REVIEW OF RESEARCH
IMPACT FACTOR : 5.7631(UIF) UGC APPROVED JOURNAL NO. 48514 ISSN: 2249-894X
VOLUME - 8 | ISSUE - 2 | NOVEMBER - 2018

COAL BASED POWER GENERATION (CBPG) AND ITS IMPACT ON HEALTH AND ENVIRONMENTAL RESOURCES (ERS): A CASE OF KOLAGHAT THERMAL POWER PLANT (KTPP) IN PURBA MEDINIPUR DISTRICT OF WEST BENGAL

Dr. Ananta Kumar Biswas
Asst. Professor-II , Dept. of Sociology,
University of Burdwan (BU), West Bengal.

ABSTRACT

Coal based power plants have a pronounced impact on the environment, peoples' health and other communities surrounding them. Kolaghat Thermal Power Plant (KTPP) releases significant quantities of inorganic particulate matters (PM), mainly ash, sulphur dioxide ($So_{2)}$, nitrogen oxide (No_2) mercury (Hg), and other trace metals and gases. The quantities of the pollutants depend upon the coal quantity, combustion temperature and pollution control technologies employed by the plant. PM_{10}, $PM_{2.5}$, SO_2 and Hg have several health impacts which can be felt up to 100 km from the plant. Operation of KTPP and its enormous releases of waste product i.e., fly ash, toxic, particulate matter and heavy metals and others degrade environment and cause health effects and diseases as well as several other consequences on plants, animals, vegetation, fish and other biota of the area.

Problems associated with disposal of coal ash /fly ash on land is two kinds, such as: (i) problems to physical or abiotic components, i.e. air, water, soil/land of the environment, and (ii) problems to biotic components, i.e. plants, biota, vegetation, agricultural crops, and human health etc. These abiotic and biotic components of environment, i.e. environmental resources (ERs) constitute ecological infrastructure of the society. Hence, qualities of these ecological infrastructures influence all aspects of human society, i.e. economy, polity and social structures.

This paper highlights the environmental pollution in connection with coal-ash/fly-ash that comes out as wastes through the activities of Thermal power Plants. It examines how sporadic utilization of coal-ash / fly-ash and its accumulation on the land surface causes degradation on the nature of the land and life of the people as well as on environmental resources of the area.

KEYWORDS: *particulate matters (PM) , Coal based power plants , Kolaghat Thermal Power Plant (KTPP).*

INTRODUCTION :

India needs power so that the country is turning to super thermal power station served by captive coal mines to get power and to build energy parks all over the country. Two such well discussed power center are the Singrauli belt on the Uttar Pradesh- Madhya Pradesh border and Korba near Bilaspur in Madhyapradesh. Kolaghat Thermal Power Plant **(**KTPP) is another such station under West Bengal Power Development Corporation Ltd (WBPDCL**).** Establishment of Clusters of power stations i.e. energy parks near mines is cost effective and reduces coal transportation headaches. But energy clusters pose serious air and water pollution problems along with other environmental and socio economic problems. Singrauli and Korba are already beginning to exhibit signs of serious environmental damage as well as others socio-economic problems. The damage and associated socio -economic problems have not gone unnoticed to the stakeholders but no appropriate steps for remedy to these problems have taken.

With such scant disregard for the environment in the rush for power, the future cannot but be murkier, in the complete sense of the word.

KOLAGHAT THERMAL POWER PLANT (KTPP)

Kolaghat Thermal Power Plant (KTPP) in Purba Medinipur was established in 1971 and began producing electricity since 1982. It is now working under the West Bengal Power Development Corporation ltd.(WBPDCL).It uses non-renewable fossil, i.e. coal for producing electricity and uses water from Rupnarayan River for mobilizing its heavy turbine and for fly ash slurries. It consumes 14000 metric tones of coal and generates 5000 metric tones of fly ash per day. Fly ash is usually dumped on land and Common Property Resources CPRs). There are three types of ash users. Cement companies and Brick kilns use 0.5 to 1 percent per day productions of fly ash. Development agencies such as National Highway (NH), Haldia Development Corporation (HDC), Ambuza Housing (AH) and others consume eighty percent of per day productions of fly ash. They use fly ash mainly for filling low- lying land, marshy land, and culturable waste land etc. Individual users such as farmers, common people use nineteen to 19.5 percent of flyash produced per day. They use it for filling low- lying land. These sporadic uses of fly ash pose serious problems for environment and health of the people in the area.

METHODOLOGY:

In order to conduct environmental impact study on the Coal burning, generation of emission, production of wastes and use of fly ash ,I go through an in- depth survey using an interview schedule in villages close to KTPP.I select twenty people from each village and total number of respondents are 200 including farmer, non-farmer, common people, employees of KTPP, political party leader, NGOs workers, teachers, doctors of locality, contractors related to ash disposal activities etc. are interviewed to find veracity of the effect of emission and fly ash dumping on land.

OBJECTIVITY OF RESEARCH:

Since I decide to collect qualitative data related to peoples' views, experiences on the problems but have to substantiate these by comparing 'scientific findings' which I collect from different Scientific journals, research documents, and reports etc on the topic time to time, as well as from books.

LIMITATIONS AND STRENGTH:

Lack of infrastructural facilities for monitoring of ambient air quality in the area, absence of adequate laboratory for chemical analysis of environmental components, non- availability of meteorological and epidemiological data may impose some constraints on objectivity of research but adopting mixed(qualitative and quantitative) methodological approach and purposive strategies have extended the opportunities for achieving more accuracy.

Waste Products:

Kolaghat Thermal Power Plant (KTPP) produces huge amount of wastes which are classified in the following manners.

Coal ash*:* It is a waste product following the burning of coal for generation of energy. It is generally referred to as' Furnace Bottom Ash (FBA)' or bottom ash. So coal ash is found at the bottom of boiler furnace and relatively higher carbon content and lower fineness.

Fly ash: The finer particles of ash are carried away with flue gases and collected at several locations between the boiler and the stack. This ash is commonly referred to as 'Pulverized Fuel Ash (PFA)' or fly ash.

Flue gas or fly ash has carried eighty five percent of the total ash; reaming fifteen per cent of ash is bottom ash deposits.

PHYSICAL PROPERTIES AND CHEMICAL COMPOSITION OF FLY ASH:

As the flue gases pass through the boiler ducting before being discharged out the chimney, ash is collected at several locations named "Hopper' along its route. The average or mean particle size of the ash particles in the economizer and pre-heater hopper is about 120 and 100 microns respectively. The size of the ash particles collected in the 'Electrostatic precipitator (ESP)' hoppers, however, is much finer. ESP could collect particulate matter or dust particles in size ranging from larger than 100 micron to ten micron and a total of 99.8 percent of particulate matter or dust it could get down and deposited in the ESP hoppers.

Remaining 0 .2 per cent of total particulate matter is released into the air causing air pollution. Particulate matter emission is major contribution of air pollution. However, the plant have been trying to control the particulate matter emission through adopting new technologies and norms, set by Environmental Protection Act, in 1986 and others time to time. It also decided to increase the capacity of the existing ESPs through various technical innovations or to replace the existing ESP with new one. But all these efforts fail to capture or down the fine particles[1] of 2.5 micron. It is noted in this context that US Environmental Protection Agency (EPA) in 1997, decided to issue a new National ambient air quality standard for 'fine particle' known as $PM_{2.5}$, which is , in their view not only pollute air but also causing health problems, diseases and even death. Chemical composition of fly ash*:* The chemical composition of fly ash depends on types of coal used. The combustion conditions, the efficiency of cleaning devices and also the sources from where the fly ash is collected.

The chemical composition of fly ash can be classified under three categories:

(I) Mineralogical composition
(II) Trace elements composition and
(III) Radio nuclides.

The main pathway through which the population living around a power plant is exposed to enhance levels of natural radio nuclides are the inhalation during the passage of cloud, i.e. external irradiation and external and ingestion dose resulting from the activity deposited on the ground. But inhalation exposure is considered as the important health hazards, since this is the significant population exposure pathway at fossil fuel plants. Radium inhaled from fly ash would be present in higher concentration in the lunges than any other soft tissues. Other effluents such as uranium daughters contribute 76% of the total does to the whole body, bone lungs and thyroid respectively. Corresponding figures for ra-228, Th-228 and Th-232 were 24%of the total dose. Contributions to the doses and dose commitments from the air born releases of uranium and thorium daughters due to inhalation and direct gamma irradiation from the surface deposition are estimated to be 6.4%for the whole body, bone, lung and thyroid. The remainder3.6% of total doses arising from ingestion pathways. Thermal power plants having mechanical dust collectors without ESP for particulate emission control give the highest dose commitments. Poorly controlled power plants having a high installed capacity coupled with high population density also give rise to higher dose commitments (Mishra U.C and Ramchandran T.V. 1989).

Air Pollution and its Effects on Health:

The major pollutants such as $PM_{2.5,}$ SO_2, No_2 and Hg has been emitted from stack of coal ash and their disposal to wide area in the downwind direction. Moreover, fugitive dust emission from coal handling, processing, and the storage area, ash pond also affects the ambient air quality up to a few kilometers. But there is absence of monitoring stations in the area and unavailability of other methods of assessing ambient air quality (AAQ). Hence, I rely on peoples' views on the air quality of the area. Local people have expressed their views on the problems of the air pollution in the area through experiencing and admitting health hazards and diseases they have been suffering from for long due to fly ash or dust released by the plant.

Respondents have expressed discontent and dissatisfaction about the operation of the plant because they believe certain specific health problems and diseases have been spreading in the area due to

its operation. In very recent times, people living close to the plant are mostly suffering from diseases such as respiratory troubles (TB, bronchitis), burning sensation in eyes (Superficial Keralists Corneal Ulcer), stomach problems (Chronic Gastric problems), liver, intestine and related diseases.

Fine particle matter is released along with other gases in the air through stack and is distributed in the ambient atmosphere. These fine particles are easily inhaled and absorbed in the bloodstream and transported to vital organs. Research by different organizations indicate short term as well as long term effects of PM $_{2.5,}$ SO_2, No_2 and Hg released by coal based thermal power plants. In my study area, people have expressed their views on short term exposure which are linked to cardiac effects and heart attack; but some long term effects have also been documented by researcher such as cancer, respiratory diseases and even death (Wilson and Spengler 2012). People's claim on various causes of the health hazards and diseases in the area are shown in the following table.

Table: I:
Peoples Views on Causes of the Health Problems in the Area

Causes of the Health problems	Farmer		Non- Farmer		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Fly ash	29	24.2	29	26.25	50	25
Air pollution	9	7.5	13	16.25	22	11
Water pollution	2	1.6	9	11.25	11	10.5
Sound pollution	1	.8	7	8.75	8	4
All these	79	65.8	30	37.5	109	54.5
Total	120	100	80	100	200	100

Source; Field Data

Table I shows that more than fifty per cent of my respondents of both farmer and non-farmer categories have claimed that fly ash, air pollution, water pollution and sound pollution are the major causes behind the onset as well as spreading of several diseases in the area. But 25 per cent of the sample report that fly ash causes various diseases. The senior villagers have told me that they hardly had experiences like suffering from irritation of eyes, throat, etc., before the establishment of KTPP. But, after its establishment, these complaints have become common. Additionally, they are also suffering from cardiac and stomach related diseases. By now, these diseases have spread over the area and children as well as elderly persons are mostly hit.

Lack of epidemiological data, health survey and other authentic data impose some constraints on me for getting any details and specific diseases list. However, villagers have told me about occurrences of brain, lungs, kidneys as well as foetus damage caused by mercury emission in the area. Mercury emission occurs when coal is burnt; ash is kept on pond as well as dumped on land. Mercury poisoning has been reported and child health as well as pregnant women's health are at risk in the area. My findings are confirmed by other studies on Thermal power plant (TPPs) made by CSE (2015). My study reveals that Kolaghat Thermal Power Plant falls under the category of maximum concentration of hg (i.e. 0.89 ppm) in the country[2].

In the similar way concentrations of So_x , No_x in the air and water cause diseases such as respiratory troubles, irritation of eyes, throat and premature mortality, headaches, impairment of lung and erosion of teeth have been confirmed by the study (*ibid*: 89).

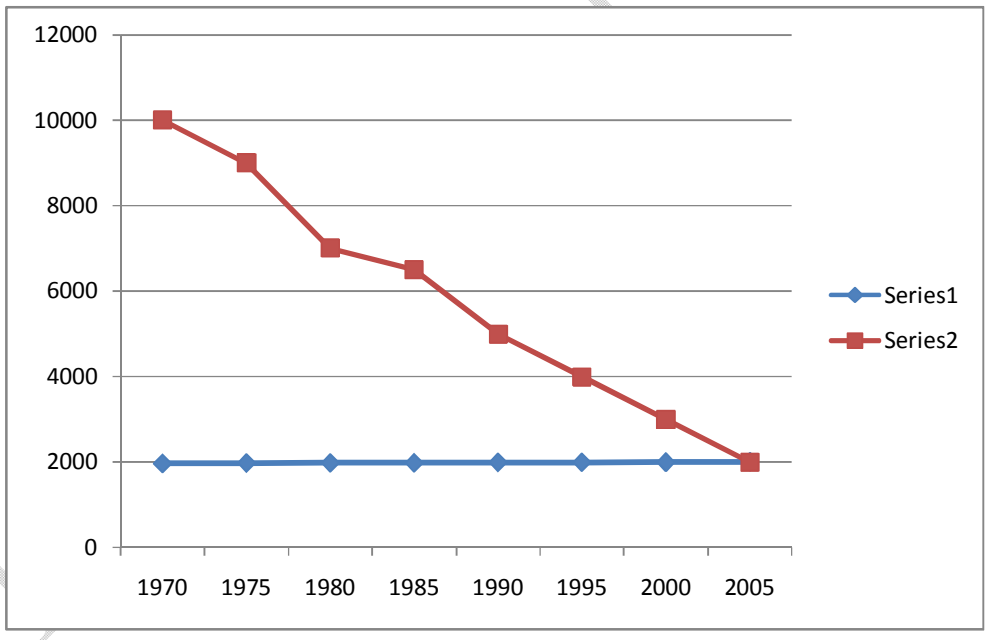
Air Pollution and its Effects on Environmental Resources (ERs):

Biotic community of living organism is the basis of our survival on earth. Biotic communities have direct consumptive values as food, fodder, fuel and medicine. It is sources of clothing, building materials and resources for Industry. It has aesthetic and procreation values. Moreover, biotic communities or bio diversity as a component of environment also maintains ecological balance and life process. But contemporary development process has done a drastic reduction in biotic communities leading to depletion of species abundance and diversity and species extinction.

Thus, to begin with, Sulpher-oxide (SO_2) emission by KTPP forms acidic aerosols in the atmosphere causing acid rain, which damages crops, forest, soils and buildings and acidifies lakes and streams. Studies have shown that plants exposed to high ambient concentrations of sulpher-dioxide may lose their foliage, become less productive and die permanently while acidification of water sources may affect aquatic flora and fauna (CSE 2015).

Villagers in the adjoining areas have been traditionally practicing Betel and flower cultivation in the area. A number of people in the area depend on such cultivation for their sustenance. Betel and floriculture as 'cash crop' has stimulated trade and business in the area. But this traditional cropping is now suffering due to air pollution caused by plant's emission of sulpher-dioxide (SO_2) released into the atmosphere. The production of betel has decreased dramatically since the establishment of plant. Similarly, quantity and quality of flower production has been affected at the same rate due to the same reason. The following graph show decrease in flower production since 1972-2005.

Chart: I
Decrease in Betel Production in from 1972 to 2005



Production per Bigha
Bigha= .33decimal
Mote= 10000 Betel
Source: Field Data

The graph shows that there has been significant fall in betel production from 1970 to 2005. In 2005, only 2000 (Number) betel have produced in one bigha (.33 decimal) land in a season (April –June) whereas

in1972, this numbers are 10000 (=Mote) in the same amount of land. My recent field visit admits the same trend in decrease in betel production in the area. This fall in betel production is due to air pollution. Air pollution in the area has been caused by plant's emission released into atmosphere. The plant has been releasing $So_{x,}$ Nox, and PM since its establishment. Air pollution is a serious threat to the diversity of life. It affects various aspects of life directly by causing toxicity and reducing their viability and fecundity. It also indirectly makes them susceptible to pests and diseases. People in the area have expressed their serious concern for the deteriorating condition of their traditional betel and flower production after the establishment of the plant. The following table show how KTPP affects betel and flower production:

Table: II
KTPP Effects on Betel and Flower Cultivation (Farmers View)

Effect	Betel		Flower		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Decrease in Production (quantity)	47	39.16	53	44.16	50	41.66
Quality decrease	25	20.83	32	26.66	28	23.75
Get disease	31	25.83	24	20	27	22.50
All these	14	11.66	7	5.83	11	9.16
No Effect	3	2.5	4	3.33	4	3.33
Total	120	100	120	100	120	100

Source; Field Data

From the table II it is clear that more than 41 per cent of my respondents of the area admit that there is decrease in both betel and flower production as well as in their quality in the villages surrounding KTPP. From Table II, it is seen that more than 23 per cent of respondent express their views on downgraded flower quality in the area. On the other hand, more than 46 per cent of respondents have fell victim of quality decrease and get various diseases due to air pollution in the area. The table further shows that more than 45 per cent of respondents witnessed spread of several types of diseases of their betel and flower. The major diseases getting betel are: 'Chital', 'Angari', 'Kasaca' 'Jhalma' etc. These diseases have appeared particularly after the establishment of KTPP and consequent air pollution in the area. Floriculture is one of the traditional livelihood practices and therefore cultivators and seller's/exporter of flowers in the state rely on production and supply of such cash crop for their sustenance. Apart from human consumption on daily basis, Betel is needed during marriage ceremony, religious festivals including Durga Puja and other occasions. But to decline in quality and quantity of Betel and flower production from this part of Bengal, the flower cultivation and its traders specifically have to look for other employment opportunities. Effects of air pollution on plant and animals have been found by other studies. As per an estimate, air pollution affects about 13 thousand species, including eleven mammals, twenty nine birds, ten amphibians, 398 higher plant, 305 fungi, 238 lichens and 65 invertebrates (Dudley 1987; Tckle at, el 1995).

Biotic component of environment such and snails, fish, wild foods, or *Kochu*, watercress, vegetables etc., are available in land and ponds controlled by rich farmers and government institutions. But the poor village people only enjoy customary right to collect and use them for their sustenance. Therefore, they are regarded as common property resources (CPRs). These CPRs not only fulfill poor people's needs; they also help in maintaining the local environment. But plant's discharge of effluents and untreated hot water into Rupnarayan River and other water reservoirs, cannels and ponds etc., cause degradation of water quality. Other sources of water pollution include runoff from agricultural field and air fall out in the area. The biota in fresh water include varieties of micro and macro organisms such as snails, fish and even aquatic plants like

wild food, *Kachu* and watercress have got affected by the water pollution and contamination through effluents discharging by the plant. Plant effluents and ash mixed water contain heavy metals such as Zn, V, Cu, Ni, and Cr. etc which cause reduction and loss of reproductive ability of fish, biota as well as amphibians in water. Fishes, biota like small snail called 'gugli' and watercress have been affected by water pollution and contamination of water. In Table III my farmer respondents have tried to provide an estimate of the affect of KTPP's water pollution on these CPRs

Table: III
Water pollution and its Effects on Fish, Biota and Wild Foods (Farmers view)

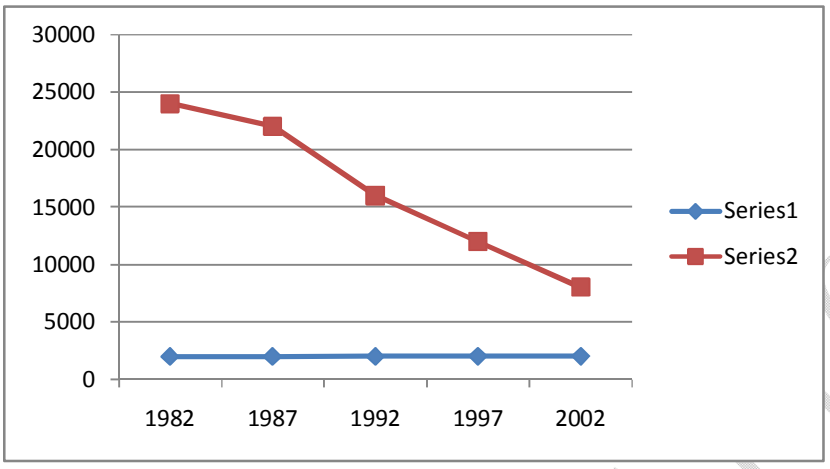
Effect	No. of peoples (Frequency)				Percentage			
	Gugli	Fish	Watercress	Total	Gugli	Fish	Watercress	Total
Decrease in No of collection	10	16	6	32	8.33	13.33	5	26.66
Decrease in variety	12	24	5	41	10	20	4.16	34.16
Get disease	07	35	3	45	5.83	29.16	2.5	37.5
No effect	01	----	1	2	0.8	--	0.8	1.6
Total	30	75	15	120	24.96	62.49	12.46	100

Source: Field Data
Source: Field Survey
Source: Field Survey

The table III shows that 62.49 percent of farmers feel that there is decrease in availability of fish including their reduced varieties. There have been instances of outbreak of unknown diseases of fish. Similarly, the table makes it clear that there are impending problems related to availability of gugli and watercress. All these problems are rooted in water pollution where water drained out from ash ponds or coal deposition gets contaminated with sulphuric acid. And such acidification of water affects aquatic organisms by influencing there physiological processes and productivity. Species like Crustacean (particularly crayfish), Molluscs are known to be extremely sensitive to acidification of water. Similarly gugli and snails get affected by such processes of acidification of water. Fish is an important aquatic organism sensitive to water pollution and contamination. Acidification along with other metal contamination of surface water in ponds and cannels hampered fish's physiological structure and productivity of fish. Therefore, sensitivity to acidification and metal contamination of water has led to decline in the availability of biota including fish.

It should also be noted that KTPP's discharge of untreated hot water into the Rupnarayan River has hampered Hilsa (*Tenualosa ilisha*) breeding in the river. Rupnarayan River is known as 'khamer' (breeding zone) of Hilsa. Number of fishing communities depend on Hilsa fishing and passion for Hilsa among the Bengalis is a well known fact. But now, Hilsa is hardly caught from then river throughout the season. I have tried to collect the opinion of fisherman about availability of Hilsa from Rupnarayan River. The following graph shows this rough estimate.

Chart: II
Hilsa Fishing from 1982 to 2002 (in metric tons per season- April-July)



Production
Metric
tons/ per
season
Source: Field Survey

Chart II shows decrease in Hilsa fishing in between 1982 and 2002. This is due to water pollution by KTPP. My respondents have put the blame on KTPP for causing several environmental problem including reduction in availability of Hilsa and other varieties of fish. The following table shows an overall picture of the major problems caused by KTPP in the area.

Table: IV
Major Problems Caused by KTPP

KTPP Causes	Frequency	Percentage
Decreasing Betel Production	9	11.25
Coconut Production effected	7	8.75
Affects on Flower Production	8	10
Extinction of Hilsa and Prawn	23	28.75
Silted up Basin of Rupnarayan River	11	13.75
Dissolution of River shore	9	11.25
Affects Fishing Community	13	16.25
Total	80	100

Source: Field Survey

From the table IV it is seen that, decreasing Hilsa production has been confirmed by 28.75 per cent non-farmers as well as fishing community and farmers in conversation in the area. They blame plant's discharges of untreated and hot water into the Rupnarayan River for this and many other consequences. The same has been happening till today.

People surrounding KTPP have been inhaling significant amount of pollutants which is high dose commitments as the population of the area increased day by day. In India, particularly in West Bengal high dose commitments are continue to happen and plant authority, pollution control board and other stakeholders not only indifferent to these problems but unfortunately they indulge in an undue nexus where

escaping norms prescribed by National and International body related to pollution as well as sidelining local environmental norms becoming a matter of regular practices. This is done for some monetary benefit in favour of them at the cost of environment by adopting cleaver method which is non- technical, like closing the ESP in night; hide the information related to emission, offering bribe, subscription to political party etc.

CONCLUSIONS:

People comprising of different social strata of society like executive, businessman, political leader, including some common people give importance to economic issues on this problem. They are more concerned about the ongoing process of economic development. It may be argued that they doing things for their own economic interest concerning money and wealth even at the cost of what is going against the common interest of saving the environment. They act in favour of existing systems which in turn make the system boost for further operation in the same manner. I would like to use the term 'EPIQL' (Economic Priority Ignoring Quality Life) to refer to this group. All members of EPIQL are not equally concerned about protecting themselves from pollutants. But rich member of the group have moved out of the locality close to KTPP and settled elsewhere in order to avoid pollution. Some of them also adopt protection to pollution. But the poor people have no option and become victims of the processes. Ulrich Beck (1992) also conceptualizes these environmental damaging activities as 'organized irresponsibility' in his book 'Risk Society'.

RECOMMENDATION:

We need tighter norms to reduce the huge environmental load imposed by coal plants. KTPP does not adhere to any norm. West Bengal Pollution Control Board (WBPCB) needs to build human power and skill to improve monitoring and regulators. It should also introduce stiff penalties for non-compliance.

Notes:

1. Usepa. (1993). Visible Emission Field Manual, Epa Methods.http;// www.epa.gov/ttnemco1/methods/ VE F ield manual.pdf,
2. Green Rating of Coal – based Thermal power plant. (2015).New Delhi, CSE

REFERENCES:

Beck, Ulrich. (1992). Risk Society: Toward A New Modernity. London, Sage

Centre for Science and Environment. (2015). Heat on Power. New Delhi, CSE

Dighton, J. and R.A, Skeffington. 1987). Effect of Artificial Acid Precipitation on the Mycorrhizas of Scots Pine Seedlings. New Phytologist.

Dudley, N. (1987); Tckle at, el, 1995. A use for Concern; Friends of Nature. London.

Giddens, Anthony. (1996). 'Capitalism, Industrialism and the transformation of Nature', in David Goldblatt (ed), Social Theory and Environment. , Cambridge, Polity press.

Wilson, R. and Spengler, J. (Eds). (2012). ' Particles in Our Air: Concentration and Health Effects in Death, Diseases, & Dirty Power - Mortality and Health Damage due to Air Pollution from power plant, in Clean Air Task Force. Boston, USA.

Mishra U. C and Ramchandran T. V (1989) Cited in Radiological Impact of Airborne Releases from Coal Fired Power Plants in India, p 29, in Encology Vol. 4, No. 3, 1989

Dr. Ananta Kumar Biswas
Asst. Professor-II , Dept. of Sociology, University of Burdwan (BU), West Bengal.