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THE REPERCUSSIONS OF DEVELOPMENT : BRICK KILNS A BOON (ECONOMY) OR BANE (ENVIRONMENT). AN OBSERVATION MADE THROUGH ANALYSIS OF SOME AIR PARAMETERS

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Abstract

This work is designed with certain objectives, one of which includes analyzing how Brick kiln emissions are slowly poisoning our environment and how the impacts are visible on the overall ecology of area. It also aims in ascertaining how development, although crucial for economy, always comes in the way of environment which shouldn't be the case when environmental awareness is at peak and environmental management should be our motto. The survival and growth of brick kiln industry hinges on the vital dimension of sustainability, which in this scenario is environmental in its form. This effort tries to highlight how brick kiln industries are one of the largest emitters of pollutants like SPM (RSPM and NRSPM), NO_2 and SO_2 from brick kilns. For the purpose of fulfillment of our objective, Brick kilns in area of Sumurbugh and Zodar area of Kashmir were monitored and hence attempts to develop a database of air pollutant emissions was focused upon and in the light of results it seems there is immediate need to formulate new rules, follow the guidelines strictly and incorporation of better technology for better sustainable environment and hence our future.
***Keywords*:** Clusters, Development, Emissions, Environment, Industry, Sustainability, Pollutants and Phases

Introduction

It is rightly said that if one needs to know about civilization, he needs to study bricks. India stands as second largest producer after china in brick making (Maithel and Uma, 2000), contributing to about 13% of total brick production in global market .Our unsatisfying needs and greed has lead to industrialization which always comes with a price which at times costs us very dearly especially when the price is paid environmentally. Environmental pollution is one the serious problems facing humanity and other living forms nowadays. (Gautam *et al.*, 2009) nominated Indian cities, among most polluted in the world.

The brick industry is the largest user of coal in India after thermal power plants and the iron and steel industry. It consumes around 35 million tonnes of coal per year or 175g of coal per unit of brick. According to a report by United States Environmental Protection Agency, the industrial sector accounts for approximately 15 per cent of all black carbon emissions in India, with approximately two-thirds of those emissions attributable to brick kilns. Use of traditional technology in brick kilns results in emissions from chimney releases great no of toxic pollutants. These toxic fumes contain suspended particulate matter rich in carbon particles, high concentration of CO, SOx, NOx etc. Selfishness on the part of private enterprise and their callous attitude towards public well being and social costs (Carter *et al.*, 1985) and natural disasters (Huppart and Sparks, 2006) make pollution bigger than mere a problem.

Kashmir being no exception also faces threat from environmental pollution, the major sources of which include ever increasing and expanding number of Brick Kilns using crude technology, low quality coal with high ash and sulfur content with construction sector in full bloom the demand for bricks is ever increasing leading to their unregulated scattering all around towns, cities, villages.

Study site

Plate I: Satellite image of study area.

The study was undertaken in two different districts of Kashmir.

Site I in Sumurbugh Lasjan area, falling in Srinagar district. The site selected had a cluster of brick kilns operating in each other's vicinity. It was not possible to locate an isolated kiln in the area, foretelling the environmental status of area.

Site II was in Zodar area, lying in the interiors of Anantnag district of Kashmir, where no interference from any other direct polluting source was given priority in order to evaluate the impact of this isolated kiln on different air parameters.

In last few decades mushrooming growth of brick kilns is being witnessed in both areas perhaps owing to clay content of their fertile soil.

Materials and Methods

To monitor the emissions from Brick Kilns, air analysis using high volume air sampler, was carried out. Air sampling for four parameters i.e. RSPM, NSRPM, SO_2 and NO_2 was done on operational basis i.e. one in pre-operational phase, another during operational phase and third in post operational phase of brick kilns in case of Site I and site II using High Volume Air sampler. The sampler measures the concentration of SPM, NRSPM and gaseous pollutants (SO_2 and NO_2) in the ambient air. The sampler was equipped with impingers to collect the gaseous pollutants (SO_2 and NO_2). Sampling was carried for 6 hours at both sites in all three seasons and the samples were transported to the laboratory and refrigerated until analysis in order to minimize volatilization and analyzed within 24 hrs.

Oven dried and pre-weighed glass microfiber filter paper (GF/ A) was used for particulate matter analysis.

Standard method of Jacob and Hochheiser (1958) was followed for measurement of Nitrogen dioxide. Ambient nitrogen dioxide (NO_2) is collected by bubbling air through a solution of sodium hydroxide and sodium arsenite. The concentration of nitrite ion (NO_2^-) produced during sampling is determined colorimetrically by reacting the nitrite ion with phosphoric acid, sulfanilamide, and N-(1- naphthyl)-ethylenediamine di-hydrochloride (NEDA) and measuring the absorbance of the highly colored azo-dye at 540 nm.

Modified West and Gaeke method (1956) was adopted for measuring Sulphur dioxide wherein, air-exposed samples are treated in a solution of potassium tetrachloro-mercurate (TCM). The dichlorosulphitomercurate complex so formed, is subsequently made to react with pararosaniline and formaldehyde to form the intensely coloured pararosaniline methylsulphonic acid. The absorbance of the coloured solution is measured with spectrophotometer at 560 nm.

Results and Discussion

Among the highly polluting units, Brick kilns in Kashmir can be counted as one, as they are using crude technology, inferior fuel; which includes low quality coal, wood, biomass available in the area and even rubber tyres, absence of control equipments and use of outdated technology as Bull's Trench kilns and inefficient firing technologies contributes to particulate and gaseous emissions which is a common observation across all the kilns we happened to visit. The impact is clearly visible from the results which are summed up as below.

The highest concentration of 110.42µg/m^3 of NO_2 was estimated for Site I during post-operational phase which could be attributed to certain atmospheric parameters that are prominent during winter. As per air quality index, this suggests unhealthy air condition especially for sensitive groups. While as the value for Site II corresponds to moderate air quality i.e. 94.32µg/m^3. However not much deviation was observed from these values in operation phase at the site where the trend observed was 103.06µg/m^3 for Site I and 99.21µg/m^3 for Site II and for both of the sites lowest values were observed during pre-operational phase where NO_2 showed 81.53µg/m^3 value for Site I and 70.13µg/m^3 value for Site II.

Similarly values for concentration of SO_2 estimated, appeared to follow similar trend i.e. more at Site I than Site II except for the fact that concentration of SO_2 corresponds to higher value during operational phase. Again value for concentration of SO_2 in pre-operational phase did not vary much from value in the post- operational phase. The trend observed was 105.97 µg/m^3 at Site I and 97.28 µg/m^3 for Site II for pre-operational phase and 103.34 µg/m^3 for Site I and 105.13µg/m^3 for site II in post-operational phase.

RSPM values at Site I were found to be dwindling between the highest value of 250.06µg/m^3 during operational phase followed by lowest value of 132.83µg/m^3 during post operational phase. At Site II highest value of 205.57 µg/m^3 of RSPM corresponded to operational phase while lowest value of 121.03 µg/m^3 was observed during post-operational phase.

The comparison of NRSPM revealed that Site I at Sumurbugh always exhibited higher scale of 283.26 µg/m^3 as compared to Site II, at Zodar where value equaled to 257.53 µg/m^3 during operational phase while post operational phase showed least value declining to 232.18 µg/m^3 at Site I and 217.81 µg/m^3 at Site II.

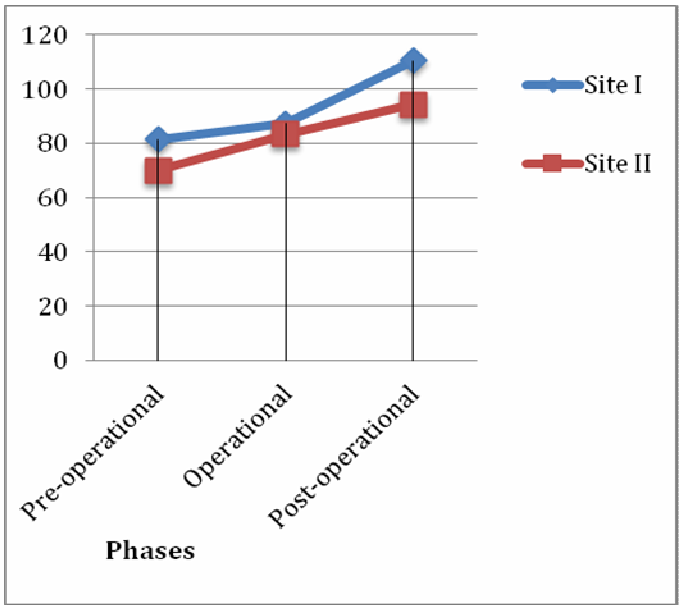

Fig. 1: NO_2 values for the sites during the three phases.

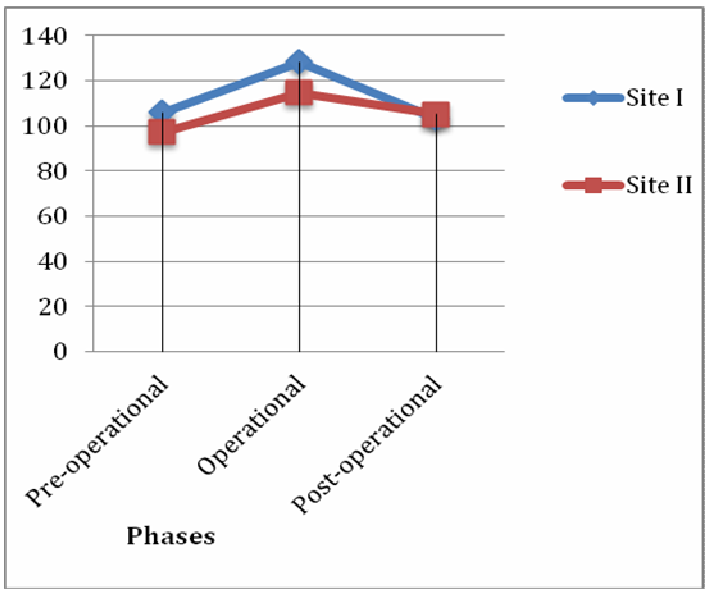

Fig 2: SO_2 values for the sites during the three phases.

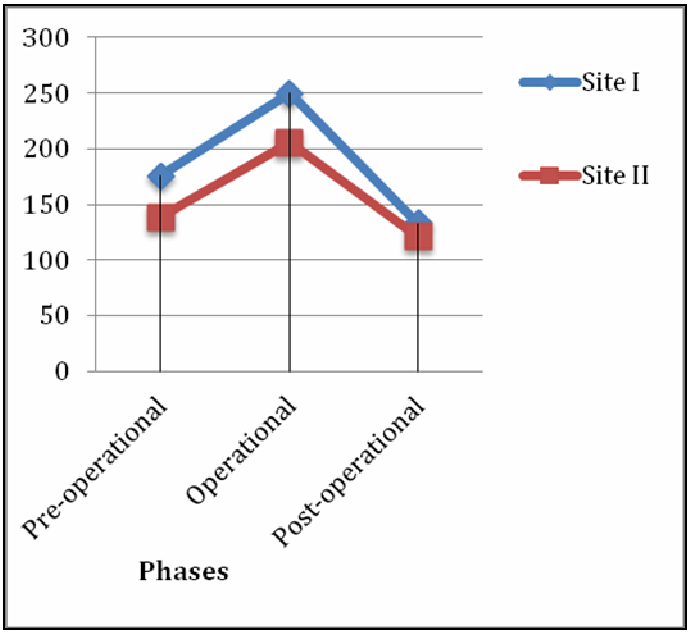

Fig. 3 : RSPM values for the sites during the three phases.

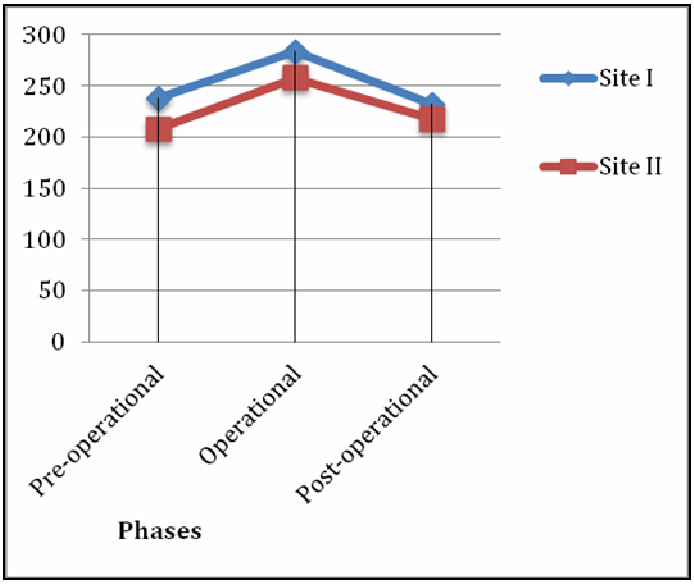

Fig. 4 : NRSPM values for the sites during the three phases.

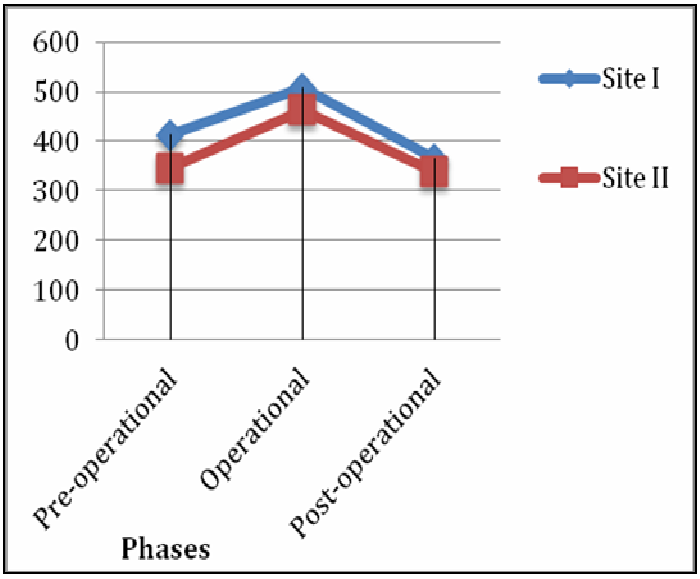

Fig. 5 : SPM values for the sites during the three phases.

The cumulative pattern emerging from air quality data reveals significant high levels of SO_2, NO_2 and SPM levels at both sites with Site I leading. The impact is quantified further by another observation that brick burning season coincides with dry season when air pollution levels are at their peak. Brick kiln industry is destroying vast tracts of land every operational season causing top soil degradation. Repeated heated cycles alter soil texture inhibiting the infiltration of rain water affecting ground water supplies in the area. The chimney height in most of the cases didn't meet the stipulated requirements, hence causing pollution. This is further aggravated by addition through fugitive emissions. The natural environment is regularly contaminated with chemicals and noxious gases, released by brick kiln units. Brick kilns have been permitted to establish themselves merely within 50mts radius of agricultural fields, saffron fields and residential lands. This volume of dust and pollutants also will affect the agriculture fields as well the yield they produce. As dust particulates get deposited on plants especially on leaf surfaces as well as on ground soil, they affect growth through biological changes. Similarly particulate matter is responsible for reduced carbon dioxide exchange thereby affecting photosynthetic performance (Ulrich *et al.*, 2009). This also increases the chances of higher levels of ground level pollution. Detrimental effects of SO_2 and NO_2 on plants and their produce have already been studied by (Belnap *et al.*, 1993). This will result in fatal health problems to nearby people, besides affecting plant population as well as total environment. Unofficial reports suggest 70% of the units are operating illegally, in sheer violation of existing norms. As toxic substances add to the environment, they hold the capability to alter the ecosystem (Mudd and Kozlowski, 1975); (Niragau and Davidson *et al.*, 1986); Claytton *et al.*, 1992). The pollutants released from the kiln, spread over a large area and affect the vegetation, soil and other natural resources.

Conclusion

From the results it is clear that air pollution of considerable magnitude has spread throughout Kashmir. The five major areas of concern include small sizes of kilns and brick manufacturing entities, energy inefficient processes, choice of fuel, unregistered or illegal status and seasonal operation. The architecture of kiln, nature of fuel used, incomplete combustion and lack of emission control contribute to release of contaminants and high concentration of pollutants from kilns in form of flue gases. At this observing level of pollution, the risks for public health stand very high. Though the levels of particulate levels remain a strong concern, newer concern around NOx and Ozone and ultrafine particle is growing.

CPCB across the country has already asked brick kilns to make this shift, after they were identified as a significant source of pollution, but the progress in conversion is slow. The brick kilns in Kashmir need to switch over to zigzag technology and VSBK the benefits of which are many. Green belts should be established along the periphery of kiln .Spraying of water should be commonly adopted .Coal with low sulphur content should be used. Height of stack should be well adjusted as per given guidelines. Establishment of kilns should be done away from residential areas and fertile plains. Though these might sound simple but they can reduce emissions, both chimney and fugitive, to a great extent.

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