

## **APPRAISAL OF ENVIRONMENTAL POLLUTION: A CASE EXPERIENCE OF SPONGE IRON FACTORY**

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### **Abstract**

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**Keywords:**

Environment;

Pollution;

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soil;

water

*The sponge iron factory situated at Bakternagar in Burdwan district of West Bengal has been able to bring about economic development in the surrounding region by enhancing the job opportunities but it is also considered as a great threat to the physical quality of human and cattle health as well as to the agricultural productivity in the neighbourhood region. The paper attempts to assess the consequences of pollution on the rural communities residing in the vicinity of the sponge iron factory and examine the negative externalities. The analyses of water and soil were done using the standard testing methods. The water, dust and soil test clearly indicates that the factory potentially deteriorates the environment by polluting the air, water and soil.*

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## 1. Introduction

Environment has become a prime concern of mankind's economic, social, development and survival relationships. The policy makers are now confronted with the need to reconcile environmental concerns with developmental imperatives. With the deteriorating air quality perhaps at its all time low, people now no longer believes in old days health prescriptions of miles of open air walk rather prefer to stay indoors specially in the industrial zones. The increasing health consciousness has raised the demand for a cleaner environment with a breathable air. Thus environment protection and sustainable development has become an integral part of human wellbeing.

Recent studies reveal that industrial pollution has inflicted damage to livelihoods and agriculture causing the small and marginal farmers in the adjacent areas to suffer the most. While substantial literature is found on the impact of air pollution on health, very few studies exists on the impact on livelihood and livestock. However, in recent studies attempts are made to assess the impact on other sectors of the economy [1],[5],[6].

This study focuses on the pollution created by the sponge iron factory situated in the Durgapur Raniganj industrial belt of West Bengal to its vicinity area. Sponge iron factory is been classified in the 'red' category industry (highly polluted) by the Central Pollution Control Board (CPCB). But there is strong evidence that questions the efficacy of the environmental monitoring and enforcement board. It lacks accountability, transparency, capacity and efficiency.

The study provides an opportunity to understand the acuteness of the problem with an intention to estimate the impact on health of the rural communities, crop production and livestock. The issues to be addressed are: impact on human health, farming and livestock, the environmental damage caused to the air quality, water and soil texture in terms of pollutants contained and the policy interventions needed to sort out the problems.

## 2. Materials and Method

Bakternagar, the study village falls under the Ballavpur gram panchayet of Barjora block of Burdwan district of West Bengal situated beside the Raniganj coalfields. Residents of the region

are worst victims of pollution. They suffer losses in terms of low crop yield, cattle loss, health problems, contaminated drinking water, skin diseases etc. The study aims at evaluating this impact of pollution on the local habitat based on the information collected from survey observations conducted during January 2017. Group discussions were held with the residents of the village who actually suffers the emission.

Samples of soil, water and dust from surface top was collected for analysis. The samples of the water were collected from a local pond, situated within the village heavily used by the villagers for bathing and other domestic activities. The soil was collected from a nearby agricultural field, where crop were sown.

### **3. Results and Discussion**

#### **3.1 General Perceptions of the people about impact of pollution**

Soon after the factory was setup, agitations were held when people started facing problems. The villagers jointly revolted against the dust deposition coming out from the sponge iron factory especially during night when the emission control device (electrostatic preceptor) is switched off. A complain was launched and protests were organized, but the outcome was reversed. Few villagers were arrested for creating unrest and were given false charges of destroying property during protest. It covered the headlines of the local news but no policy interventions were made to sort out the problem. According to the local people, no enquiry was made to the villagers as such they had no option but to compromise with the situation. Villagers complained about the nexus between the factory owners and the police.

The dwellings within the two kilometers range of the factory are most vulnerable. Over the years since its inception, the crop yield has reduced, most of the land become barren with deposition of heavy chemicals in the agricultural fields. Some of them even sold their land since they had no other choice when production started falling over the years. Migratory fluxes have increased from the surrounding villages in search of breathable air. Most commonly found disease is cough and cold resulting from dust allergy followed by skin and eye infection. Elderly people often suffer from respiratory troubles with reduced life expectancy. The black smoke coming out from the factory is deposited in the nearby water bodies like ponds, lakes and wells which are used by

the villagers for domestic works. The trees were found coated with thick layer of grey dust. According to one villager they cannot remember when they have last seen leaves to be green. The paddy grains were coated with this deposition of dust which makes them black. The blackish grains are rendered unsalable. Producers are incurring losses which have dampened their spirit to continue cultivation as their occupation.

### **3.2 Types of Pollution:**

Survey confirms that the types of pollution that the inhabitants face in the region are water, air, soil and even noise pollution. All the respondents were facing air, water and land pollution except a few households which are situated nearer to the factory complained about the irritating noise that comes out of the factory especially felt the most at night. Students feel disturbances in their studies.

Air pollution in the region was seriously felt by all the residents. They had very hard feelings about the contaminated air they inhale. They cannot even keep their doors and windows kept open for few minutes as that would result in a sheet of dust over everything inside the house. The rooftops of the houses were found to be carrying a sheet of black residue. The houses needed to be paint wash every year for maintenance. As such the maintenance cost is higher than normal. Females complained that they have to clean the floors several times. Infants crawling on the floor are most vulnerable. They often suffer from stomach infections.

Water bodies surrounding the villages were found with a layer of dust settled over the top surface. People using these water bodies for bathing and other domestic purposes often suffer from skin disease and allergies. Some households having private wells reported that they cover the wells with plastics at night when the smog is more and keep open at day time.

### **3.3 Impact of pollution on:**

#### *Agriculture:*

Relation between pollution and livelihood cannot be underestimated in an agro-based region. The damage inflicted to agriculture due to pollution ultimately threatens the livelihood of the farmers or persons dependent on agriculture as the main source of income. Most of the

households of Baktarnagar who possess land holdings are either engaged in farming as main source of livelihood or conduct farming through share croppers. But it is evident that overtime farming is become increasingly difficult with deteriorating soil quality. Agricultural fields nearer to the factory are left barren. The size of the paddy grains has reduced and unable to sale at reasonable price.

#### *Livestock:*

Livestock rearing, an activity very much associated with farming has also become a problem. Cattles grazing on the smog-deposited grass possess ill heath resulting in skeleton figures. Milk production reduced and even the cow dung appears blackish. Cows which feed on the grass from these fields often suffer from diarrhea and dysentery. This has burdened the cattle rearing with increasing veterinary cost.

#### *On Health:*

Water, air and soil quality in a specific geographical area have a great role in influencing the quality of life of human beings surrounding the region. People living in a particular region usually depend on the local water resources, ambient air quality and soil productivity of that region for sustaining life and eking out a healthy productive livelihood. According to the estimates of the global burden of disease (GBD), about 18 million light years are lost every year and over 627,000 people prematurely die due to health hazards caused by tiny particles).

According to WHO (2003) report, life expectancy in the developing countries is decreasing due to disposal of industrial effluents in the environment causing great damages of ambient quality of these three resources. Though the exact measurement of pollution impact caused by industrial effluents is rather difficult, the potential of health damages caused by such toxic elements is far greater compared to domestic refuse.

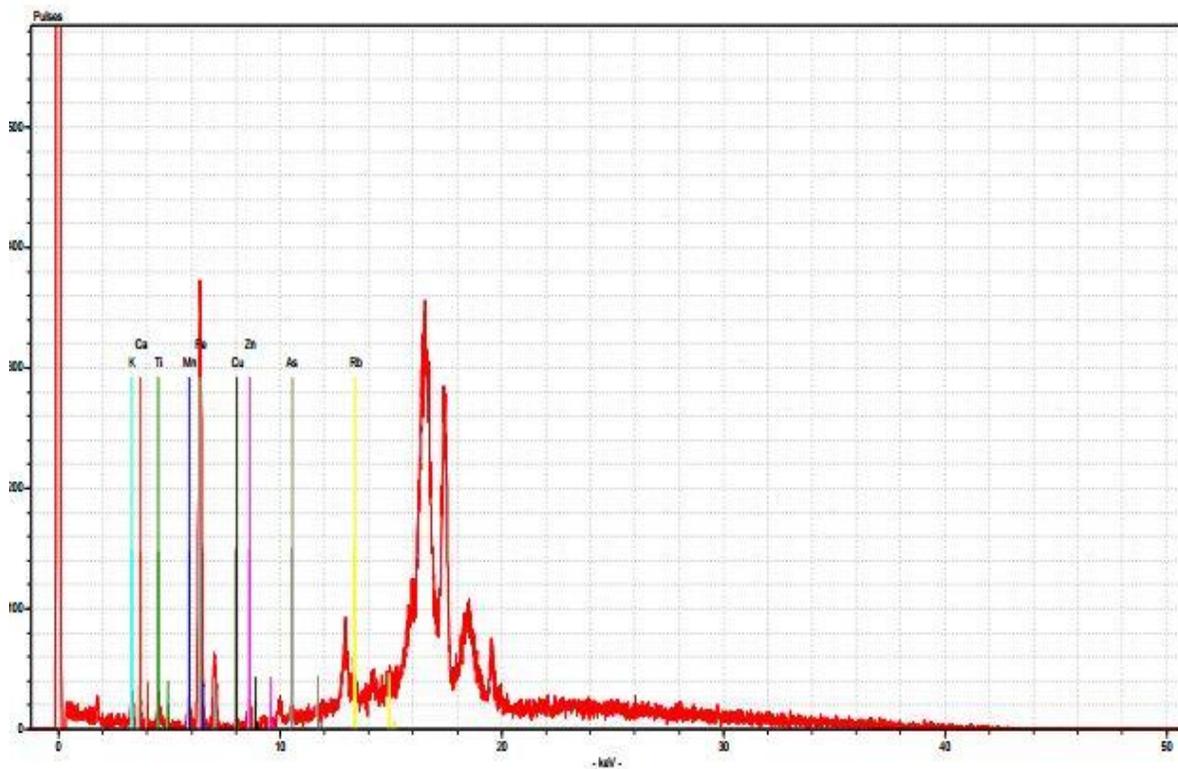
The adverse impact of industrial pollutants are manifest in various forms that include damages to sensory organs or sometimes slow moving permanent damages to internal physical functioning process. In order to assess the vulnerability of the local people to the probable diseases caused by toxic emission of the power plant, the study targeted a section of people who were residing in the neighborhood (within a radius of 3-4 km) of the plant. The major health problems as reported

by the local people included diseases like gastroenteritis, cholera, dysentery, respiratory problems, eye problems, skin diseases and dental problems. Apart from this, they also reported problems like nausea, headache or drowsiness to which they have become partially accustomed which of course have affected their productivity.

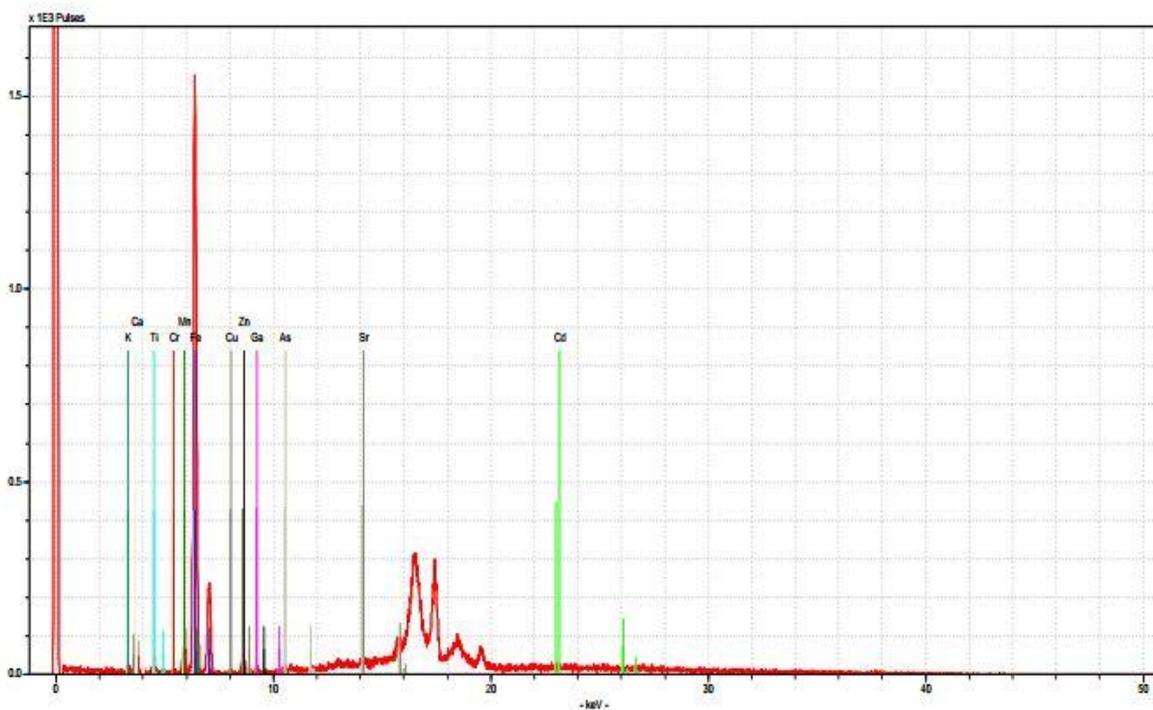
#### 4. Analysis of the water and soil tests in terms of pollutants

To assess the air, soil and water pollution in terms of pollutants deposition intensity, usability of water, deposition of air particles tests were performed.

Soil and dust samples collected from the adjacent agricultural field of Ballavpur Sponge Iron Factory, Raniganj, West Bengal were analyzed by a Bruker Nano GmbH , Product ID 1207-0000-000, serial number 6264 (made in 12489 Berlin, Germany) having X ray Flash Detector lying in the University Science Instrumentation Centre, The University of Burdwan, Golapbag Academic Campus, Burdwan, West Bengal.



**Fig 1: Spectral pattern from XRF of soil sample collected from the adjacent agricultural field of Ballavpur Sponge Iron Factory, Raniganj, West Bengal.**



**Fig 2: Spectral pattern from XRF of dust sample collected**

Both the figures (Fig.-1 and Fig.-2) demonstrated the existence of strong iron signals which is quite possible as the samples were collected from the adjacent area of a sponge iron factory. Almost similar observation was reported by [2],[7].

XRF spectral signature of the said soil sample clearly reveals that some of the metal concentrations such as Copper (Cu), Zinc (Zn), Arsenic (As), Manganese (Mn) and Iron (Fe) are very high. However, other metals such as alkali [Potassium (K)] and alkaline earth [Calcium (Ca)] also showed strong peaks (Fig.-1).

Similarly, XRF study of the dust samples collected from the roof surfaces and leaf surface of the herbs and shrubs grown on the adjacent field of the said sponge iron factory clearly indicates the abundance of various transitional metal concentrations such as Chromium (Cr), Manganese (Mn), Copper (Cu), Zinc (Zn), and Cadmium (Cd) (Fig.-2). The existence of Arsenic (As) and Gallium (Ga) along with Potassium and Calcium (Ca) were also observed in dust sample.

*Microbiological Study of the water sample:*

Water sample collected from a heavily used water body of the target area was diluted up to  $10^{-4}$  with sterile water. A small volume of this dilution (0.1 ml) was inoculated in a number of Petri plates containing suitable nutrient agar medium. Plates were then incubated in a shaker-incubator at  $37^{\circ}$  C for 24 hours. Pure cultures of bacterial species were then prepared by isolate cultures of the bacteria collected from the composite bacterial colonies. Now the bacterial species were subjected to Gram Staining and IMVC Test series (Indole Test, MR Test, VP Test and Citrate Test). On the basis of microscopic morphological observation, staining properties, biochemical characteristics, preliminary identification of bacterial species were done using Bergey's Manual ([David Hendricks Bergey](#), 1923) for bacterial identification and seven different bacterial species were found. All these species are Gram negative and belong to the family Enterobacteriaceae. The possible bacterial species with the results obtained from four confirmative tests suggested by Bergey's Manual and their harmful effects are depicted in the following table:

Results of microbiological analysis of collected water sample clearly indicate the contaminated nature of the water. The identified bacteria in the water sample can cause a number of diseases which may sometimes be fatal. It can be inferred from the study that the source of this water sample can't be potable without proper treatment.

**Table: Microbiological study of the water sample including their harmful effects:**

Sl. No	Species	Indole Test	Methyl Red Test	Voges-Proskaus Test	Citrate Test	Identified as	Harmful effects
1.	Species-1	+	+	-	-	<i>Escherichia coli</i>	Diarrheal infection (with/without blood), Meningitis, Urinary Tract infection, Gastrointestinal infection etc.
2.	Species-4	-	-	+	+	<i>Enterobacter sp.</i>	Sepsis, Meningitis, enterocolitis etc.
3.	Species-5	+/-	+	-	-	<i>Shigella sp.</i>	Bacillary dysentery, UTI etc.

4.	Species-2	-	-	+	+	<i>Klebsiella pneumoniae</i>	Neo-natal infections, burn-wounds infection, Pneumonia etc.
5.	Species-6	-	-	-	+	<i>Salmonella sp.</i>	Typhoid and other enteric fever, Acute Gastroenteritis, Bacteremia etc.
6.	Species-7	+	+	-	+	<i>Vibrio cholerae</i>	Cholera
7.	Species-8	-	-	-	+	<i>Pseudomonas sp.</i>	Pneumonia, Skin folliculitis, Cystic fibrosis, Antibiotic resistance

## 5. Conclusion and ways forward

The study attempted to assess the impact of pollution resulting from the emissions coming out from the sponge iron factory and the findings clearly reveal that it has contributed to a number of environmental and economic challenges including damages to air, soil and water quality and threat to human and cattle health. The study also tried to estimate the negative outcomes such as deterioration of agricultural and livestock production, damages caused to human health. The analysis shows that dust particulates coming out of the factory caused a lot of harm to the living beings around and they are affected with skin diseases and constant burning. Agricultural production has declined overtime due to constant dust spill over. To address this problem, plantation programme should be carried out in the region. In this context credit facilities should be enhanced for farming activity. Incentives in some other forms can also be extended. Contamination of water due to pollution has made fresh water virtually unavailable. Fresh water supply through pipe networking should be enhanced. Cattle feeding on fodder coated with fly ash have put a threat to the farming occupation. Cattles often fall sick and become prey to pollution related diseases. More efforts should be given to set up veterinary dispensaries in the vicinity and extend the related services. Human health hazards are severe with insufficient

facilities. Health infrastructure should be improved with proper monitoring of the facilities provided.

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