Impact Of Air Pollution And Its Remedial Measure At Pasakha

Tashi Choden[1], Tshering Cheki[2], Loday Jamtsho[3], Tshering[4]

Department of Civil Engineering and Architecture, College of Science and Technology
Royal University of Bhutan

* E-mail: 2010109@cst.edu.bt[1], edc2011055@cst.edu.bt[2], 20101056@cst.edu.bt[3]

Abstract

The study focuses on the extent of air pollution and its impact on the human health, vegetation, agriculture, subsurface water and soil at Pasakha industrial area. To study the health impact, the region was divided into three areas and questionnaire survey was carried out to assess the adversely affected area. The morbidity report of industrial and non-industrial were compared to see the variation in numbers of cases for the pollution associated diseases. People residing within the industrial area were found to be suffering from air pollution related diseases as compared to those who were residing in the non-industrial area. Visual inspection of the vegetation cover was carried out within an area of 3.06 km^2 including the farming villages to evaluate the change in vegetation and agriculture production. The most common plants and crops diseases namely chlorosis and necrosis along with air pollution were identified as one of the contributing factors for the reduction of agriculture production over the years.

Water and soil test were carried out on samples collected from different locations in the affected area and it was established that there was no significant effect on the quality of soil and water. Various tests values such as pH, acidity, alkalinity, sulphate etc. were found to be within the permissible limits set by NEC.

Though only PM10 is monitored currently at Pasakha, the presence of other pollutants was confirmed from the source of emission and impact study. The inadequacy of the current monitoring station is discussed and the remedial measures are proposed for the improvement of the monitoring schemes. The proposed air quality monitoring network is based on the effectiveness of the area coverage, the varieties of the pollutants it can monitored, the consistency and accuracy of the methods and the user friendly.

***Key Words:** Air pollution, PM10, health impacts, vegetation impact, agriculture impact, soil and water impact.*

1. INTRODUCTION

The atmosphere, which makes up the largest fraction of the biosphere, is a dynamic system that continuously absorbs wide range of solids, liquids and gases from both natural and man-made sources. Various amounts of contaminants continuously enters into the atmosphere. The portion of these contaminants which cause toxicity, disease, aesthetic distress, psychological effects or environmental decay is known as pollutants.

Air pollution means the presence in the outdoor atmosphere of one or more contaminants, such as dust, fumes, gas, mist, odour, smoke, or vapour, in quantities, with characteristics, and of durations such as to be injurious to human, plant, or animal life or to property, or which unreasonably interfere with the comfortable enjoyment of life and property. (Rao, 1989).

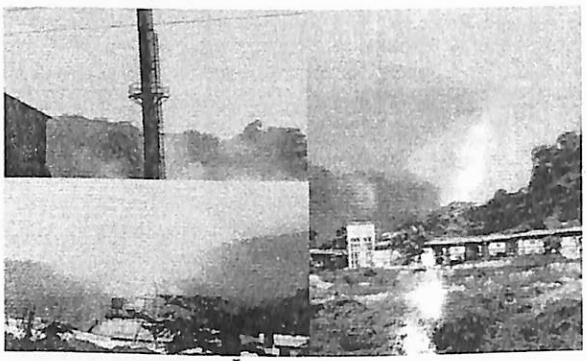
2. PROBLEM STATEMENT

Apart from the visual observation of the billowing smokes from the industries at Pasakha and several media coverages on the prevailing air pollution, there is no valid data or study carried out to validate the impact of the air pollution. The Bhutanese (11th April, 2015) reported that "In the case of Pasakha it (air pollution) increased by 41% in 2013 from 2% in the year before. More than 33 percent of the days monitored, during the first quarter of 2011, showed concentration of air pollutants in Pasakha exceeded the allowable limit according to reports from NEC. On January 4, the online air pollution index of NECS for Pasakha industrial es-tate showed 217.14 microgram per cubic metre, 17.14 more than the standard 200 microgram per cubic metre." Kuensel (13th January, 2013). The public perception and concern on the impact of air pollution are growing increasingly according to a report by BBS (26th February, 2015) which stated that "The residents

of Pasakha say they are worried about the impact of worsening pollution in their area on their health and environment."

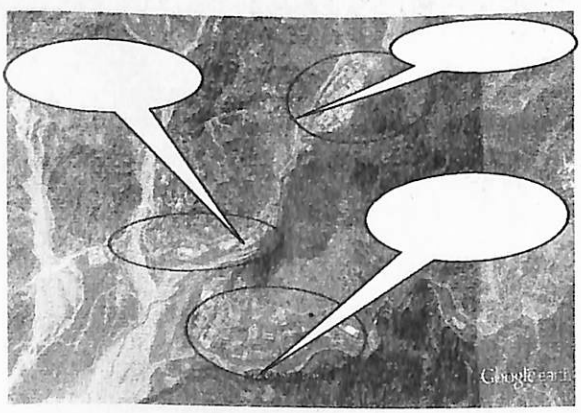
Pasakha Middle Secondary School was located at the heart of the industrial estate of Pasakha. The various problems of pollution such as air, noise, water, etc. posed a great risk to the health of the students. So, the school was relocated at safer site at Ahalley in 2013.

(Reported By: LekiWangdi, Principal, Chumithang MSS).



3. LOCATION OF THE STUDY AREA

Geographically, the southern belt of Bhutan is the foot-hills of the Eastern Himalayas which fall Roughly within the latitude corridor of 26°50' to 89°27'14" N; and climatically, the foothills are of sub-tropical nature with broad-leaf rainforests with the temperature lying between 18 degrees in winter and 38 in summer.



Though Pasakha area as a whole is taken as study area, the area is specifically divided into three zones to study and compare the impact. It is divided with accordance to the intensity of population, location and number of industries and sources of emission of air pollution.

4. OBJECTIVE

- The research is based on following objectives:
- To study the impacts of air pollution at Pasakha.
- To validate the impacts of air pollution at Pasakha.
- To provide a remedial measures for the impact of pollution.

2. IDENTIFICATION OF SOURCE OF EMISSION

5.1. SITE VISITS

The three day visit to all the 11 industries at Pasakha was to identify and quantify the pollutants released by the particular industries. The type of industries, the different types and quantity of raw materials fed for the production, the equipment used, the pollution control measures taken, total production annually, the time of release of the pollution in air is enquired to achieve the above objective.

The emission of the pollution from the various types of vehicle movement is also taken into consideration for the prevailing air pollution at Pasakha.

5.2. Location

Only one respirable dust sampler (RDS) is present at trade office to monitor the pollutant PM10. They are written just as the sub-headings for sec-tions are done, but follow alphabets with period. No spacing of lines is left before and after every sub-heading.

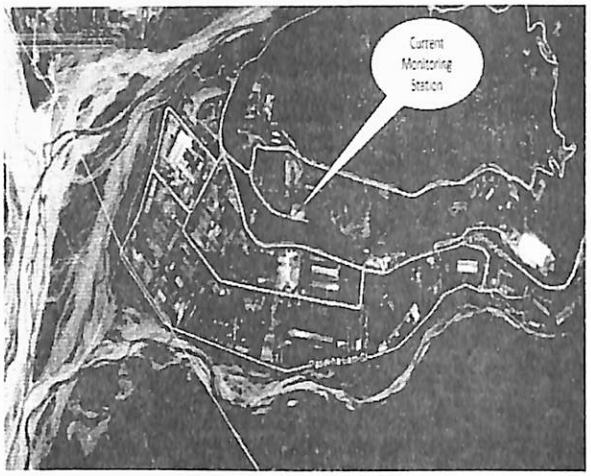


Fig. 3: Current monitoring System

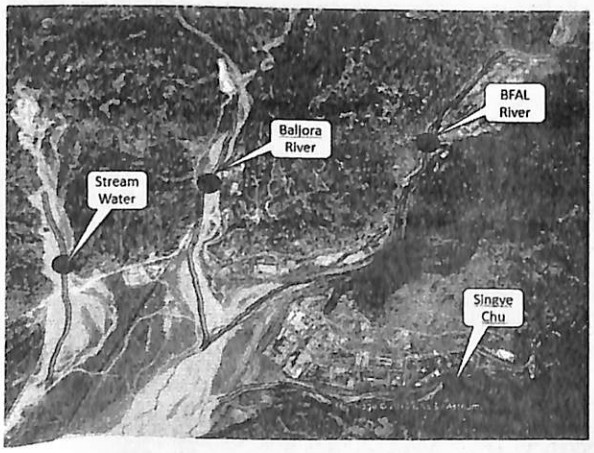
5.2.1. PM10

The concentration of PM10 is monitored daily when it is not raining. NEC installed RDS from 2011 to monitor the PM10 level at different location across the country. One is situated at Pasakha and one at CST, other at Thimphu and Kanglung.

It was observed that due to lack of reagents and equipment, other pollutants such as oxides of nitrogen and Sulphur are not monitored.

Pm10 also not consistently monitored due to lack of skilled personnel when a concerned person is on leave.

5.3. Water Test



The samples from four stations were tested in the Public Health Engineering lab using the standard methods of testing. The methods and test procedures are shown in the Appendix. The parameters tested for all samples are given below.

1. Acidity test
2. Alkalinity test
3. Total dissolve test
4. Hardness test
5. Sulphate test

5.4 Soil Test

Soil sample are taken from different areas of Pasakha according to the possibilities of having impact on soil due to pollutants produced by various industries. To compare the concentration of pollution produced by pollutants from industries, different locations of soil sample are taken. The First sample is taken from Industrial area near Ugyen Ferro alloys Ltd, Second sample near BFAL area, Third sample near Tashi Beverages Pvt. Ltd. and fourth sample from Baljora residential area.

5.5. Impact on Health

5.5.1 Questionnaire Survey

Though Pasakha area as a whole is taken as study area, the area is specifically divided into three zones to study and compare the impact. It is divided with accordance to the intensity of population, location and number of industries and sources of emission of air pollution.

Out of 150 questionnaire survey, each area is circulated with 50 questionnaires. The targeted people were employees, family, shopkeepers and students of Pasakha. The purpose of the questionnaire is to find how air pollution is affecting the people working or residing at Paskha.

5.5.2 Health Impact Zonation Map

From the questionnaire survey, the data of air severely air pollution have affected the people on the different locations are identified. The health impact zonation map is produced with the help of ERDAS Imagine and ARCG is software.

5.5.3 Morbidity Data

The morbidity report of industrial area and non-industrial area are collected for the comparison to analyze and validate whether the air pollution is having any impact on the human health or not.

For the industrial area, the data is collected from the private BCCL BHU which provides medical aids to BCCL and BFAL employees and their family. It caters the medical services to approximately 1200 people.

For the non-industrial area, the morbidity report of CST Infirmary is studied. The college infirmary provides a service to 1100 people including students, faculty and their family and the people residing around the campus.

The morbidity reports of both the parties from 2011 to 2015 were studied thoroughly.

5.6. Impacts on Vegetation

The area in and around the premises of industries at Pasakha is closely studied by visual inspection to see the change or difference in vegetation. Any unusual changes were noted and through the literature review as references, the diseases of the plant are identified. Also the pollutants causing the diseases in the plant are verified.

5.7. Impacts on Agriculture Production

To find the impact on the agriculture productivity due to air pollution we visited the village and individual farm and checked the crops and enquired about the variation in the crops production over a past few decades.

We could access the annual compiled of Agriculture productivity record for the year 2013-2015 from the RNR, valley to study the variation in agricultural production. The data is studied and correlated how the particular pollutants are affecting variant crops in different ways.

6. AIR QUALITY MONITORING NETWORK

6.1.1 Limitation of Current Monitoring Station

- Currently only one Respirable Dust Sampler (RDS) at Trade Office.
- RDS can monitor a pollutant at a time.
- Need for continuous supervision.
- Inability to provide a consistent data of pollutant. Laborious.

6.1.2. Remedial Measures

From the foregoing analysis, results and discussion, it was established that there is environmental degradation, loss of health and vitality of the local population and reduction in agricultural production in the vicinity of the industries in Pasakha. It is however not conclusive as to a particular pollutant causing the impact. Therefore it is impertinent that vigilant monitoring of the various pollutants and their levels be studied to ascertain the pollutant causing a particular impact. To achieve this, it is hereby recommended that air quality monitoring stations be improved by increasing the number of stations as well as installing state of the art equipment.

6.2. Proposed Location of additional Air Quality

Monitoring Station and Equipment

Method

1) Method : Local Air Monitoring Network (LAMS)
2) Network scale : 100 -1000m
3) No. of Stations : 3

4) Equipment Proposed: a. Instrument Pm10 / PM2.5 Sampler & Model 85-02

b. Radiello Sampler (NOx and SOx)

5) Need to design separate station to control, monitor and for storage purpose.

The Radiello Sampaler needs to be set up 3m and above from the ground level (CH2MHill, 1997).

6.2.1 Site Selection

- Total Population of Pasakha: 6526 (NSB).
- Source of emission: 34 industries & vehicle movement.
- Station 1(Industrial Estate Area): 19 plot of industries are located.
- Station 2 (BFAL Area): 11 plot of Industries located.
- Station 3 (Baljora): 3 industries, access to main road and residential area.

7. CONCLUSION

Air pollution from the industries have health hazard on people. They are more prone to immediate impact diseases compared to non-industrial area.

The health of the employees are more suscep-tible than the family. It depends on the time of exposure.

The diseases such as necrosis and chlorosis indicate the presence of other pollutants.

There is an average of 11% reduction in agri-culture productivity from 2013-2015 to 2015-2015.

An increment of 20-30% of PM10 concentra-tion every year.

Suggestions for Mitigation Measures

Improvement of current monitoring stations for other pollutants.

Use of de-dusting filter.

Use of electrostatic precipitator.

Use of environmental conservation technolo-gies.

8 RECOMMENDATION

- Strict supervision and monitoring of the air pollution is required.
- Development of industry-specific emission guidelines.

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