

Environment And Health Impact For Brick Kilns In Kathmandu Valley

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Abstract: In Kathmandu Valley among the other environment pollutions, air pollution is one of them. Valley is vulnerable due to its topography, which restricts the wind movement and allows pollutants to remain within the valley and the anthropocentric reasons. Brick kilns are the major source of air pollution along with other sources. These are not only deteriorating air quality and it is also degrading the health of the people living near the kilns. This research is base on both primary and secondary data sources to know about brick kilns pollution impacts on human health and environment around brick kilns zones, and to find out for minimize the air pollution do brick kilns adopt new technologies. For this research, primary data were collected from Nalin Chok of Bhaktapur district because many brick kilns were situated there and secondary data sources were provided the information about brick kilns production of different toxic pollutant components for air pollution and human hazards. Respondents of this research have shared that they are suffering with diseases like respiratory, nasal cognition, burning of eyes and loss of visibility, which accelerated many accidents on that particular area due to brick kilns. However, positive outcome of this study is that recently government has decided to ban Bulls Trench brick kilns in Kathmandu as a result; entrepreneurs are searching for environment friendly and cost effective alternative technologies, which will help us to built pollution free city.

Index Terms: Air pollution, Brick kilns, Environment, Health impact.

1 INTRODUCTION

Kathmandu valley is the capital of Nepal and country's main economic as well as cultural center. This City is spread over an area of 5067 sq km and is situated at an altitude of 1300 m to 1350 m. This valley is the combination of three districts namely Kathmandu, Bhaktapur, and Lalitpur. The cross section of valley is about 20km north to south and 30km east to west (CEN fact sheet, 2001). As like other major cities in the world, Kathmandu Valley is also facing the problem of pollutions. Among all the pollutions, air pollution is the major one. Air pollution begins mainly for the anthropocentric reasons like; fuel-burning, stone grinding factories, brick factories, and unmentioned roads (Shakya, 2002). Raut (2003) claim that, Kathmandu valley is vulnerable for air pollution problem due to its topography that restricts the wind movement and allow pollutants remain within valley. In valley, brick kilns are the major sources for air pollution (Raut, 2003). Currently in the valley, 500 brick kilns are in operation and amount of these brick kilns increased 200% since 2000 (Animal Nepal, 2011). These brick kilns are deteriorating air quality and degrading people's health nearby the brick kilns. Recent studies have found that the concentrations of particulate matter (PM) in air around the brick kilns zones are three times higher than the offseason of brick kilns (Raut, 2003).

Particulate matter does not consist of one compound or element but rather, it is a complex mixture of different organic and inorganic substances, many of those are harmful to human health (WHO, 2000). Other environmental costs of the brick kilns are reduction in soil fertility, reduced visibility, drying the ground water sources. The Brick production in Nepal is an old phenomenon. Archeologists believe that the production of bricks started in Kathmandu three thousand years ago and then it had expanded the whole country. Bricks are the part of Nepalese art and architecture from the very beginning. Bricks are decorative facade of buildings to show social prestige. Old Nepalese temples are the testimonial of long history of brick production and use. Usually sun-dried and raw bricks were used when there was no technology to fire the bricks. Brick industry falls under small/cottage industry group, and it is a seasonal industry, with a seasonal employment opportunity. Along with the urbanization, these industries are rapidly growing and migration of people into the city area forcing to create more brick kilns. Currently more than 400,000 workers are working in the brickfields (GEFONT, 2007).

2 THE AIM OF THE RESEARCH

This research is directed toward three purposes below.

- To know the impact of air pollution on human health and environmental caused by brick kilns.
- To identify the pattern of human health effects are caused by brick kiln air pollution to local people around kilns.
- To find out for control air pollution brick kilns are really adopting environmental friendly technologies.

3 LITERATURE REVIEW

3.1 Air Pollution

According to the World Health Organization (WHO), Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. Household combustion devices, motor vehicles, industrial facilities, and forest fires are common sources of air pollution (WHO, 2013). Environmental Protection Agency (EPA), claimed that particulate matter, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead are the main pollutants

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for the air pollution. These pollutants can harm your health and the environment, and also cause property damages (EPA, 2012). In the South Asian region, brick kilns are the major source for air pollution. Brick industries are growing rapidly in Bangladesh, India, and Nepal and air pollution increases along with it. More than 108000 brick kilns are in operation in these countries and for the urban air pollution, brick kilns are taking the leading position in rank (World Bank, 2012).

3.2 Health Impact

Globally, it is difficult to estimate how many people die off prematurely or get sick due to air pollution because people are exposed to so many different pollutants in various concentrations over their lifetimes. However, according to WHO for air pollution approximately 3 million people have died each year. Among them, 800,000 people die prematurely every year due to lung cancer, cardiovascular and respiratory diseases, which are caused by outdoor air pollution (WHO, 2000). Approximately 150,000 of these deaths are estimated to occur in South Asia alone (World Bank, 2003). Inhalation is the most common route for pollutants to enter the human body and damage the respiratory system. Exposure to air pollutants can overload or break down natural defense mechanisms in the body, causing or contributing to respiratory diseases such as lung cancer, asthma, chronic bronchitis, and emphysema. Air pollution can also have adverse impacts on other important systems such as cardiovascular system and central nervous system (Genc et al 2012; Joshi & Dudani, 2008). The most significant health impacts of outdoor air pollution are associated with particulate matter (PM) (Raut, 2003). World Bank (1997) reported that the main contributing sources for Total Suspended Particles (TSP) in the valley are cement factories (36%), brick kilns (31%) domestic fuel combustions (14%), road re-suspensions (9%) and vehicle exhausts (3.5%). However, particulate matter of size less than 10 microns (PM_{10}) concentration, which is another major reason for damaging the respiratory system; contribution by the brick kilns were found highest than other sources and it was about 28% (World Bank, 1997). As EPA defined, tiny airborne particles or aerosols that are less than 100 micrometers are collectively referred to as total suspended particulate matter (TSP) (EPA, 2012). Most of the brick kilns are poorly designed, which cause incomplete combustion of coals. This incomplete combustion produces Carbon Monoxide (CO), which increase for heart diseases. If rubber tires were used as fuel then along with CO, emission from brick kilns comprises of fine dust particles, hydrocarbons, Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_x), Fluoride compounds, and small amount of carcinogenic dioxins (Joshi & Dudani, 2008). All these typical brick kilns use woods, recycled motor oils, coals, fuel oils, diesels, tires, trashes, and plastics for fuel. Really, what they will use for fuel it mainly depends on what is available for the brick makers. However, ultimate reality is that all these fuels are responsible for the emission of toxic gases. In Spain, it is reported that the open brick kilns were also responsible to emit fluoride, chlorine, and bromine in addition with other toxic gases (González, Galán, & Fabbri, 2002). In Bangladesh, it is reported that brick kilns produced $PM_{2.5}$. This fine PM is considering more harmful to human health, because it has deeper capacity to travel into respiratory system 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 becomes weaker (OAQPS Fact Sheet, 1997). American Lung Association (ALA) found in their research that, for the PM in air premature deaths rate increased three times higher than the previous studies. Child mortality rate were also increase for air pollution (ALA, 2006). Recent studies have revealed that a traditional oven emits about 863 pounds of pollutants for each production and burns covering approximately 10,000 bricks (TCEQ, 2002). A health survey 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 (Joshi & Dudani, 2008).

3.2 Environmental Impact

Air pollution has local as well as global impacts. Both living and non-living organism are facing the adverse effect of pollution. Plant health is affected by air pollution because pollutants like fluorine, lead, and mercury damage the plants. Acid rain, fog formation, bio-diversity loss etc. are the negative impacts for air pollution in environment. Industrialization is the major reason for acid rain because industries emits sulphur dioxide and oxides of nitrogen, which combines with water vapour in the atmosphere and forms mild acids. When it comes to the earth as rain, we call it acid rain. It causes extensive damage to plant lives, buildings and contaminate of lakes and rivers (EPA, 2012). Fog is another phenomenon whose effect can extend to nearby areas. Due to air pollution, ratio of fog formation is accelerating. This fog can damage normal transportation systems, reduce the growth of crops due to decrease of sunlight. Bio-diversity of different areas can degrade due to air pollution because all these chemical components are affects the organisms (WHO, 2011). As we understand that brick kilns are one of the major sources for air pollution. So, as environmental rules, brick kilns should not be set up on arable lands and minimum three kilometers distance away from any housing area, reserve forest, and educational institution. However, no rule is maintaining for setup brick kilns. As a result brick kilns produces black smoke which ultimately move away the species which are involved pollination process. This ultimately declines the agricultural and farming production (Islam, 2012). The effects of brick kilns have both long term and short-term impacts in the environment. In short term the vegetation process hampers, crops production decreases, plants fruits falls down etc. and long term impacts are ozone depletions, global warming, photochemical smog's, land fertility decreases, ground water level down etc. (Pokhrel & Lee, 2011). For the brick production, top soil is removed from the land and it takes between 25 to 30 years for those lands to be fertile as earlier. The period can be longer if vast quantities of toxic wastes such as in the form of carbon monoxide and sulphur oxide will mix into the land. On average each kiln burn 350 tones of woods a year, so more kilns means having a devastating effect on the forests (Morley, 2012). Brick kiln removes on an average of 1500 MT of soil per ropani (0.05 ha) per year. Burning soil decreases the soil pH making it acidic, increase sand and decrease the clay content. It has serious impacts on soil physical, biological, and chemical properties resulting sharp declination in soil fertility and productivity. Moreover, it removes organic matters and makes the soil unfit for crop cultivation. Local farmers have already experienced

the problems of drying water sources, low water holding capacity on soils, poor crop stability, landslides and reduced crop productivity in the areas that have been used for brick factory. Due to the lack of essential soil nutrients, crops are reported to be prone to many pests and diseases as well. To recover the production, farmers have been applying heavy doses of chemical fertilizers, which have other harmful consequences (Thapa, 2011). In the valley, along with the rising construction activity brick kilns are growing fast. Negative rate of growth in construction activity in past few years has resulted in a proliferation of brick kilns, which has reappeared in the valley with spectacular speed raising serious concerns about the deteriorating air quality. It has been reported that brick kilns, producing in excess of 350 million bricks are the major and single source of SO₂ and PM in the environment of Kathmandu valley; contributing over 60 percent of the emissions (Maity, 2011). Because unusual chemical composition and optical behavior, it affects visibility and climate differently than other particulate species also.

4 METHOD AND TECHNIQUE OF THE RESEARCH

This research is base on both primary and secondary data sources. Both quantitative and qualitative approaches are use for collecting primary data. Study area of this research is Nalin chock VDC of Bhaktapur district in Kathmandu Valley. Most of the brick kilns of this district are here. With the help of random sampling 30 respondents were selected from around the brick kilns zones. To collect the information from every respondent survey and interview were used.

5. RESULT AND DISCUSSION

- **Impact of air pollution contributed by brick kilns.**

From the literature review, we got sufficient evidence that for the air pollution brick kilns are the major offender. It influences on both human life and environment sector. Human lives are more vulnerable for the air pollution and environment degrades a lot due to the consequence of air pollution. One examination was conducted in order to assess air quality in the areas with brick kilns and without, different instruments had been used to collect and analyze the samples. Average value of PM₁₀ for the pre operation time was 0.029 mg/m³, whereas, it reached 0.050 mg/m³ during the brick kilns operation time. Similarly, TSP value was found to be 0.033 mg/m³ during pre operation time and 0.056 mg/m³ during operation time (Joshi & Dudani, 2008).

- **Human health effect causes by brick kilns for local people.**

As the survey and interview results found that most of the people around the brick kilns were more concern about the air pollution and 90% of them had strong believe that brick kilns were the main reason behind it. They also believed that due to air pollution from brick kilns, community people are facing breath problem, nasal problem, eye burning and others diseases. Around 50% of the respondents had faced breath problem only. They also shared that some of the house hold members in the community were facing long time agama, allergic base diseases. Local residents are facing the problem of losing visibility along with the time, which was there another major concern. Near about 60% of the respondents believed

that, their visibility reduced for brick kilns pollution. For saving their life, they wanted to stop the brick kilns or adapt scientific technologies to the brick kilns to reduce pollution. 80% of them had strong view to adopt new technology as soon as possible for reduce pollution. Some of the respondents told us that, for the old pattern of brick kilns human were suffering more than modern brick kilns area. They also shared us that along with their health problem, they were facing low food production, scarcity of ground water; all types of plants nearby brick kilns were in exhausted condition. So, it is clear from people perception that people living nearby brick kilns are suffering more and they feel the adverse effect of air pollution.

- **Adopting environmental friendly technologies for the brick kilns.**

Brick manufacture is a big industry and major source of air pollution in Kathmandu Valley. According to an emission inventory of 1993, brick kilns were responsible for 27 percent of PM₁₀ and 31 percent of Suspended Particulate Matter (SPM) in Kathmandu Valley (World Bank, 2007). Since 2004, the brick industry has gone through a major transformation as the whole industry switched over from the polluting Moving Chimney Bulls Trench Kilns to the cleaner Fixed Chimney and Vertical Shaft Brick Kilns (VSBK) (Joshi & Dudani, 2008). Actually new technological implementation was started in valley, when local people raised the voice of brick kilns pollution. In the late 1990s, several local groups in Bhaktapur and Lalitpur area started raising the issues of pollution from brick kilns with local government authorities as well as the industrialists through letters, meetings, and protests. Later they were supported by some local NGOs by conducting more scientific studies to justify their claims. Clean Energy Nepal for example conducted air quality monitoring and health studies among children in areas with and without brick kilns (Raut, 2003). By 2005, cleaner kilns had replaced all the polluting moving chimney brick kilns in Kathmandu Valley. World bank report have shown that compared to mass emission load of 8.06 kg of SPM per 1000 bricks produced by Moving Chimney Bulls Trench Kilns, but Fixed Chimney kilns produce only 1.71 and VSBK produces 0.55 kg of SPM per 1000 bricks. Therefore, the VSBK is more than 14 times cleaner and Fixed Chimney is almost five times cleaner than the traditional kilns (World Bank, 2007). Technology modification has resulted in improved air quality. According to records from the Bhaktapur air quality monitoring station the PM₁₀ concentration in Bhaktapur around brick kilns zones went down by 26.5 percent between 2003 and 2005 (UNEP,2007).

6 CONCLUSION

It is clearly visible that brick kilns operating in Kathmandu valley are in leading position for air pollution. Bhaktapur area is also facing air pollution due to brick kilns. The study has revealed that the health status of local people is in danger with brick kilns in the vicinity. The level of different air pollutants in the ambient air were higher during the operation of brick kilns. So community people are facing diseases like respiratory, nasal cognition and reduce visibility for the brick kilns pollution. Smoke and dust from brick kilns emission have adverse effect on visibility. Wide ranges of interventions are available to reduce ambient air pollution due to brick kiln in Kathmandu. Measures like shutting down illegal kilns, introduction of cleaner technologies such as vertical shaft kilns and fixed chimney kilns, substitution of traditional kilns with newer

technologies are reducing air pollution. Along with suggestion for standard emission from brick kilns will significantly reduce the air pollution as well as reduced the impact on environment and human health. Similarly, provisions need to create that brick kilns should constructed away from the residential areas.

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