

Effect of airborne pollution of cement factory and brick kilns on human health in Bokajan area

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■ **ABSTRACT** : Cement and brick manufacturing include emissions of airborne pollution during operation and production which can cause tremendous effect on human health and environment. Thus, this study was undertaken with the aim to study the health condition of the workers working in the cement factory and brick kiln of Bokajan, Assam and their adoption rate of safety measures. A total of 80 workers (40 numbers of workers exposed to cement dust and another 40 numbers of brick manufacturing workers) were randomly selected for the study. Data were gathered by personal interview and observation method. The findings of the study depicted that the workers of the cement factory and brick kiln of Bokajan were exposed to industrial dust and smoke for prolonged period, causing different health problems on them. Adoption rate of the safety measures was very poor among the brick kiln workers, while the cement factory workers fairly adopted few safety measures provided by the factory. The study recommends proper preventive measures and awareness for health and wellbeing of the workers which would increase work efficiency and productivity.

■ **KEY WORDS**: Airborne pollution, Cement factory, Brick kilns, Human health

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Being the only home for human life, the environment has many factors that make it crucial to humans. Besides, clean air is one of the most important elements for a healthy life. But today industrial sectors become a key source of air, water and earth pollution that leading us to worldwide disease and fatality. Being the basic element for building construction cement industry and Brick kilns are two of the largest manufacturing industries in India, employing an immense number of workers as well as supporting the livelihood of many. According to an article of Global Cement

Magazine on 4th December, 2017, India was the second largest producer in the world after China by producing approximately 290 Mt/ yr of cement in 2016. In the other hand, India holds the second position in clay fired brick manufacturing, produces about 200-250 billion bricks annually, reported by SAARC Energy Centre, in March, 2013. Many studies have shown that workers of these manufacturing units are highly exposed to Repairable Suspended Particulate Matters (RSPM), at various manufacturing processes which leads to tremendous health impacts of the workers (Al-Neaimi *et al.*, 2001;

Meo, 2004; Mwaiselage *et al.*, 2006; Mehraj *et al.*, 2013; Meo *et al.*, 2013 and Aljeesh *et al.*, 2015). According to Central Pollution Control Board of India (CPCB), cement industries ranked at 12th position on the list of most polluting industry of India.

Manufacturing of cement emits particulate matters, SO_x, NO_x and CO₂ (Baby *et al.*, 2008). Exposure these emissions of cement manufacturing has been linked to a number of negative health outcomes, starting from temporary changes in the respiratory tract and impaired pulmonary function, continuing to restricted activity/reduced performance, frequent medical check-ups/hospital visits and to mortality (Schuhmacher *et al.*, 2004; Aydin *et al.*, 2010; Badri and Saeed, 2008; Zeleke *et al.*, 2010 and Poornajaf *et al.*, 2010).

In other hand brick manufacturing in India is a small scale and very scattered sector which plays a dynamic role in the development of the nation by employing a huge number of workers and holding worldwide market. India is the second largest producer of brick producing around 240 billion bricks per annum after China (SAARC). The raw materials used for brick productions are soil clay or sediments from river, which are rich in fine particles. Burning of coal, wood and saw dust as fuel to bake the bricks produces high level of black carbon and sulphur dioxide (Skinder *et al.*, 2014). Brick kilns are usually operated during autumn and winter and shutdown during the rainfall seasons. Raut (2003), have found that during the operation period of brick kilns, the concentrations of particulate matter (PM) in atmosphere around the brick kilns regions are significantly higher than the offseason. Workers at brick kiln were mainly involved in carrying the clay/ dust and bricks, moulding or baking. According to Shaikh *et al.* (2012), even though all the workers are exposed to dust and smoke, the moulders were highly exposed to dust and bakers were more prone to exposed to smoke among all the workers. Meo *et al.* (2013), found that a long-term duration and effect of years of exposure to industrial dust affect lung functions. Besides Shaikh *et al.* (2012), observed the occurrence of respiratory symptoms and illnesses in higher level among brick kiln workers.

Objectives:

- To study the health condition of the workers working in the Bokajan cement factory.
- To study the health condition of the brick kiln

workers.

- To study the adoption rate of safety measures by the workers of cement factory and brick kiln.

■ RESEARCH METHODS

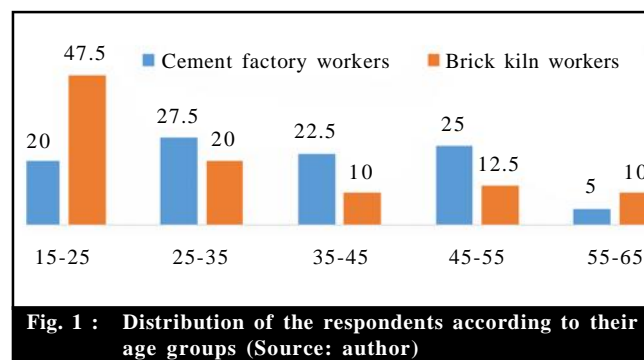
The study was conducted in CCI (Cement Corporation of India) cement factory and brick kiln of Gharialdubi, Bokajan, district of Krabi Anglong, Assam through purposive random sampling technique. A total of 40 numbers of workers were randomly selected from each factory amounting to 80 numbers of respondents. Source of the data were primary and secondary. Primary data were collected through questionnaire method. Statistical analysis of the data was decided according to the objectives of the study. The frequencies, percentage, mean was calculated to aid meaningful tabulation and result analysis. This experiment was carried out from the period of 2016 to 2018.

■ RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Age:

The results of the study revealed that greater percentage (27.50%) of the cement factory workers were belong to the age group of 25-35 years and brick kiln workers belonging to the age group of 15-25 years were maximum (Fig. 1). The finding of cement factory and brick kiln workers are supported with Yoganandan and Sivasamy (2015) and Nandal and Kumar (2016), who found higher percentage of cement manufacturing workers were belonged to the age group of 31-40 years and brick kiln workers belonged to 15-25 years.



Working hour:

The observation of the daily work schedule of the cement factory workers showed that working hour for the entire group of employees (100%) was 8 hours. In other hand most of the brick kiln workers (83%) work for more than 8 hours (Fig. 2). Sheta and El Laithy (2015), found in their study that 55 percentage of workers were work for 10 hours per day.

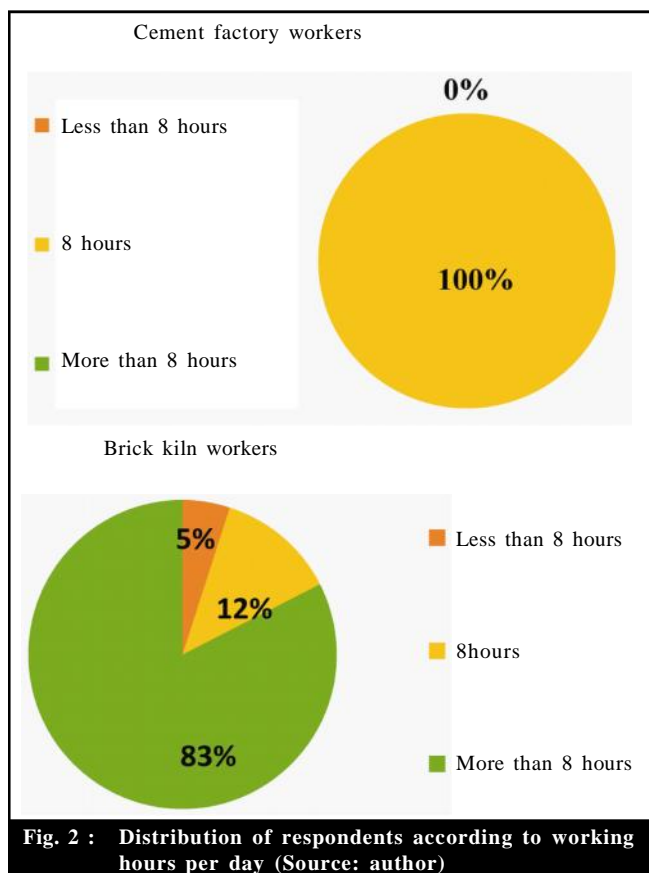


Fig. 2 : Distribution of respondents according to working hours per day (Source: author)

Years of involvement:

The study depicts that majority of the cement factory workers (30%) worked for more than 15 years in the factory while majority of the brick kiln workers (50%) worked in brick kilns for last 5-10 years (Fig. 3). Similarly, the findings of Das (2015), showed that higher per cent workers were involved with brick manufacturing for 5-7 years.

Physical health of the cement factory worker:

Occupational and environmental exposure to cement dust and their effects on human health is a leading respiratory health problem (Meo *et al.*, 2013). Data

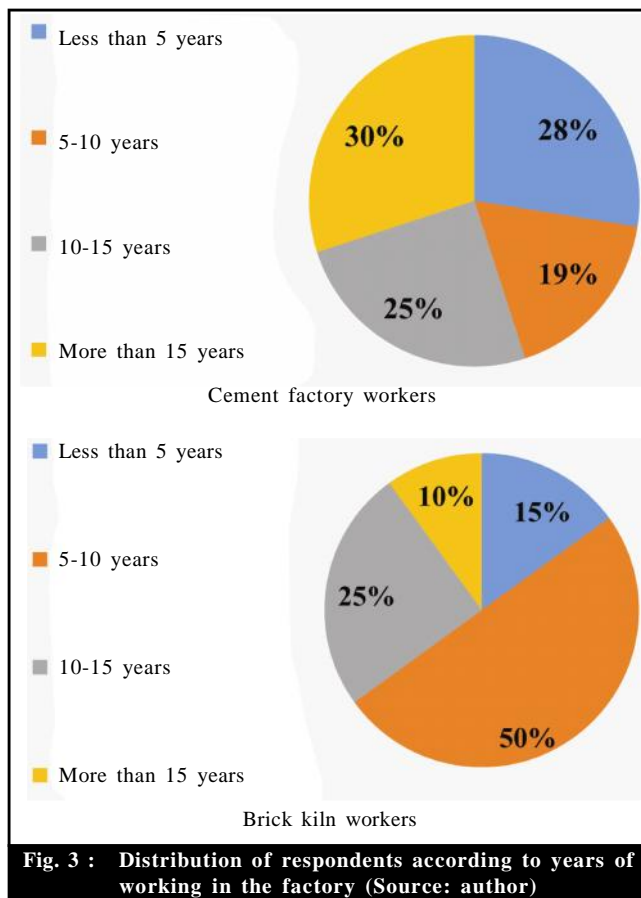


Fig. 3 : Distribution of respondents according to years of working in the factory (Source: author)

regarding the effect of cement dust on physical health of the workers of the cement factory in relation to years of exposure represented in Table 1 reveals that the majority of the respondents suffered from headache (67.93%), followed by chronic bronchitis (61.86%), Weakness/ fatigue/ anxiety (61.67%), nausea (57.54%), skin problem (53.71%), hair loss (50.65%) and eye irritation (49.35%). The respondents were also found to be mostly suffer from health problems such as pneumonia (47.08%), shortness of breath (43.16%), asthma (31.87%), cough lasting longer than 2 weeks (29.60%), other ear problem (12.74%) and difficulty in breathing (11.25%) correspondingly.

It was also found that more percentage (52.57%) of respondents with more than fifteen years of working in the cement factory suffered from more numbers of health problems and lesser percentage of respondents (37.06%) working for less than five years suffered from lesser number of health problems. This results are in conformity with Meo *et al.* (2013), who observed the effect of long term exposure to cement dust on lung

function. Hair loss, headache, chronic bronchitis, weakness/ fatigue, skin problem, eye irritation, nausea and pneumonia were common among the respondents in all the categories of period of working in the factory. The problems regarding hair loss, eye irritation, skin problem, and other ear problem might occur due to exposure to dust particles (Zelege *et al.*, 2010). Further, workers were found to also suffer from weakness/ fatigue/ psychological problems like anxiety which may be due to night shift work, frequent number of overtime work, noisy and hot environment.

Similar study on respiratory illnesses and ventilatory function among workers at a cement factory was observed by Al-Neaimi *et al.* (2001), Ahmed and Abdullah (2012) and Aljeesh *et al.* (2015). Effect of overtime work, noisy and hot environment on workers was studied by Asad *et al.* (2013) and made similar conclusion.

Physical health of the brick kiln worker:

Data regarding the physical health of the worker of the brick kiln, Bokajan in relation to number of years of habitation of the respondents are presented on Table 2. The table depicts that the majority of the respondents suffered from headache (70%), followed by pneumonia (67.50%) and Nausea (66.25). Health problems like Chronic bronchitis was found to be sixty-five per cent

(65%). Other health problems like Weakness/ fatigue/ anxiety is found to be fifty-eight per cent (58.75), eye irritation (55%), skin problem (52.92%), cough lasting longer than 2 weeks (50.84%), respectively.

The respondents were also found to be mostly suffered from health problems such as hair loss (47.09%), Asthma (30%), shortness of breath (26.25%), difficulty in breathing (18.75%), ear problem (15%) due to exposure to high amount of heat, smoke, and dust emits during the production process of bricks.

The problems regarding hair loss, eye irritation, skin problem, and other ear problem and dust allergy might occur due to exposure to dust particles (Zelege *et al.*, 2010). Further health problems like head ache, nausea, sneezing and wheezing, high blood pressure, pneumonia, chronic bronchitis, asthma, difficulty in breathing and cough might occur due to inhalation of dust and smoke (Joshi and Dudani, 2008; Genc *et al.*, 2012 and Sheta and El Laithy, 2015).

The findings also showed that more percentage (63.46%) of respondents with more than fifteen years of working suffered more numbers of health problems and lesser percentage of respondents (29.49%) who worked for less than five years suffered from less health problems. It showed that health problems may be dependent on period of exposure. Sheta and El Laithy (2015), observed a significant increase of chronic

Table 1 : Distribution of the respondents of Bokajan cement factory according to their health problems in relation to years of working in the factory

Sr. No.	Types of health problems	Number and percentage of respondents effected				Average percentage of respondents effected by the health problem
		Less than 5 years (n=11)	5-10 years (n=7)	10-15 years (n=10)	More than 15 years (n=12)	
1.	Shortness of breath	1(9.10)	2(28.57)	6(60)	9(75)	43.16
2.	Cough lasting longer than 2 weeks	2(18.18)	2(28.57)	3(30)	5(41.67)	29.60
3.	Asthma	3(27.27)	2(28.57)	3(30)	5(41.67)	31.87
4.	Pneumonia	5(45.45)	3(42.85)	5(50)	6(50)	47.08
5.	Chronic bronchitis	7(63.63)	4(57.14)	6(60)	8(66.67)	61.86
6.	Difficulty in breathing	-	-	2(20)	3(25)	11.25
7.	Nausea	4(36.36)	4(57.14)	7(70)	8(66.67)	57.54
8.	Hair loss	5(45.45)	4(57.14)	5(50)	6(50)	50.65
9.	Eye irritation	6(54.54)	3(42.86)	5(50)	6(50)	49.35
10.	Skin problem	7(63.63)	3(42.86)	5(50)	7(58.34)	53.71
11.	Ear problem	-	1(14.28)	2(20)	2(16.67)	12.74
12.	Head ache	7(63.63)	5(71.42)	7(70)	8(66.67)	67.93
13.	Weakness/ fatigue/ anxiety	6(54.54)	4(57.14)	6(60)	9(75)	61.67
Average % of respondents effected in terms of period of work		37.06	40.65	47.69	52.57	

*Number in the parenthesis indicates percentage (Source: author)

respiratory problems among brick kilns workers who were involved in brick manufacturing for more than 15 years and work for 10 hours per day and further. Shortness of breath, cough, nausea and pneumonia, headache, and fatigue and weakness after work were common among the respondents in all the categories of period of engagement. From the present study it can be concluded that the respondents of the brick kiln were affected by the smoke and dust due to direct or indirect exposure from a prolonged period of time.

Adoption rate of safety measures:

It was revealed (Table 3) that with regard to safety

devices, 100 per cent of the workers used masks, shoes, caps and ate jaggery provided by CCI cement factory, Bokajan. Seventy-one and sixty-seven per cent of the workers used self-provided full body covering clothes and glasses for eyes, respectively followed by 45 per cent taking honey for protection from cement dust. In other hand it was found that there was a very poor rate of adoption of safety measures by the brick kiln workers (Shewale *et al.*, 2013 and Prasad *et al.*, 2016). Only twelve per cent of the respondent intake jaggery. It can be said that there is a very high need of proper knowledge and awareness among the brick kiln workers about safety measures and its importance to maintain occupational

Sr. No.	Types of health problems	Number and percentage of respondents effected				Average percentage of respondents effected by the health problem
		Less than 5 years (n=6)	5-10 years (n=20)	10-15 years (n=10)	More than 15 years (n=4)	
1.	Shortness of breath	-	3(15)	4(40)	2(50)	26.25
2.	Cough lasting longer than 2 weeks	2(33.34)	7(35)	6(60)	3(75)	50.84
3.	Asthma	-	6(30)	4(40)	2(50)	30
4.	Pneumonia	3(50)	10(50)	7(70)	4(100)	67.50
5.	Chronic bronchitis	3(50)	13(65)	7(70)	3(75)	65
6.	Difficulty in breathing	-	4(20)	3(30)	1(25)	18.75
7.	Nausea	3(50)	14(70)	7(70)	3(75)	66.25
8.	Hair loss	2(33.34)	9(45)	6(60)	2(50)	47.09
9.	Eye irritation	2(50)	12(60)	6(60)	2(50)	55
10.	Skin problem	1(16.67)	12(60)	6(60)	3(75)	52.92
11.	Ear problem	-	3(15)	2(20)	1(25)	15
12.	Head ache	2(50)	12(60)	7(70)	4(100)	70
13.	Weakness/ fatigue/ anxiety	2(50)	10(50)	6(60)	3(75)	58.75
Average % of respondents effected in terms of period of work		29.49	44.23	54.62	63.46	

*Number in the parenthesis indicates percentage (Source: author)

Sr. No.	Safety provision/ devices	Cement factory		Brick kiln	
		Provided by factory	Self-provided	Provided by factory	Self-provided
1.	Mask	40 (100)	-	-	-
2.	Gloves	-	-	-	-
3.	Apron	-	-	-	-
4.	Respirator	-	-	-	-
5.	Shoes/boots	40(100)	-	-	-
6.	Cap	40 (100)	-	-	-
7.	Full body covering clothes	-	31 (71.5)	-	-
8.	Glasses for eyes	-	27 (67.50)	-	-
9.	Helmet	-	-	-	-
10.	Honey	-	18 (45)	-	-
11.	Jaggery	40 (100)	-	-	5 (12.50)

*Number in the parenthesis indicates percentage (Source: author)

health.

Conclusion and recommendation:

From the discussion of the foregoing chapters it was established that the CCI factory workers and brick kiln workers of Bokajan were exposed to high amount of dust, smoke and industrial noise for prolonged period causing different health problems on them. Health problems like cough, hair loss, head ache, nausea was most common among the respondents. It was also found that there was a significant relationship between health problems and years of exposure to cement dust.

In the present study it was revealed that adoption rate of safety measures was somewhat satisfactory among the workers of the cement factory but very poor among the workers of the brick kiln. It was also found by the observer that there is no felt need about personal protective equipment or safety measures among the brick kiln workers.

Thus, from the study it can be concluded that there was a significant effect on various health problems in both worker groups and need proper preventive measures for wellbeing of the workers. Development should not be at the cost of human lives and environment therefore industries should take care so that adverse effect is minimised.

Further, the benefits of this study could be achieved through generating awareness about health consequences of exposure to cement dust and importance of obtaining and using recommended safety devices for preventive measures. Audio visual aids, real life situations could be utilized as a tool to create awareness among the brick workers. The study also recommends that proper preventive measures should be implemented by the factories against dust inhalation. Regular health check-up of workers should be done to reduce health issues. Green belt development should be encouraged in nearby areas for decreasing air pollution and most importantly pollution control technologies should be installed by the factories.

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