

Effects of Surkh-Rod District Brick Kilns Emissions on Human Health

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ABSTRACT

In this paper, we tried to find the effects of brick kiln emissions on human health at Surkh-Rod district of Nangarhar province, Afghanistan and which live in a circle of one kilometer of brick kilns. Establishing the facts, both quantitative and qualitative data were simultaneously collected, the area was sampled based on non-random convenience sampling, (20) brick kilns selected based on random stratified sampling and the respondents were selected based on sample random sampling. Microsoft excel descriptive analysis, percentage analysis was performed for data analysis of close-ended statements and thematic analysis was used to analyze non-quantifiable data from the open-ended items (textual). After analyzing the data, it concludes that a wide range of individuals, including men, women, kids, adolescents, and senior citizens, work in brick kilns. The majority of these workers lack access to modern education, and their religious education is also at a low level. The toxic gases in the kiln causes more suffer to those employed there. Furthermore, those families who live near kilns for at least five years at a distance of almost one kilometer have shortness of breath, headaches, different types of lung diseases, Eye Irritation, Hearth and skin diseases. These disease is caused by the harmful gases produced by the burning of coal, coal, wood, garbage and various types of fuel. Also, our finding shows that they don't wear any of the protective equipment that should be worn at work to protect themselves from the potentially harmful impacts of these hazardous gasses.

Keywords: Brick kilns, Health Problems, brick kiln, Emissions

INTRODUCTION

Surkhrod is a district in the west of Nangarhar Province, Afghanistan. The district center is the town of Sultanpur. The district takes its name from the Surkh Rod River, also known as the Surkhhab, which flows through the district. The district is also called "Sra rod" or "Sra road", "Sra" in Pashto means "Red" (in Persian it's called "surkh"). "Rod" means "river" or "canal". It is well known to locals because of its abundance of fertile land, it's soil consist of sand, clay and silt. (*Surkh Rod District, Nangarhar, Afghanistan*, n.d.) which are the basic ingredients for loamy sands, sandy loams or sandy clay loams and these types of soil is the desirable soil for brick making. (Dominguez, 2011). There are around 140 kilns in the province of Nangarhar, 120 of which are in the Surkh-Rod area. Of these, 50 are working at the moment, while the remaining kilns are inactive (EPA, 2013). Brick manufacturing is the fastest-growing industrial sector which contributing to the air pollution and health problems which is sever problem world facing today, especially for developing country like Afghanistan. (Mazumdar, Manashi; Goswami, H; Arabinda, 2018). Among the industrial sector brick kilns are the source of air pollution. Firing is the most common method to produce bricks, while this process involves enormous energy consumption and carbon footprint (Zhang et al., 2018). Most of the emissions originating from this industry include carbon dioxide (CO_2), methane (CH_4) oxides of nitrogen (NO_x), and particulate matter (PM). Raw material which is used as fuel in brick making includes old tires, wood, used motor oil, coal, trash, and even plastics. An incomplete combustion of these furnaces favors the emission of PM and greenhouse gases (Ahmad et al., 2022). The burning and incomplete combustion of these material leads to the emission of poisonous gases with underlying health impacts and environmental problems (Tusher et al., 2019). Average emission factors per 1,000 bricks were 6.35–12.3 kg of CO , 0.52–5.9 kg of SO_2 and 0.64–1.4 kg of particulate matter (PM). PM emission size distribution in the stack plume was determined using a modified cascade impactor (Le & Oanh, 2010). A health survey conducted by Joshi & Dudani⁹ in Nepal clearly showed that people who are living near

brick kilns are more likely to suffer from illnesses caused by kilns pollution, comparing those who are living in areas without the kilns. School children nearby brick kilns were had the worse condition of health and they were suffered for higher prevalence of upper respiratory tract infections like pharyngitis and tonsillitis (*Environmental Health Effects of Brick Kilns in Khatmandu Valley*, n.d.) Biological impact of CO_x , NO_x , SO_x and PM are mainly getting infected by Asthma, malaria, cardiovascular diseases, pulmonary disorders, human cancers, lung and cardiac diseases. (Grosser et al., 2006). A research shows that brick kilns produced PM 2.5 (particulate matter) is considered more harmful to human health, because it has the capacity to travel deeper into the respiratory system and cause premature mortality and respiratory ailments (Guttikunda, 2009). From these PM, mainly both elder people and children are suffered more than any ages because on these stages of life our disease prevention mechanisms become weaker (*Health and Environmental Effects of Particulate Matter (PM) / US EPA*, n.d.). Under these circumstances, the present study was conducted to investigate the effects of emissions of brick kiln operations on the public (brick kiln workers and local inhabitants) health at Surkh-Rod District, Nangarhar Province Afghanistan.

METHODOLOGY

The study was conducted by descriptive method; the purpose of the descriptive method is to revile in existing situation as it is. We combined qualitative and quantitative methods to achieve a comprehensive view of the problem at hand. Both quantitative and qualitative data were simultaneously collected, analyzed separately for the purpose of establishing the facts. With the help of random sampling, 160 respondents including 104(65.3%) brick kiln workers and 56(34.7%) inhabitants were surveyed from (20/40) (50%) Surkh Rud District different active brick kilns. The area was sampled based on non-random convenience sampling, (20) brick kilns selected based on random stratified sampling and the respondents were selected based on sample random sampling in in a circle of one kilometer from these brick kilns. A structured questionnaire was developed by the authors, which was composed of 14 questions covering with both the closed and open-ended questions to gain the maximum possible results. the questions were asked systematically and the responses were carefully recorded because it is believed that closed-ended questions likely restrict the answers to the issues that were covered. Approvals were obtained from brick kiln owners and informed consent was sought from the respondents.

DATA ANALYSIS

A quantitative method was used to analyze quantifiable portion of the research, using Microsoft excel descriptive analysis, percentage analysis was performed for data obtained from close-ended statements. We made bar chart for each related factors. thematic analysis was used to analyze non-quantifiable data from the open-ended items (textual). The analysis was done manually and followed a number of stages. The first stage involved familiarization with the data whereby the data were transcribed in such a way that textual data were recorded from the students' written responses. Then the transcriptions were read in a repeated manner while writing notes of the initial issues. In the second stage, the data were coded. The third stage involved sorting of different codes into the emerging themes and pulling together all relevant data extracts within the identified themes which were organized by using a table. In the next stage, the themes were reviewed to ascertain the relationships with the data set. The themes were then grouped into different subjects based on the research questions. Finally, we extract some factors of brick kilns which direct effect on health of brick kiln worker and inhabitants. Details on the factor effects their health are given in the results section in relation to the research questions.

RESULTS

In this research, 20 respondents (12.4%) were female, 10 of them were children under the age of 10, 5 were 10-20 years old, and 5 others were 20-35. The remaining 140 respondents (87.6%) were male, including 13 children under the age of 10, 44 adolescents aged 10-20 years, 60 respondents aged 20-35 years and the remaining 23 respondents were over 35 years old. Among the respondents (104(65.2%) workers and 56(34.8%) inhabitants), where 98(61.5%) of the respondents were illiterate and 62(38.5%) were educated (Table 1). The study revealed that the highest proportion of the respondents (N=104),(65.2%) of whole sample were brick kilns workers where 19(18.27%) of these workers were living in or around the study area for less than 5 years,

62(59.62%) of them were living in or around the study area from 5-10 years, 19(18.27%) of them were living in or around the study area from 10-15 years, while only 4(3.84%) of them are living for more than 15 years in the area. In case of inhabitants (N=56), (34.8%), where 9(16.07%) of these workers were living in or around the study area for less than 5 years, 22(39.28%) of them were living in or around the study area from 5-10 years, 16(28.58%) of them were living in or around the study area from 10-15 years, while only 9(16.07%) of them are living for more than 15 years in the area. (Table 1). The results of the survey revealed that workers identified Coal, Rubber, Tires, Wood, Garbage and different kinds of fuel used for brick production in the brick kilns (Fig.1), this is contrasted to the National Environmental Protection Agency's information, which states that using Rubber and Tires in brick kilns are completely prohibited. The study revealed that the respondents were higher prevalence of shortness of breath (N=126), (78.3%), headache (N=141), (87.6%), eye irritation (N=110), (68.3%), different types of lung disease (N=117), (72.7%), Skin diseases (N=79) (49.1%), Heart disease (N=15), (9.37%) and Some illnesses that affect the lungs include Pneumonia, Cold, Norasht, Nervous, blood pressure due to brick kiln operations. Among the respondents, workers were badly suffering from skin diseases, shortness of breath (asthma), eye irritation, different types of lung diseases, skin diseases than the inhabitants due to working continuously at the brick kiln periphery. On the other hand, inhabitants living here for many years were influenced by surrounding adverse environmental conditions and were suffering much from eye irritation, headache, bronchitis and others lung diseases than the workers. That implies that workers were suffering much from skin disease, asthma and lung disease than the inhabitants though headache, eye irritation and bronchitis were prevalent in inhabitants.

Among the respondents, only 4.8% (N=5) and 35.7% (N=20) of the workers and inhabitants, respectively, participated in different health education and awareness programs organized by several Governmental organizations or Non-Governmental organizations (NGOs), whereas most of the respondents, 95.2% and 64.3% of the workers and inhabitants, respectively, were never participated in any health education or awareness raising programs (Table 1). Health and safety measures taken by the workers were also determined through questionnaire survey. Among the respondents, 10(9.5%) of the workers stated that they use mask and also concerned about the health impacts of brick kiln emissions induced air pollution. On the other hand 94(90.5%) of the workers stated that they never use mask during working period (Fig. 2), as they not concerned about the health impacts of brick kiln emissions, similarly Among the respondents, 2(1.9%) of the workers stated that they use glasses and also concerned about the health impacts of brick kiln emissions induced air pollution. On the other hand 102(98.1%) of the workers stated that they never use glasses during working period (Fig.3), as they not concerned about the health impacts of brick kiln emissions because training program from brick kiln authority were not provided to them (Table 1).

Table 1. Socio demographic details about the participants

Variables		Respondents (%)
Age		
Below 10 years		23 (14.3%)
10-20 years		49 (30.4%)
21- 35 years		63 (39.8%)
Above 35 years		25 (15.5%)
Gender		
Male		140 (87.6%)
Female		20 (12.4%)
Educational Qualifications		
<i>Educated 99(61.5%)</i>		<i>Illiterate 61(38.5%)</i>
<i>Religious Education</i> 24(38.7%)	<i>School Based Education</i> 38(61.3%)	
<i>Only recitation from Quran-e-karim</i> 19 (79.2%)	<i>Primary</i> 11(28.9%)	
<i>Hafiz</i> 2(8.3%)	<i>Secondary</i> 14(36.8%)	
<i>Short cycle (wara dawra)</i> 3(12.5%)	<i>High School</i> 6(15.8%)	
<i>Long cycle (Loya dawra)</i>	<i>Bachelor</i> 4(10.5%)	
	<i>Master</i> 3(7.9%)	
Occupation		
Workers		104 (65.2%)
Inhabitants		56 (34.8%)
Residence time		
Below 5 years		28 (17.4%)
5-10 years		84 (52.8%)
10-20 years		35 (21.7%)
Above 20 years		13 (8.1%)
Workers' participation: Environmental Programs		
Yes		5 (4.8%)
No		99 (95.2%)
Inhabitants' participation: Environmental Programs		
Yes		20 (35.7%)
No		36 (64.3%)
Use of masks during working hours		
Yes		10(9.5%)
No		94(90.5%)
Use of glasses during working hours		
Yes		2(1.9%)
No		102(98.1%)

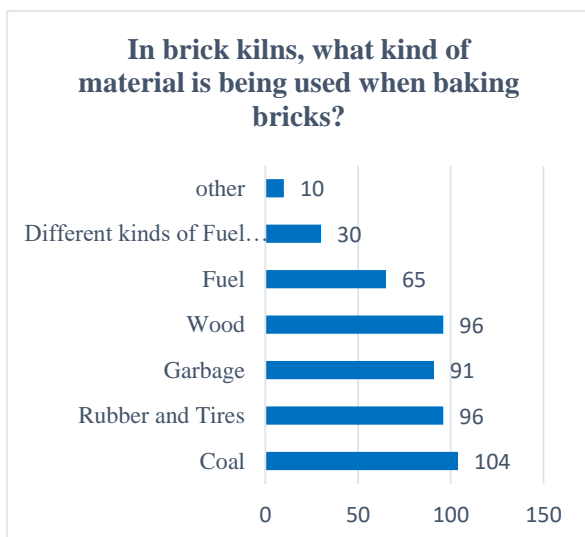


Figure 1: Material Used in Brick Kilns

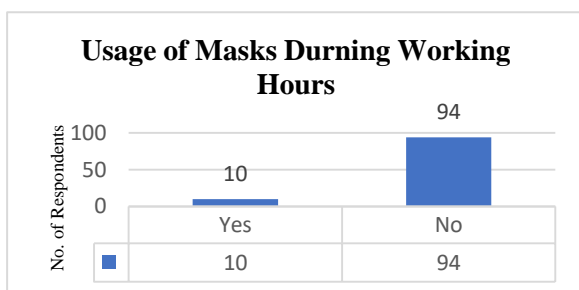


Figure 2: Usage of Masks



Figure 3: Usage of Glasses

fuel in brick making includes old tires, wood, used motor oil, coal, trash, and even plastics. An incomplete combustion of these furnaces favors the emission of PM and greenhouse gases, in this research, we have tried to study the effects brick kiln emissions on the people of this area. According to the study workers identified Coal, Rubber, Tires, Wood, Garbage and different kinds of fuel used for brick production in the brick kilns which similar to the finding of (Ahmad et al., 2022), The study revealed that the respondents were higher prevalence of shortness of breath, headache, eye irritation, different types of lung disease, Skin diseases, Heart disease which is similar to the finding of (Grosser et al., 2006) this research also show that the workers failed to use the necessary supplies and tools at work and did not participate in any health training, as shown by the numerous reasons listed in the results section.

CONCLUSION

The study's findings indicate that a wide range of individuals, including men, women, kids, adolescents, and senior citizens, work in brick kilns. The majority of these workers lack access to modern education, and their religious education is also at a low level. The toxic gases in the kiln causes more suffer to those employed there. Furthermore, those families who live near kilns for at least five years at a distance of almost one kilometer have shortness of breath, headaches, different types of lung diseases, Eye Irritation, Hearth and skin diseases. These disease is caused by the harmful gases produced by the burning of coal, coal, wood, garbage and various types of fuel. For a variety of reasons that have been discussed in the results section, they do not utilize any of

At the end while respondents asked for which additional diseases, in your experience, are transmitted by brick kilns and how may they be prevented? So they shared the problems in the form of suggestion as follows.

1. There should be a brick kiln replacement developed.
2. Air filters have to be provided to regions with a large number of brick kilns.
3. Regularly monitor the implementation of the rules set by the Environmental Protection Agency. Especially the burning materials must be carefully monitored.
4. Providing accommodation at a distance of at least one kilometer from the brick kilns.
5. Hospitals should regularly evaluate the health of brick kiln workers and others living nearby in order to prevent the spread of these diseases. Their plans should be based on a health team.

DISCUSSION

The industry with the quickest rate of growth is brick production, which is a major concern for the world today due to air pollution and health issues, particularly in developing nations like Afghanistan (Mazumdar, Manashi; Goswami, H; Arabinda, 2018). The province of NANGARHAR contains about 140 kilns, 120 of which are located in the Sarkhrod region. Of 40 are now in operation, while the remaining kilns being Closed (EPA, 2013). Most of the emissions originating from this industry include carbon dioxide (CO_2), methane (CH_4), oxides of nitrogen (NO_x), and particulate matter (PM). Raw material which is used as

the equipment that they should be using during work in order to protect themselves from the negative effects that these dangerous gases might cause. It is notable that their information has been approved based on local clinics of that area.

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