ENSEMBLE
A bi-lingual peer reviewed academic journal
ISSN: 2582 - 0427 (Online)
Vol. 3, No. 1
March, 2021
http://www.ensembledrms.in

Article Type: Research Article
Article Ref. No.: 21021800712SF
https://doi.org/10.37948/ensemble-2021-0301-a031

SPONGE IRON INDUSTRY IN BARJORA INDUSTRIAL AREA, BANKURA DISTRICT, WEST BENGAL: AN ENVIRONMENTAL IMPACT ASSESSMENT

Papia Nandy Palit[1]✉

Abstract:

The industry has got severe negative consequences over the growth and development of any area. The present investigation was carried out in the Barjora area, Bankura, West Bengal to assess the impact of the sponge iron industry on the local environmental setup. The entire study was conducted through the survey method. Results reveal that the sponge iron set up in the Barjora area has severe negative consequences on various spheres of the environment. Results reveal a significant impact on agriculture, human health, impairment of water quality, air pollution, a decline in local flora and faunal status, changes in plant morphological and physiological features. Therefore, a suitable strategy formulation for eco-friendly alternatives is very much essential to minimize the impact of sponge iron setup in the Barjora area, West Bengal, India. To make various operations in the steel industry environment-friendly, environmental audit and life cycle assessment of existing steel plants (including sponge iron units) would be encouraged so that the relevant processes reduce emissions and effluents, minimize and better manage solid waste generation, and improve resource conservation such as energy and water.

Keywords: Agriculture, Consequences

1.0 Introduction:

Air pollution is recognized as a major threat to human health. Due to heavy-loaded industrial air pollutants, people are suffering from a wide range of health effects, especially on the cardiorespiratory system (Barik et al., 2005). Sponge iron provided the main source of iron for many centuries before the blast furnace was developed. In historic times, sponge iron was produced in shallow hearths, which used charcoal as reductant fuel. The product of these early smelting processes was a sponge mass of coalesced granules of nearly pure iron intermixed with considerable slag. A process that produces iron by reduction of iron ore, below the melting point of the iron produced, is called direct reduction processes, and the products are referred to as Direct Reduced Iron (DRI), commonly called sponge iron. In modern times, sponge iron has found increasing use in the manufacture of wrought iron and as a substitute for scrap during steelmaking. Sponge iron is chemically more active than steel or iron millings, turnings, or wire strips. Sponge iron known as Direct Reduced Iron (DRI) is a basic input for steel production. Hence the sponge iron industry is also contributing to the economic development of our country by supplying inputs to the steel sector. The decade 1996-2006 witnessed a phenomenal growth of the

1 [Author] ✉ [Corresponding Author] Assistant Professor, Department of Geography, Barjora College, Barjora, Bankura, 722202, West Bengal, INDIA. E-mail: drdpalit@gmail.com

sponge iron units in some parts of the country including areas in and around Barjora, Bankura, West Bengal marks significant progress.

A typical Sponge iron industrial area is afforded by air, water and sire pollution as well aschanges in topography, land use/land cover (LULC) and vegetation patterns (Behera and Ratna Reddy,2002). Sponge iron factories are categorized as red industries (highly polluted industries) and the major pollutants are of three types: Solid waste heavy metals (cadmium, chromium, lead, mercury and nickel). Particulate matters (suspended particulate matter and reparable particulate matter) and gaseous pollutants (oxides of sulfur, nitrogen and hydrocarbons) Sponge iron factories are categorized as red industries (highly polluted industries) and themajor pollutants are of three types: Solid waste heavy metals (cadmium, chromium, lead, mercury and nickel). Particulate matters (suspended particulate matter and reparable particulate matter) andgaseous pollutants (oxides of sulfur and nitrogen and hydrocarbons). Thus, all these factors cumulatively take a toll on the environment. The major social cost of this industry is environmentalpollution (Bhattacharjee 2007; Pandit et al., 2002) It is therefore important thathad asystematic study on environmental impact assessment is carried out to reveal the effects of the sponge iron industry on the surrounding environment (Sundar, 2005). In this paper, an attempt has been made to assess the people's perception ofthe impact of the sponge iron industry on the local environment. The study is purely based on an anthropo-geographical perspective.

It is observed that during the last few years, there has been a phenomenal growthof Sponge Iron units in the Barjora area (Bankura, West Bengal, India) and such growth has beenaccompanied by serious environmental impact in the surrounding areas, resulting in, contamination of water resources and destruction of food crops. The sponge iron units are thus critically air polluting in nature having a serious problem of emission of high concentration of particulate matter not only from point sources (rotary kilns, cooler discharge, raw material handling, and product separation house) but also for a high degree of defused secondary emissionof the particulate matter. Full proof air pollution abatement system for such units is yet to be arrivedat. Despite the installation of the emission control system, the sponge iron units are also causing environmental ecological disturbances. The main characteristics of this industry in West Bengal especially in Barjora are that most of the sponge iron plants are located in clusters. These clusterscomprise essentially small and medium scale plants. With the aim of the achievement of the basic objectives of the study to investigate the impact of sponge iron industries on the local environmentin the Barjora area of Bankura District of the state of West Bengal in India, our main task was to conduct an intensive field survey on the study area including all possible industrial, environmentaland socio-economic aspects. The empirical observations are found to be consistent with the background which motivated me to conduct this study and significantly support all objectives of the project.

2.0 Material and Methods Description of the study area:

Barjora is located in the northern part of the Bankura District consisting of 44 Mouzas under Borjora Panchayet Samity and38 Mouzas under Gangajolghati Panchayat Samity. The river Damodar just touched the planning area in the north. Geographically this planning area lies between 23°23' and 23°31' north of latitude and in between 87°05' and 87°20'east of longitude. It covers a little more than 220 sq km area where the total population as per the 2001 census is around one hundred twenty thousand This region is mainly covered by older alluvial soil and laterite soil. The average elevation of thisarea varies from 80 -140 meters above the mean sea level (MSL). The general slope of this area isfrom West to East. The regional climate is characterized by an oppressively hot summer, high humidity nearly throughout the years associated with distributed rainfall during the monsoon months. The temperature starts rising rapidly from the beginning of

March. The summer heat is particularly oppressive due to the high moisture content in the air. Occasionally, the maximum temperature rises to about 47^0C or 48^0C

3.0 Methodology:

Intensive field observations were made in different villages of Barjora industrial areas. Almost all the conventional methods of anthropo-geography, e.g. interview, observation were applied for the collection of data. Structured questionnaires/ spot interviews had been taken from different villages.

4.0 Results:

4.1 Impact due to Project Location:

Fivelocal economic environmental indicators are identified in this regard, agriculture, human health, air pollution, water and temperature. We have observed that air pollution (more than 40%) and human health (21%) are highly impacted by both project location and project operation in the study area. However other environmental indicators are also significantly influenced by location as wellas the operation of the project. It is observed that during the past few decades due to the phenomenal growth of the sponge iron industry in the Barjora region a significant amount of forest has been cleared. In this project not only local people are absorbed but also people from even outside the district get a job in the unit. Surrounding any sponge iron unit, a local market has grown up and the local stakeholders are benefitted from letting a room to the worker. The land, on which once rice cultivation was practised,is now purchased by an industrialist

4.2 Impact due to Project Operation:

There are three shift operations in the sponge iron plant/unit in a day. Among the day, afternoon and night shifts, the last one is safest because of the resting /sleeping time of inhabitants. From sunrise to sunset, the pollutants emanating from the chimneys of sponge iron plant is very harmful to all organisms including human being. Low chimney height and irregular chimney pathway clearance lead to the suspension of carbon, sulfur particle in the air causing pollution. Fig. 2 represents the impact of the operation of the sponge iron industry on the local environmental set-up of Borjora. It was observed that due to the operation of the Sponge iron industry higher level of air pollution is prevalent in the concerned study site. The major impact comes over on human health (21%)

4.3 Impact on Land Fertility:

Land is an important attribute in any of the environmental setup. Land fertility can be reduced under the influence of the sponge iron industrial setup. Fig. 3 represents the response of the respondents concerning the impact of the sponge iron industry on decreasing land fertility. The field survey report found that 66% of households in the study area don't think that land fertility is decreasing due to sponge iron plants.

4.4 Impact on Soil:

The response obtained from the respondents of the Barjora area revealed a higher loss of soil quality due to MnO dumping over the land area. (Fig. 1)

4.5 Impact on Land:

Among the surveyed respondents in the present study area, the majority (26%) responds that soil erosion and contamination occur, due to MnOdumping. Twenty-one parent respondents' opinions for soil erosion, Findings revealed that there is a decrease in soil fertility due to deposition of industrial water (19% respondents) and soil erosion and contaminationsdue to pollution(19%

respondents). About 11% of respondents replied that the quality of soil has slight deterioration due to the dumping of waste. A negligible respondent's opinion was pollution effects on soil health and decrease in soil fertility (Fig. 2).

4.6 Impact on Water Quality:

Water pollution caused due to excessive soil erosion and runoff from dumps led to a decrease in penetration power of light in water bodies, affecting the survival of living organisms. The majority of the respondents replied that pollution contaminates water. Another group of respondents (25%) opinion is that deposition of carbon soot particles on the surface of water bodies and water quality decreases. About 21% of respondents believed that a layer of fly ash has been observed on the water of ponds. Pond water has become unfit for bathing, washing utensils and drinking. The rest of 19% of respondents' views was the contamination of water bodies occur due to acid rain and changes in the water quality. During the present investigation, it was found that different forms of pollution significantly impair the quality of the water as reflected from the responses of the respondents during the survey. Deposition of carbon soot particles, acid rain, fly ash deposition, as well as domestic use patterns, was found to be the crucial factors for harming the water quality (Fig.3).

4.7 Impact on Groundwater Level:

Industrial activity was found to harm the groundwater level. the results reveal that 48% of households realize that the groundwater level is decreasing due to the industrial plants and the against view is also supported by 50% of total households (Fig. 4).

4.7.1 Water Quality Satisfaction:

The response scenario in terms of satisfaction in water quality was found to be significant for most of the respondents. However, there were exceptions to this fact as revealed in the present investigation. Due to the mushrooming of the sponge iron industry in the Barjora area, a significant amount of forest has been cleared. About 55% of respondents view is that of moderate deforestation, followed by 24% as low and 21% as high respectively. Morphological deformation and discolouration of leaves due to pollution has been observed. Deposition of carbon soot particles on leaves, obstruct transpiration of plants and affects plant health, rate of forest destruction.

4.7.2 Impact upon Plants:

Fig. 5 and 6 reflects the response of the respondents concerning the impact of the sponge iron industryon the plants. Results reveal that in the majority of the cases no specific information is obtained regarding the impact of the sponge iron industry on the plants. However, the water hyacinth population increased upto 9% followed by & 7% rise in *Eucalyptus* and *Acacia* species. Further 3% presence of *Parthenium* were reported by the respondents.

4.7.3 Impact on Plant Health:

Major physiological and morphological alterations of plant species were reported by the respondents of the present investigation. Increase in crop disease due to fly as deposition in the surficial layer, rate of transpiration and photosynthesis was reduced due to deposition of the fly ash over the leaves. Hower majority of the responses revealed no awareness concerning this issue (Fig. 7).

4.8 Impact on Animals

The various response of animals under the sponge iron industry under the Barjora area were reported by the respondents during their interview. The higher level of pollution is affecting the health of the species, deforestation is causing habitat loss for animals leading to intense man

wildlife conflict, the decline in the cow and goat population, declining area of grazing land causing a decline in the population of castles, decrease in fish population (Fig.8).

4.8.1 Impact on the physiology of animals:

In the present study, a maximum number of respondents (27%) replied about their experience with an abnormality in the tail structure of fish in the pond near the sponge iron plants. About 10%of respondents revealed that street dogs drink water from industrial ponds and form leprosy like patches all over the body. Loose stool in cows due to eating grass covered in fly ash is the experience of 7% of respondents. About 4% of the respondent's opinion is negative about the adverse effect of pollution on the number of cows and goats decreased because of ingesting fly ash-covered pastures. Half of the respondents have no information about the effect of pollution on the animal (Fig.9).

4.8.2 Impact on birds: Fig. 10

4.8.3 Impact on migratory Birds:

So far as the effects of pollution on birds are concerned, the number of ducks decreased (67% respondents opinion) and also the number of migratory birds has decreased (4% respondents view) in the past decades. About 29% of respondents have no information about the effect of pollution on birds. Surface water contamination has led to a decline in duck population, increase disease occurrence in birds, contamination of water is affecting the health of the birds followed by a decline in the number of migratory birds (Fig. 10 and 11).

4.9 Impact on Human Health:

Various forms of diseases such as skin disease, lung infection, cancer, other respiratory lung alignments, asthma, viral diseases were found to be prevalent under the rising level of pollution under the sponge iron industrial setup. However, the survey results reveal that majority of the respondents are relatively unaware of the health impacts of the sponge iron industry. Although some feedback was obtained from the respondents during the present survey in terms of fly ash pollution, allergic symptom and various other forms of diseases (Fig. 12).

4.10 Impact on Agriculture:

Agriculture is a major sector in India as it is the economic regulator of the country. Results of the present survey revealed that various form of disturbances such as diseases, irregular rainfall patterns, pollution due to industries significantly hampers the productivity of the agroecosystem. However, fly ash pollution reflects a decline in agricultural productivity through an increase in crop diseases.

4.11 Impact on Historical and Cultural Monuments:

The number of historical and cultural monuments in the present study area is few. Half of the respondents are indifferent about the adverse effect of pollution on the monuments. Findings reveal that there is the deposition of fly ash and particulate matter on the terrace and floor of buildings (27% respondent opinion). About 23% of respondents replied that those cultural monuments are getting affected due to carbon soot particles or fly ash on walls and floors. This happens due to the small height of chimneys.

4.12 Impact on Waste Management:

About half of the respondents are not aware of the unhealthy fate of sponge iron industrial waste. A maximum number of respondents (29%) opinion is that dumps of fly ash are seen on nearby industrial lands. After rainfall, the washed fly ash terminates into lowland, ponds and agricultural

land, causing pollution. According to 21% of respondents, the industry dumps fly ash in wetlands which are further used by farmers and builders for their purpose.

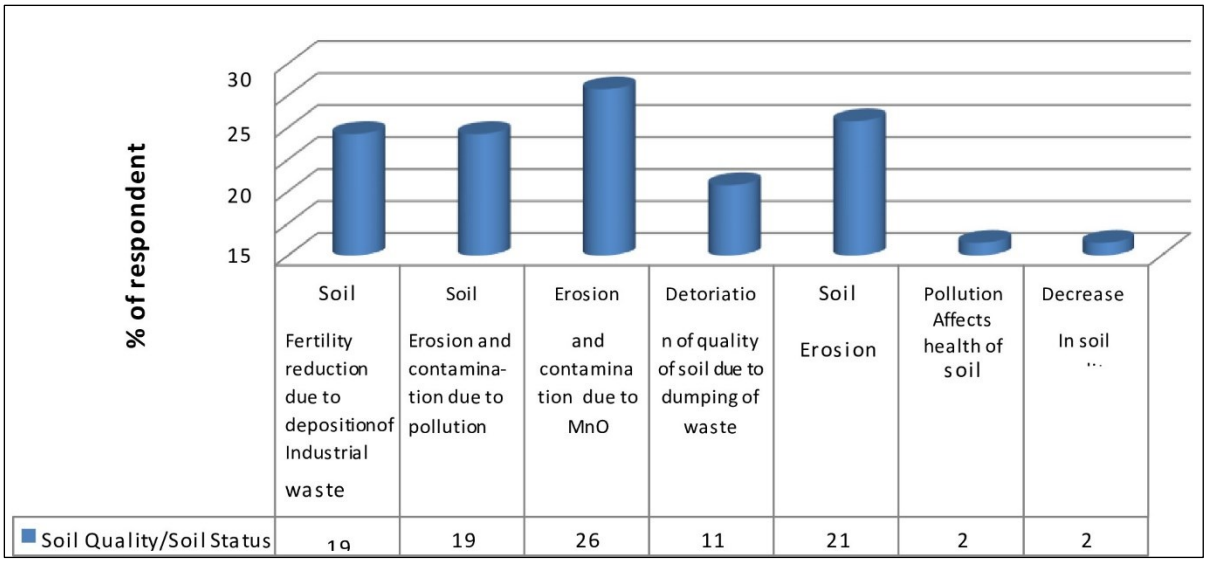

Fig. 1. Response in terms of soil quality
Source: Computed by the author

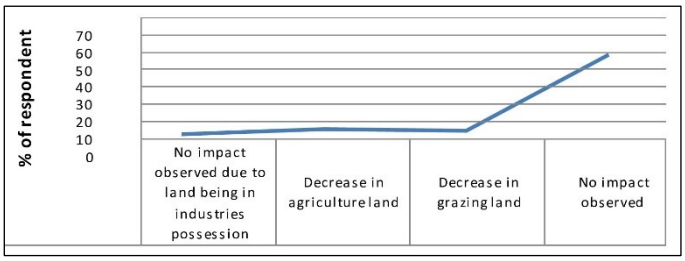

Fig. 2. The impact on land quality
Source: Computed by the author

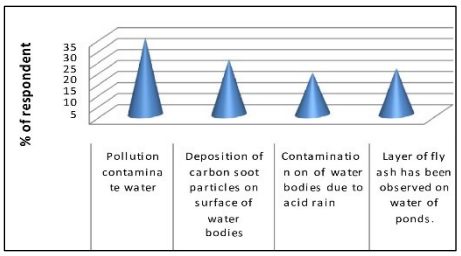

Fig. 3. Respondents response concerning impact on water quality
Source: Computed by the author

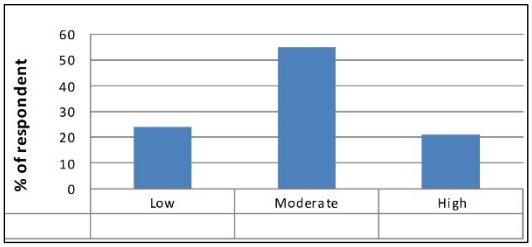

Fig. 4. Impact of Industrial Development through deforestation
Source: Computed by the author

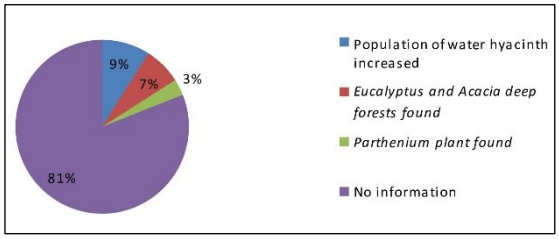

Fig. 5. Rate of forest destruction
Source: Computed by the author

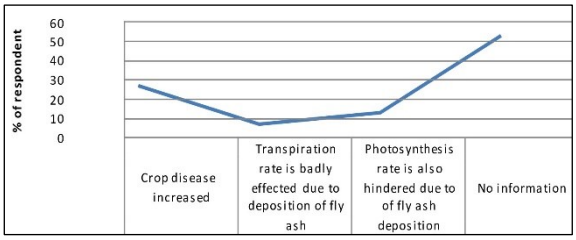

Fig. 6. Impact upon plants
Source: Computed by the author

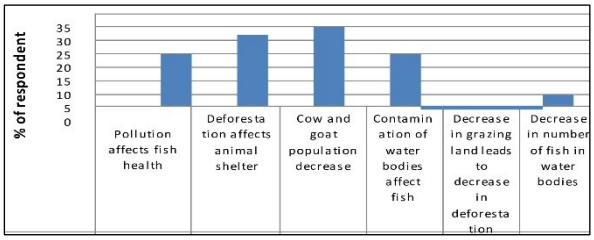

Fig. 7. Impact on plant health
Source: Computed by the author

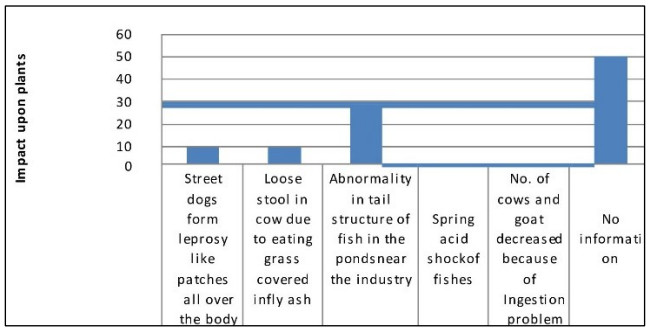

Fig. 8. Impact on animals
Source: Computed by the author

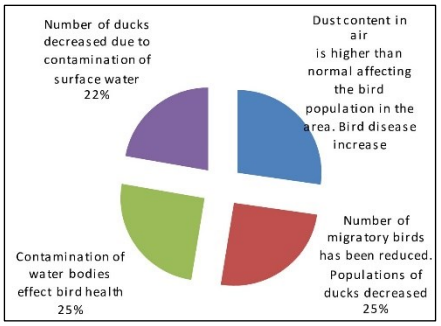

Fig.9. Impact on the physiology of animals
Source: Computed by the author

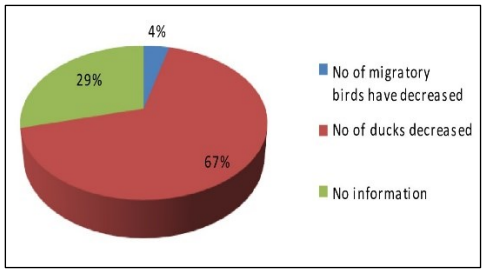

Fig.10. Impact on birds
Source: Computed by the author

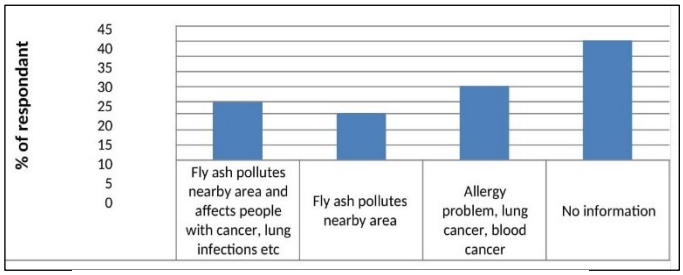

Fig. 11. Impact on birds
Source: Computed by the author

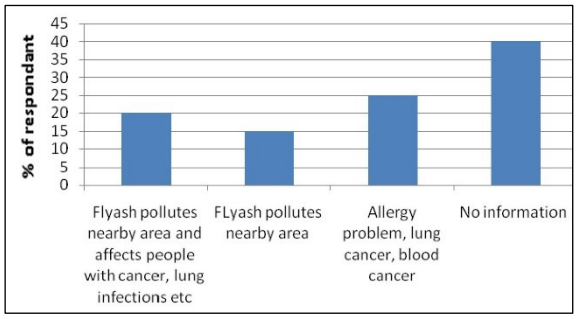

Fig.12. Impact on Human Health
Source: Computed by the author

5.0 Discussion:

In less developed countries a large number of people draw their livelihood from natural resources like agricultural land, forest, fallow land and water bodies. The industrialization program would be socially and environmentally sustainable only if its long-term and short-term benefits to the society are at least as great as its total social cost which includes cost due to loss of environmental quality. The potential positive impact of an industrialization program on culture, social consciousness, health and education of the people along with its economic benefits on employment and income should be valued against the enormous social cost involved with such programs. Apart from cost due to conversion of land from other uses to industrial use, the negative externality of a rural industrialization program arises due to its impact on the environment and quality of resources like agricultural land, forest, grazing land, water bodies, livestock and human health. Emission of solid, gaseous and liquid effluents cause damage to air, soil, water bodies, human health, livestock and biodiversity. The burning of fossil fuels leads to the emission of carbon-di-oxide, carbonmono-oxide, sulfur and many other harmful particulates During solid and liquid waste results in air and water pollution, which is aggravated by the discharge of heavy metals and chemicals into water and drainage of liquid effluents? Moreover, theuse of water for industries leads to a lowering of groundwater level creating a scarcity of water, particularly in dry areas (Kumar, SA. 2005; Nakra

1996). The possible effect of environmental degradation can be listed as, i) The result of the harmful impact of industrial pollution on human bodies is to create health hazards leading to diseases of chronic and permanent nature, sometimeseven affecting the health of the newborn. There can be a long-run adverse effect onthe standard ofliving of the affected people, deteriorating their social and cultural life. ii) The degradation causedto the ponds, rivers, and other water bodies on which farmers depend for irrigation and other purposes leads to lowering of agricultural productivity, the value of cropland and agricultural income which expose them to high risk and uncertainty. iii) The degradation of other common property resources like forest and grazing land has adverse effects on like stock and livelihood ofthe people depending on those resources.

6.0 Conclusion:

The effect on ecology and bio-diversity creates the condition for loss of life support system both for the present and future generations. To make various operations in the steel industry environment-friendly, environmental audit and life cycle assessment of existing steel plants (including sponge iron units) would be encouraged so that the relevant processes reduce emissions and effluents, minimize and better manage solid waste generation, and improve resource conservation such as energy and water. There are some fine examples of high-level environmental performance in the steel sector already. However, the steel sector would join the efforts of other industries to improve environmental performance even more. The secondary steel producers would be proactively assisted in shifting to processes that are more environmentally friendly.

References

Barik, RN., Pradhan, B., and Patel, RK. (2005): A study of dust pollution around open cast coalmines of IB valley area, Brajarajnagar. J. IndlPollnContl. 21(2): 305–308. BIBLIOGRAPHY 162.

Behera, B. and Ratna Reddy, V. (2002): Environment and Accountability: Impact of Industrialpollution on Rural communities; EPW. 37 (3), January

Battacharjee, S. (2007): Sponge iron industry; current scenario. In: Research papers. Available via DIALOG. http://www.steelworld.com/report0707.pdf

Kumar, SA. (2005): Environmental management practices and strategies for sponge iron plants. Intl symposium Environmental Management Mining Metallurgical Industries, 11-14 Dec2005, Bhubaneswar 157-178.

Nakra, N. (1996): Changing Trends in Iron & steel industry in the world & its impact on India steel scenario. Metal News, 18 (5): 12-18. Nics, DH. (1999): Microbial heavy metal resistance; Microbial biotechnology. 51: 730-750

Pandit, A, Sarangi, BM, Kesava Babu, A, and Sheshadri, MK. (2002): Coal-based sponge iron industry, a prime mover to enhance steel making capacities in India. In research papers, available via dialogue, http://www.steelworld.com/coal/htm.

Sundar, I. (2005): Methods and technologies of environmental impact assessment: a broadreview. Nature Env.Polln. Techno. 4(4): 605-610.