [8]. These building materials are made in scaled-down or mega BK and CCB businesses [9].

These production lines or plants or crushers fulfill the request of individuals and play a vital part within the improvement of the structure of this progressed and advanced world at one side but they contaminate the environment by discharging particulate matter of dust at another side. Air contamination may be a causative figure driving to malady and passing among the tenants of mechanical social orders as pressurized canned products are routinely breathed in [10]. Millions of people groups are locked in every day in such sorts of dusty plants and businesses and have to confront diverse sorts of wellbeing dangers like exhaust, gasses, and dust which are a chance figure in emerging word related illnesses [9]. The dust particles less than 2μ are caught within the lung and their settling may influence the physiology of lungs when it is uncovered to the dust for a drawn-out time [9]. The impact of dust on the body changes with nature and length of introduction as well as the age of the people [11]. Silica dust causes pneumoconiosis, and skin infections are strict of word related root. Particulate discuss contamination has been related with the frequency and seriousness of the respiratory clutter. Other than, with the expanding complexity of mechanical tissue and with the velocity that the methods created within the enormous industrial facilities, dangers evaluation gets to be a pivotal and vital reply to protect workers' wellbeing and security on the one hand and to keeping up a qualified labor on the other hand .

In Pakistan, health and safety issues are presently a colossal burden, both wellbeing and financial, on specialists, on companies and society in common. The circumstance is troubling; the slightest can be said is the circumstance is disturbing, indeed disastrous, given the state of disregard in which the government has cleared out the field of anticipation within the work environment. Each year, through our companies, thousands of individuals are casualties of mishaps or create genuine wellbeing issues within the working environment. More than 50,000 mischances a year were recorded coming about for the year 2013 social security mechanical security does not appear to be considered genuinely by the government. Subsequently advancing a culture of security has presently been built up as a basic of unwavering quality and maintainability of organizations. This security culture is spoken to by the set of hones created and executed by the most partners to oversee the dangers of their occupation. The point of this work has been to propose a health and safety and directly an important control measures and a methodological approach that would permit companies in specific the BK and CCB plant in address to embrace and succeed nearly certainly a energetic security culture advancement, adaptable and feasible.

OBJECTIVE OF THE STUDY

This research study aims to evaluate and specify the different hazards available in the Brick Kiln and Construction Concrete Block (BK and CCB) and to recommend scientific control measures. Furthermore to educate the representatives and the authority regarding the hazards and obligations of the occupational health and safety rules and regulations.

METHODOLOGY

As this study was investigation and questionnaire base so first of all information about the physical bio-data and work experience were collected given in Table 1. After that, a detailed discomfort survey was conducted. A questionnaire with a human body diagram was shared in the 300 workers, 32 workers do not respond and the remaining 44 responses were found incomplete and vague. Those workers were guided to tick body parts with severity level associated with their discomfort body region as given in table 2 and a detailed questionnaire with verbal translation. After completing the discomfort survey the deep visit was conducted to the whole plant. The work schedule and work activities were checked and analyzed with the Health and Safety Executive recommendations and Laws. After completing the study a risk assessment report was shared with the top management.

Physical bio-data of the workers

A simple questionnaire of four questions was distributed among the workers and was asked to write the age, height, weight, and work experience. Then the recorded DATA was arranged in different age groups, work experience, and height as shown in Table 1.

Age (years)	17-22	23-28	29-34	35-40	41-46	>46
	33	57	65	54	48	43
Height(cm)	<164	164-174	>174			
	84	118	98			
Work Experience	< 2 years	2-5 years	5-10 years	> 10 years		
	32	98	78	92		
Weight(kg)	<55	55-60	61-65	66-70	>70	
	35	45	116	69	35	

Table 1: Physical Bio-Data and work experience.

Result of health and safety conditions surveys

Detailed questions of the worker's knowledge and perception about factory health and safety culture were collected. A high percentage of workers have very poor knowledge and overall perceptions of health and safety. A detailed questionnaire consist of seventeen questions was shared with the workers with a translator to translate and make it simple and understandable for the workers were provided. These questions were about the overall perceptions and prevailing situation of the workplace

were asked. In total 224 participants responded were acceptable for analysis. The responses were collected in the form of agree, mostly agree, disagree, and mostly disagree. The overall responses and workplace condition is recorded in Table 2.

Questions asked from the participants	Numbers of participants Responded					
	Agree	Mostly agree	Mostly disagree	Disagree	%age of Mostly agree	%age of Mostly Disagree
Supervisors here are not involved in health & safety	70	77	45	32	34.375	20.089
I apprehend the health & safety risks linked with my work	76	65	51	32	29.017	22.767
I have had no training in the risks related to my work	76	62	54	32	27.678	24.107
Accidents are not always reported	85	73	43	23	32.589	19.196
I report safety issues but get no feedback	85	62	54	23	27.678	24.107
Accidents are investigated at this site	8	12	119	85	5.357	53.125
Appropriate PPE is always worn by people here	4	20	74	126	8.928	33.035
My supervisor/ manager does not talk to me about safety	73	65	52	34	29.017	23.214
Getting the job done is more important than safety at this site	84	73	45	22	32.589	20.089
The company takes health & safety seriously	32	35	84	73	15.625	37.5
Sometimes people do not wear their PPE	83	75	32	34	33.482	14.285
I am not sure of the correct safety procedures for my job	72	76	44	32	33.928	19.642
The site manager is slow to react to safety problems	47	70	59	48	31.257	26.339
No recognition is given to people who	58	44	76	46	19.642	33.928

work safely						
The hazard reporting system works well here	22	21	87	94	9.375	38.839
The owner provide necessary medical treatment	12	29	89	94	12.946	39.732

Table 2: Participants responses surveys.

Result of discomfort survey

The data shows the highest level of mild pain of eye swell which is 40.32 percent followed by mild foot finger pain 17.92 percent. Similarly, 22.4 percent discomfort complain is recorded in a moderate level foot finger followed by 20.16 percent in the lower back. And finally, the highest severe pain was recorded in the foot finger, or toes which are 17.92 percent followed by eye swell of 17.92 percent. As figure 2 Distribution of discomfort shows the highest region in mild pain is mild back and moderate pain is lower back and hand .similarly in the case of severs pain more discomfort complain were recorded in the leg and foot fingers especially the toes region (Table 3, Figure 1).

Body Parts	Mild Pain	%age	Moderate pain	%age2	Severs Pain	%age3
Throat irritation	9	20.16	5	11.2	6	13.44
Chest Pain	7	15.68	4	8.96	7	15.68
Eye swell	18	40.32	3	6.72	8	17.92
Skin Swell	5	11.2	3	6.72	2	4.48
head	2	4.48	1	2.24	3	6.72
Neck	1	2.24	2	4.48	6	13.44
Shoulder	2	4.48	3	6.72	3	6.72
Mild Back	6	13.44	8	17.92	7	15.68
Elbow	1	2.24	0	0	2	4.48
Lower back	8	17.92	9	20.16	8	17.92
Knee	1	2.24	3	6.72	3	6.72
Lower Leg	3	6.72	5	11.2	5	11.2
Foot	5	11.2	2	4.48	4	8.96
Hand Finger	7	15.68	7	15.68	4	8.96
Foot Finger	8	17.92	10	22.4	8	17.92

Table 3: Body parts discomfort with %age.

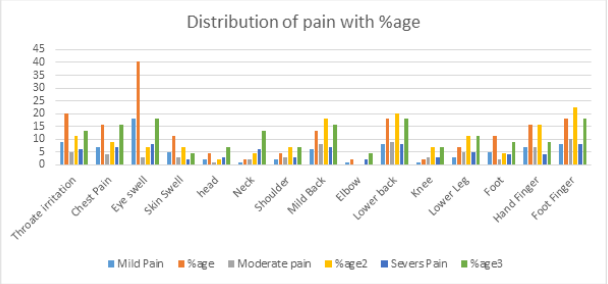

Figure 1: Distribution of discomfort in various body parts.

Control measures of considerable hazards

Most of the injuries and discomfort fond as shown in table 2 is associated with the following hazards which were either not identified or intentionally lift uncontrolled. These hazards need to be considered and further control measures are required as per the Health and Safety Executive Regulations is concerned. The prevailing condition of the workspace is very hazardous so the recommended control measures are provided according to the HSE recommendations (Table 4).

Hazards
Dust, Air pollution, Particulate Matter
Generation of various compounds such as NOx, CO2, Sox, and extra fuel start by-products. Clinker dust may be a major issue. Tall concentrations of handle dust are continuously existing from the schedule and recurrent exercises being carried out. As there's no dust extraction, people inward breathe in dangerous dust which can cause anything from short-term bothering to long-term genuine wellbeing circumstances. Individuals to get the aggravation dust on their skin, in their eyes.
1. Bordered space to be set up for grinding/sanding processes comprising that will contain an appropriate nearby deplete ventilation framework [12]

2. The foundation of an advancement High-Pressure Pounding Rolls (clinker–roller-press degree) rather than the ordinary Ball Plants [13]

3. The outpouring of CO2, SOx and NOx from the heater can be obliged by presenting an improved-innovation clinker cooler to boost warm recovery from stoves vapor gas for reuse, and to restrain the start of fuel (LPFO) for heater ending [13]

4. The current weakening ventilation framework to be reviewed and repaired on the off chance that fundamental. Upkeep program for all ventilation frameworks

5. The utilize of splash water ought to be utilized to stifle dust outflow amid pulverizing, crushing and processing operations [13]

6. Improved housekeeping – buy at slightest two reasonable vacuum dusters to keep dust within the common work environment and office regions to the least.

7. General dustiness instruction for those specialists undertaking these exercises e.g., dust ingestion or breathed in from hand to mouth contact.

8. Construction of isolated encased range of the changing room for the expulsion of dust-covered overalls. 9. Look into the plausibility of setting up a wellbeing observation program for all influenced workers.

Clamor, Vibration, Temperature extremes. Fundamentally the mechanics and others who work for long periods inside the workshop zone. Drawn out an uncontrolled introduction to a commotion at 80+dB will, over time, cause NIHL. The workshop is uproarious at certain times as you've had to raise your voice/shout when holding a talk e.g., car engines and the device running at the same time. Expect utilization of or utilize of imperfect hand-held disobedient such as plate cutters, sanders, and processors appear to lead to hand-arm vibration (HAV) conditions such as vibration white finger.

1. Engineering/technical controls to decrease, at source, the clamor created by a machine or prepare [14] 2. using screens, boundaries, walled in areas and permeable materials to diminish the clamor on its way to the individuals uncover [15]

2. Ergonomic helps bolster the weight of the instrument and diminish strengths connected by the operator 3. Regular breaks from work including vibration and energize administrators to work out fingers [16]

3. Using an elective prepare that does not uncover laborers to vibration. Look into setting up a health surveillance program for all affected workers.

4. Tool-box talks to be held twice a year on the impacts of vibration from hand-held instruments.

5. Issuing licenses to work that indicate how long your workers ought to work in circumstances where there's a hazard.

6. Use the British HSE's commotion calculators to discover out presentation levels Providing occasional rest breaks and rest offices in cooler conditions

There are moreover levels of commotion presentation that must not be surpassed. These are called limits constrain values:

I. Daily or week after week presentation of 87 dB;

II. Peak sound weight of 140 dB

7. Presentation activity esteem of 0.5 m/s2 A(8) at which level bosses ought to present specialized and organizational measures to diminish presentation [17, 18].

8. Presentation restrain esteem of 1.15 m/s2 A(8) which ought to not be surpassed [19]

Slips, trips, and falls

Falling, slipping due to uneven surfaces, trench, and hazy walkways Control measures. Cuts, bruises, muscle strains/sprains, broken bones from stumbling over cables or tools/equipment cleared out in walkways, or on damp surfaces (counting oil/fuel spills), etc.

1. Taking alternate routes, not observing where one is going, carrying materials that discourage the vision, wearing shades in low-light regions, not utilizing assigned walkways and speed are common components in numerous on-the-job wounds.[20]

2. designated as a walkway and signposted given with satisfactory lighting

3. Plan person on foot and vehicle courses to maintain a strategic distance from sullied ranges.

4. Have viable courses of action for both schedule dusting and managing with spills

5. Make beyond any doubt lighting is adequate which slants or steps are visible.

6. Keep walkways and work ranges clear of obstructions. Get the proper footwear

7. Consider how work is organized and overseen, e.g. to maintain a strategic distance from surging, overcrowding, trailing cables.

8. Make beyond any doubt workers are included within the choices that influence them, e.g. choice of PPE footwear or alter in dusting methods.

9. Arrange for floors to be degreased at the slightest weekly.

10. System for arbitrary housekeeping checks to be bought in.

11. Check whether extra electrical attachments may well be introduced to anticipate as numerous trailing cables.

12. Require floors to be appropriate, in great condition, and free from obstacles. Individuals ought to be able to move around safely.

13. Implementation of The Work environment (Wellbeing, Security, and Welfare) Controls 1992 (Direction 12) [21]

Frequent lifting, poor postures, overloading, awkward movement

1. Arrange to prepare for ergonomics and manual dealing with techniques

2. Reduce the rehashed dealing with of the same stack all through a process.
3. Use mechanical taking care of help: Apparatuses, lifts, controllers, counter-balanced lifters, bed trucks, stackers, and forklifts where it is appropriate [22].
4. Reduce the stack weight: Update bundling, utilize littler holders, or constrain the amounts of items in holders [23,24].
5. Increase the stack weight: Bring products in by bulk with mechanical dealing with, instead of parcels of sacks, etc. 6. Reduce the dangers of visit lifting: Look at handle rates and make beyond any doubt they are inside the physical capability of all those doing the assignment; turn laborers to employments with less physical requests. Permit adequate rest periods [25].
6. Reduce the require for bending and sideways bowing and embrace a legitimate approach where rehashed lighting is required [26].

Table 4: Hazards and Recommended Hazards Control Measures.

RESULTS AND DISCUSSION

After data collection of the health status of BK and CCB workers, it was noticed that the risk of injuries depends direly on the ignorance of the health and safety situation of the workplace. During investigations, many discomfort and injuries from mild to servers like skin, eye and throat irritation, and chest pain were identified among workers. The percentage of total affected people in BK and CCB plants was found at 74.66%. Some injuries like back pain, throat irritation, chest pain, and skin swell were found which a significant threat is for the workers because it can lead to permanent disability. The highest level of pain found is eye swell due to BK and CCB dust which is 40.32 percent followed by throat irritation 20.16 percent. Similarly, 22.40 percent discomfort complain is recorded in a moderate level of foot finger followed by 20.16 percent in the lower back. And finally, the highest severe pain was recorded in eye swell which is 17.92 percent followed by a foot finger of 17.92 percent. Hence the BK and CCB factory must implement health and safety laws and regulations. To control the palatable level of risk by utilizing hazard valuation strategies and procedures and give a security instrument. Tall dangers extend to diminish this chance to require prompt activity is required utilizing security control measures. Dangers ought to be minimized as a worthy level to manage it. To play down the dangers, chance control can include observing, assessment, and compliance with choices. Legitimate activity is vital for actualizing risk evaluation choices from the time to time. It is sweet hone to audit the appraisal for a specific time to time (1 year) to be done. The level of documentation is based on administered necessities.

CONCLUSION

In total 16 of the workers does not respond and 224 participant were found complaining of discomfort and in range of pain, they suffer due to several reasons. The highest level of pain found is eye swell due to BK and CCB dust which is 40.32 percent followed by throat irritation 20.16 percent. Similarly, 22.40 percent discomfort complain is recorded in a moderate level of foot finger followed by 20.16 percent in the lower back. And finally, the highest severe pain was recorded in eye swell which is 17.92 percent followed by a foot finger of 17.92 percent. The percentage of total affected people in BK and CCB plants was found at 74.66%. Some injuries like back pain, throat irritation, chest pain, and skin swell were found which a significant threat is for the workers because it can lead to permanent disability. The highest level of pain found is eye swell due to BK and CCB dust which is 40.32 percent followed by throat irritation 20.16 percent.

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