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Changing Environment and Health Hazard of Displaced/Affected Families: A Case of NTPC, Kaniha, Odisha (India)

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Abstract: *The leading power giant NTPC (National Thermal Power Corporation) has achieved the bench mark status for Indian power sector at present. In term of its power production and profit generation it has become one amongst the incomparable public sector units in India. Beside this acclaimed status it is quite famous for producing adversities- coal-fired environments, ash fly and coal dust pollution and consequent health risks in its locations. Of many environmental related studies, NTPC's environment impact assessment (EIA) study and its environment policy and management system (EPMS) are unique but lack their actual application in regenerating the ecological health in and around the thermal plants. It is also true that in order to reduce resettlement and rehabilitation cost NTPC project deliberately avoids acquiring households and displacing people faraway from its power plants' locations. Consequently, the affected villagers staying nearby by the projects cannot rescue themselves of pollutants caused health risks generated in the thermal plant environment. In case of Odisha, the health hazards of affected villagers who have been staying close to Thermal plants, for instance, are therefore direct and cumulative. Our study reveals that NTPC affected villagers' health goes beyond medical facilities and village amenities. The field observation and focus group based people's perception on polluted environments and pollutants and consequent health risks are critically analysed in the paper. A collective stand point- views and counter views were sought during interviewing of the respondents in the affected villages. The article reflects upon the questions of affected people's health and hygiene versus thermal plant and village amenities in NTPC Kaniha locality. The article also warns that the preventive and correctional measures taken by NTPC projects fail to generate an environmental friendly atmosphere in the coal-fired plant area in Odisha.*

Keywords*: Coal-Fired Power Plant, Health Risks, Coal Ash caused Pollution, Village Amenities and Health*

I. Introduction

Health being the indispensable factor of human life and living significantly contributes in the process of progressive human society, civilization and history worldwide. The critical factors responsible for such health suggest a harmonic linkage between our physical and mental health and health of physical and social environment in the given human habitations of the world. However, these human habitations polluted by industrial centres, coal mining operation, coal-fired plants and so on break loose this sustainable linkage. Particularly in the coal mining area the animal and human habitations polluted by coal dusts and coal-fired thermal gases severely impact human health. The coal-related activities i.e. mining of coals, washing of mined coals, transportation of washed coals to thermal stations, combustion of coal and disposing of post-combustion wastes in ash ponds profusely pollute the local environments (see, Das and Mishra,2015; Guha,2014; Chakroborty and Narayan, 2014; Goswami, 2013a and 2013b; Garada, 2013, 2012, 2011, 2009 and 1995; Mathur, 2008; Padel and Das,2008; Pandey;1998; Warhurst,1998; Ramaiah 1995; XIX,1994; http://www.mcl.-gov.in/Others/ecoalfields.php, Tiwary & Dhar 1994). Consequently, individuals and animal residing in and around thermal plants, coal depots and ash pond area are at health risks of morbidity and mortality problems. There are many cases of human mortalities and morbidities caused by Thermal plants found in international level (see,Garada, 2012 and 2009; Cropper, Gamkhar, Malik, Limonov and Partridge, 2012; CPCB; National Research Council,2010; Levy, Baxter & Schwartz, 2009; Sahay, 2008; Sharma, 1995, Larrimore and Pike,1989; Morgan, Barkovich and Meier,1973). The coal fired-plants generally form carbon dioxide, sulfur dioxide, nitrogen oxides, mercury and ozon and release these into the local atmosphere. These pollutants ubiquitously produce health hazards of coughing, wheezing, shortness of breath, rapid shallow breathing, airway irritation, asthma problems, nasal congestion, inflammation, cold and heat impacted sickness and illnesses, infant morbidity, low birth weight, cardiac birth defects, premature birth, stunted lung growth, infectious disease and atmospheric ozone changes, climate change, etc in the local environments **(see,** Garada,2012& 2009; Cropper, Gamkhar, Malik, Limonov and Partridge,2012; CPCB;2012; National Research Council,2010; Lockwood, FAAN Kristen, Welker-Hood, ScD MSN, Rauch, Gottlieb,2009; Baxter & Schwartz, 2009; Levy, Baxter & Schwartz, 2009; Sahay,2008; Chandra and Kaushik, 2003; Sharma, 1995, OTA, 1994; Larrimore and Pike 1989; Agarwal,1985; Morgan; Barkovich and Meier,1973). The coal-fired industries in India and Odisha

are not exception to these challenges. However, no national, international and regional government could dare to close down the thermal power plants/ coal mines because the coal-fired plants are the pre-dominant sources of electricity generation worldwide. Addition to that thermal plants and coal as if engine and fuel together significantly contribute to the economic growth of nation-states worldwide. In this context, the impact of NTPC environment on people's health, and especially on their mental, societal and cultural health not simply exposes the danger of coal-fired plant caused pollutions but also help evolving the remedial action plans for sustainable environment and social health. The possible remedies to health problems in the polluted environment like in thermal plants area include regenerating fresh air, providing clean drinking water, making frequent health check up, ensuring quality food grain availability, implementing programmes of compensatory reforestation, installation of pollution check machines, etc. However, so far, the preventive and correctional measures taken by the local government and NTPC project could not become the promising mechanism in rectifying the environmental disruption in Odisha's mining area at present. In this context, the NTPC's environment impact assessment (EIA) study and environment policy and management system (EPMS) are unique but these are not applied effectively in regenerating the ecological health in and around the thermal plants. The NTPC claims that its project authorities are highly committed to the stability of ecology, environment and people's health in and around the plant locality (Sahay, 2008). It uses modern technologies to reduce pollutions and suggests coal-fired ashes to be better used as cement and brick making materials. Its EPMS envisages the minimum environmental cost and maximum environmental regeneration. However, it is not being effectively materialised in the thermal plant area in India. It is also true that NTPC project usually causes least human displacement to faraway places from its site, thereby reducing resettlement cost and avoiding rehabilitation burden. In case of Odisha, the health hazards of affected villagers who have been staying close to Thermal Plants for instance, is therefore direct and cumulative. Further, the study of social health of mining affected villages and villagers go beyond the medical and environmental impact.

II. Area of Study and Household Profile

The studied villages namely Bhimakanda, Rangabeda, Gadasila, Takua and Derang within a radius of 15 km distance from the NTPC, Kaniha are situated in the bank of river Brahmani and its tributaries Singharajora and Tikira in Angul-Talcher area, Odisha. The NTPC situated at Kaniha is 60 km away from the district headquarters, Angul which is 150 km away from Bhubaneswar, the capital city of Odisha. The then Prime Minister late Rajiv Gandhi laid the foundation stone of NTPC project in June 1989 at Kaniha. It covers an area of around 3700 acres of land. The NTPC Kaniha consumes coals from the Talcher coalfields (especially from Lingaraj coal mine) and takes water from Samal Barrage Reservoir located in Angul district. The approved capacity of NTPC, Kaniha plant is 3000 MW (6x500 MW) but it had its installed capacity of 1000 MW and 2000 MW in stage-I and in stage-II respectively. The NTPC, Kaniha plant supplies electricity energy to the many states and corporation namely Odisha, Jharkhand, Bihar, West Bengal, Southern States, Sikkim and Damodar Valley Corporation. NTPC acquired 3555.28 acres of lands from 53 villages in 1991. The land was acquired for the construction of the NTPC plant, permanent railway siding area, construction of Ash Ponds (phase-I and II), construction of Ash corridor, construction of township, make up water pipe line, etc. The project acquired lands from local people but treated the land acquisition affected people differently such as substantially affected persons (SAPs) (lost 1/3rd or more of their total lands) and least affected people for rehabilitation and resettlement benefits. Our study reveals that there were 1591 SAPs affected from 27 villages (as on 21.1.2009 government record). Out of 1591 SAPs 650(40.85%) was identified eligible for plant jobs. However, out of these 650 eligible persons only 67.69 percent persons could get jobs in NTPC plant. The rest others were entitled to cash compensation for buying land, cash dole assistance and allotted shops for self employments in the NTPC, Township and skilled-based training for others' economic engagement.

II.I. Objectives and Sample Frame

The study on National Thermal Power Corporation (NTPC) affected villages in the Kaniha locality does not merely fall on the causes and consequences of physical health hazard of NTPC affected people but their perceptions on the dynamics of the concept "health" in a holistic manner. The broad objective included in the study was to assess the pre- and post- NTPC affected situation of village amenities and health. The field observation and focus group based perception on polluted environment and pollutants and consequent individual and social health problems are analysed in the paper. A collective stand points- views and counter views were sought during interviewing of the respondents in the affected villages. The study covers five villages out of which two are Ash ponds affected namely Takua and Derang and other three are thermal plant affected namely Bhimakanda, Gadasila and Rangabeda. Many of the physically displaced people stayed back in and around the NTPC plant for their survival needs. Out of total 926 substantially affected households from these five villagers a total of 111 sample households were taken through simple random sampling method

(12% from each affected village). The descriptive design with simple statistics methods are being used in the study.

Table 1: Sample Frame

Sl.No.	Affected Village	Universe	Sample(12% each Village)
1	Bhimakanda	68	8
2	Rangabeda	171	21
3	Gadasila,	329	39
4	Takua	117	14
5	Derang	241	29
Total		926	111

Source: Angul, Land Acquisition Office

II.II.Social and Demographic Structure

The demographic profile of Pre-Affected families reveals that out of total 972 population 51.75 and 48.25 percents male and female were there respectively in the sample villages. The sex ratio was 941 females per 1000 males and the average family size was 8.76. This demographic profile was changed during the post-displaced/affected period. In post-displaced period out of total 974 population 50.64 and 49.36 percents belong to male and female population respectively in the sample villages. The increase in female population witnessed the increase of sex ratio during post-displaced period. The sex ratio was increased from 941 during Pre-Affected periods to 974.82 females per 1000 males during post-displaced periods whereas the average family size was decreased from 8.76 during pre-displaced/affected periods to 7.77 during post-displaced/affected periods. The early marriage, increasing number of widows, etc are responsible for the increased sex ratio.

Table2: Profile of Pre-Displaced/Affected Households

Sl.No.	Sex	%	%
1	Male	503(51.75)	437(50.64)
2	Female	469(48.25)	426(49.36)
Total		972(100.00)	863(100.00)
3	Sex Ratio	932	974.82
4	Avg. Family Size	8.76	7.77

NB: Figures in Parenthesis denote percentage
Source: Household Survey 2007-08.

The household survey data reveals that before the setting up of the NTPC project at Kaniha region majority of the affected families were living in joint family set up. Our study also reveals that it was possible because of the fact that the main source of living of all such families was agriculture and allied activities.

Table3: Demographic Profile of Surveyed Households

Sl.No.	Age Structure	**Pre- NTPC Affected/Displaced Period**			**Post- NTPC Affected/Displaced Period**		
		Male	Female	Total	Male	Female	Total
1	0-6 Year	79 (8.13)	69 (7.10)	148 (15.23)	36 (4.17)	38 (4.40)	74 (8.57)
2	6-14Year	56 (5.76)	46 (4.73)	102 (10.49)	57 (6.60)	54 (6.26)	111 (12.86)
3	14-18Year	46 (4.73)	30 (3.09)	76 (7.82)	24 (2.78)	20 (2.32)	44 (5.10)
4	18-45Year	207 (21.30)	188 (19.34)	395 (40.64)	191 (22.13)	180 (20.86)	371 (42.99)
5	45-60Year	65 (6.69)	72 (7.41)	137 (14.09)	59 (6.84)	60 (6.95)	119 (13.79)
6	60 Year & above	50 (5.14)	64 (6.58)	114 (11.73)	70 (8.11)	74 (8.57)	144 (16.69)
Total		503 (51.75)	469 (48.25)	972 (100.00)	437 (50.64)	426 (49.36)	863 (100.00)

NB: Figures in Parenthesis denote percentage.
Source: Household Survey 2007-08.

When we look into the demographic profile of pre-affected/displaced families, it is found that the size of economically productive age group (in between 18-60 years) was not drastically increased even after the employment opportunities created in Thermal power project. The difference was minimal such as from 54.73 per cent during pre-affected period to 56.78 per cent in post-displaced period. However, in young population there has been remarkable change took place such as from 33.54 in pre-affected period to 56.78 per cent in post-displaced period. And in case of old age population there were 11.73 and 13.79 percents in pre- and post-displaced periods respectively.

III. FINDINGS

III.Village Amenities and Health Problems

III.I.Transportation and Communication Particulars

The Table clears that the distance of NTPC affected villages to nearby railway station is found in-between 29 km and 40 km. It also reflects that the conditions of road are found to be Kutcha and Pucca in these affected villages. It means no remarkable changes are found in the condition of transportation after coming of NTPC in Kaniha area. However, beside traditional mode of transpiration like bullock cart, Thella, Cycle, the modern mode of transpiration like Train, cycle, motor cycles, Bus, rickshaw, car, jeep, etc are largely used by the people after establishment of NTPC at Kanhia. But to what extent the modern transportation infrastructure like road and railway contribute to the community health is a matter of question. In focus group discussion the elder people argue that the transportation infrastructure and modern mode of transportation largely facilitate to the prospect of pollution in the locality and consequently environmental degradation lead to people's health problems in the locality.

Table4: Transportation and Communication Particulars

Sl.No.	Affected Villages	Distance to Railway station	Pre-NTPC Affected Situation		Post-NTPC Affected Situation	
			Road	Mode of Transportation	Road	Mode of Transportation
1	Takua	37 km	Kutcha and Pucca	Thella, bullock cart, Cycle, Bus	Kutcha and Pucca	Train,Thella, bullock cart, Cycle, Bus, rickshaw Buses /car/jeep
2	Bhimakanda	34 km	Kutcha and Pucca	Thella, bullock cart, Cycle	Muddy and kutcha	Train,Thella, bullock cart, Cycle, Bus, rickshaw Buses /car/jeep
3	Rangabeda village	29 km	Kutcha and Pucca	Thella, bullock cart, Cycle	Kutcha and Pucca	Train,Thella, bullock cart, Cycle, Bus, rickshaw Buses /car/jeep
4	Gadasila	30 km	Kutcha and Pucca	Thella, bullock cart, Cycle	Kutcha and Pucca	Train,Thella, bullock cart, Cycle, Bus, rickshaw Buses /car/jeep
5	Derang	40 km	Kutcha and Pucca	Thella, bullock cart, Cycle	Kutcha and Pucca	Train, Thella, bullock cart, Cycle, Bus, rickshaw Buses /car/jeep

Source: Household Survey 2007-08.

Many families directly affected by NTPC or very closely living to Thermal plant argue that the increasing numbers of vehicle plying in between thermal plant and affected villages highly pollute the environment. The coal carrying railway wagon profusely pollute the environments without halt. Bhimakanda, Rangabeda and Gadasila villages situated just around the NTPC boundary are highly vulnerable to such transportation caused pollution at Kaniha. In our focus group discussion many argue that besides coal and chimney polluted environment the new mode of transportation opened up the entry gate to the outsiders who migrate and settle down in the areas adjacent to the coal-fired Industry, NTPC at Kaniha. As a result, the other vices like addicting to foreign liquor, illegal smoking, gambling and prostitutions, insiders and outsiders' conflict, etc are alarmingly increasing at the NTPC locality. The other villagers taken in our study from Takua and Derang are directly affected by the coal dusts of Ash ponds. They living around Ash pond corridor suffer from the fly ash pollution caused by trucks carrying coal ash from NTPC. Thus, the transportation facility in NTPC area has become the supporting infrastructure for the coal-fired industry but actually not for the transportation need of the local people. In fact, the transportation caused pollution adversely affects the physical and social health of people since the starting of NTPC projects. Although the NTPC's two hospitals (at Kaniha and Talcher), District headquarter hospital (DHH) at Angul, sub-divisional hospitals at Athamallik, Talcher and Pallahara are there but cannot cater to the health need of the people at present.

Table5: Sanitation Facility

Sl.No.	Affected villages	Pre-NTPC Affected Situation			Post-NTPC Affected Situation		
		Private latrine	Drainage facilities	Space for open air defecation	Private latrine	Drainage facilities	Space for open air defecation
1	Takua	Not Available	Not Available	Available	Available	Available	Available
2	Bhimakanda	Not Available	Not Available	Available	Available	Available	Available but no or restricted space
3	Rangabeda	Not Available	Not Available	Available	Available	Available	Available but no or restricted space
4	Gadasila	Not Available	Not Available	Available	Available	Available	Available but no or restricted space
5	Derang	Not Available	Not Available	Available	Available	Available	Available

Source: Household Survey 2007-08.

The Table-5 reflects a comparative picture of sanitation facilities during pre-NTPC and post-NTPC situation. During pre-NTPC period the affected villages did not have private latrine and drainage facilities but had enough space for open air defecation. However, during post-NTPC situation more private latrines and drainages and less open air defecation space are found to be there in the affected villages. It is also true that the villagers do not feel comfortable at private latrines and largely still prefer open space for defecation. Unfortunately, due to lack of space in Bhimakanda, Gadasila and Rangabeda the affected people cannot help going to an unusual space left for cremation ground for their defection. But Takua and Derang villagers still continue to prefer open air defecation in their villages. Thus, the overall sanitation condition could not be improved for good social health after coming of the NTPC project in the locality. It is also true that the dysfunctional private latrines and drainages without maintenance create health and hygienic problems in the locality.

Table6: Water Facility

Sl.No.	Affected villages	Pond	Dug well	Tube well and Hand Pump	Government Open Well	Pipe Water Supply
1	Takua	0	3	11	1	0
2	Bhimakanda	0	24	10	0	0
3	Rangabeda	3	25	20	4	4
4	Gadasila	3	20	12	6	4
5	Derang	3	30	15	7	0
Total		9	102	68	18	8

Source: Household Survey 2007-08

The Table reflects that there are about 102 dug wells, 9 ponds, 18 governments open well, 68 tube wells and 8 pipe water supply points found in the affected villages at present. These water points used for the domestic purposes of cleaning, drinking, bathing, etc, in the affected villages are severely polluted by fly ashes and coal dusts. For instance, in Derang and Taku villages the existing ponds are severely polluted by the fly ashes from the Ash ponds located nearby these villages. The industrial dusts and wastages released in and around affected villages like Bhimakanda, Gadasila and Rangabeda pollute water canal and rivers every day. The villagers drinking contaminated and polluted waters more often fall sick and there are cases of death of cows after drinking the ash pond released water in Derang and Takua locality. The villagers also argue that NTPC and Ash pond caused land acquisition has reduced the size of earlier ponds and that too these remain unused on pollution grounds. Many tube wells and open wells are also found in dysfunctional states as these are hardly maintained or remain dry during summer season. Thus, the drinking water crisis has become all time problem in these affected villages. Though the water tanker service provided by NTPC authority for drinking purpose is the only option but it hardly resolves drinking water scarcity at present.

Table7: Electricity Facility

Sl.No.	Affected Villages	Pre-Affected Period				Pro-Affected Period			
		Connected to households	Connected to streets	Power cut	Low voltage	Connected to households	Free Street light	Power cut	Low voltage
1	Takua	No	NA	NA	NA	Yes	No	Yes	Yes
2	Bhimakanda	No	NA	NA	NA	Yes	No	Yes	Yes
3	Rangabeda	No	NA	NA	NA	Yes	No	Yes	Yes
4	Gadasila	No	NA	NA	NA	Yes	No	Yes	Yes
5	Derang	No	NA	NA	NA	Yes	No	Yes	Yes

Source: Household Survey 2007-08

The Table-7 reflects that before NTPC came to Kaniha the sample villages under study were not connected to electricity. After NTPC started its power generation the villages were connected. However, on behalf of thermal plant there was no provision of free street light in the affected villages. The power supply to the affected households is fluctuated in the locality. The affected villagers argue that on the one hand there is increasing hot in the village and on the other hand there is frequent power cut and low voltage which make their life unbearable. The NTPC authority provides electricity supply to the emplyees' quarters in free of cost. And the so called NTPC employees can afford to air cooler and air conditioners but the unemployed villagers suffer a lot. Thus, electricity connection to the affected villages instead of solving health problems creating the health problems among the villagers in the situation of frequent power cut and fluctuation. The villagers miss the earlier atmosphere when without fan and coolers they used to live a healthy life.

III.II.Housing Structure

The Table-8 reflects that number of Kutcha houses with thatched roof has been drastically reduced from 58.56 per cent during pre-affected period to 9.01 per cent during post-affected period. It means there has been a significant increase of pucca houses with concrete roof after coming of NTPC project in the Kaniha locality (from 2.70% to 58.56%). However, the number of Kutcha houses with tile roof was found to be more in the pre-affected period than post-affected period. The number of semi-pucca and kutcha houses with thatched

roof or tile roof has been increased during post-affected period. The affected villagers argue that they could build concrete houses after land acquisition but invited NTPC polluted environment around their inhabitation. Many also repent that the frequent power cut remind them of their cool Kutcha houses before establishment of NTPC.

Table 8: Structure of Dwelling

Sl.No.	Condition of Dwelling Structure	Pre-Affected Period	Post-Affected Period
1	Kutcha with Thatched Roof	65(58.56)	10(9.01)
2	Kutcha with Tile Roof	32(28.83)	10(9.01)
3	Pucca with Thatched Roof	2(1.80)	4(3.60)
4	Pucca with Concrete Roof	3(2.70)	65(58.56)
5	Semi-Pucca with Thatched Roof	5(4.50)	09(8.11)
6	Semi-Pucca with Tile Roof	4(3.60)	13(11.71)
Total		111(100.00)	111(100.00)

NB: Figures in Parenthesis denote percentage.
Source: Household Survey 2007-08.

III.III.Dwelling Amenity and Health

The Table-9 clears that space and security infrastructure such as backside space; garden land and fencing/ wall are inadequate in the post-affected period. Except fencing/ wall less number of affected households are found to have backside space and garden land during post-affected period (44.14% and10.81% respectively) comparison to that of post-affected periods (73.87% and 13.51% respectively).

Table 9: Space Infrastructure

Sl.No.	**Space & Security infrastructure**	Pre-Affected Period	Post-Affected Period
1	Backside Space	82 (73.87)	49 (44.14)
2	Garden Land	15 (13.51)	12 (10.81)
3	Fencing/ Wall	16 (14.41)	39 (35.14)

NB: Figures in Parenthesis denote percentage.
Source: Household Survey 2007-08

We can find in the Table-10 that in case of availability of dwelling rooms there are no much difference found between pre-affected and post-affected periods. Except bed rooms the number of kitchen rooms, drawing rooms, store rooms/extra rooms has been increased by eight to 10 per cents in the post-affected period. The displaced/affected families argue that now the need of different rooms has been largely felt and accordingly many substantially affected families have also constructed such rooms. But they could not construct the required numbers of rooms due to lack of spaces left for further construction. Therefore, they feel congestion and suffocations after NTPC acquired their lands.

Table 10: Availability of Dwelling Rooms

Sl.No.	**Dwelling Rooms**	Pre-Land Acquisition	Post-Land Acquisition
1	Bed Rooms	111(100.00)	111(100.00)
2	Kitchen Room	88 (79.28)	102 (91.89)
3	Drawing Rooms	82(73.87)	102 (91.89)
4	Store Rooms/Extra Rooms	73 (65.77)	82 (73.87)

NB: Figures in Parenthesis denote percentage.
Source: Household Survey 2007-08

The affected villagers in and around the NTPC (in Bhimkand, Rangabeda and Godasila) argue that since their valuable landed properties have been acquired by Thermal plant their next generation cannot find suitable spaces to reconstruct better dwelling structures in the future. The other villagers though have homestead lands in their affected villages but do not like to construct adequate dwelling structures as their future generation would not like to stay back at the affected villages (Derang and Takua) due to increasing size of Ash ponds that located in-between Derang and Takua villages. Our study reveals that future generation in this area would like to leave their affected villages toward urban areas and non-affected villages.

Table 11: Dwelling Health Amenities

Sl.No.	**Health Amenities**	Pre-Land Acquisition	Post- Land Acquisition
A	**Light and Water supply**		
1	Electricity	15 (13.51)	73 (65.77)
2	Drinking Water supply points	0	49 (44.14)
B	**Hygienic Infrastructure**		
3	Bath Room	1 (0.90)	28 (25.23)
4	Toilets	18 (16.22)	73 (65.77)
5	Drainage	2 (1.80)	12 (10.81)

NB: Figures in Parenthesis denote percentage.
Source: Household Survey 2007-08.

Thus, there is no perceived prospect of better dwelling structure in and around the affected villages at NTPC Kaniha. The Table-11 also reveals that the water supply points and electricity connection at affected households though have been increased but it has not been useable for the people after land acquisition. In the context of frequent power cut and low voltage problems in the locality the electricity connection does not add much prospect for the affected families as stated earlier.

In case of hygienic infrastructure available in the pre-and post-affected households there has been significant change as the number of bathroom, toilets and drainage infrastructures has been increased to 25.23 per cent, 65.77 per cent and 10.81 per cent respectively during post-affected period from 0.90 per cent, 16.28 per cent and 1.80 per cent respectively in pre-affected period. But it is strange that as much as 75 per cent and 34 per cent of the oustees' households do not yet have bath rooms and toilet facilities respectively. As much as 89 per cent of affected people argue that they do not have required drainage to their households even after decades of their land acquisition to NTPC.

Table12: Fuel Consumption Pattern of Displaced/Affected Households

Sl.No.	Type of Fuels used	Pre-Affected	Post-Displaced
1	Wood	91 (81.98)	35 (31.53)
2	Kerosene	3 (2.70)	10 (9.01)
3	Coal	14 (12.61)	32 (28.83)
4	Gas	0 (0.00)	30 (27.03)
5	Cow- dung	1 (0.90)	0 (0.00)
6	Others	2 (1.80)	4 (3.60)
Total		111(100.00)	111(100.00)

NB: Figures in Parenthesis denote percentage.
Source: Household Survey 2007-08.

In pre-NTPC affected period fuel wood was the major source of cooking energy in the sample villages (82% of households). After NTPC came to Kaniha locality the coal, LP Gas and Kerosene are being significantly used as cooking fuels in the affected villages. However, the increasing use of LP Gas as cooking fuel has not replaced the use of coal and woods at present. The increasing use of cheap coal as fuel energy for domestic purpose and for other manufacturing operation further pollute the domestic environment in the locality.

IV. Discussion

The NTPC claims to have evolved many technological systems such as for example ash water recycling system, ash dykes and ash disposal systems, effluent water treatment systems, etc on compensatory ground to regulate and manage coal ash caused pollution in thermal power plant area in the country. But to what extent they are managed to do so is a matter of questions in NTPC Kaniha locality at present. In fact, the variation on NTPC affected people's awareness and detail understanding of this management reflects an alternative story on such facts.

For instance, though about 66.67 per cent of the affected households aware that NTPC has been monitoring &treating the waste water effluent from the main plants but only 25.23 per cent of them knew that how it is actually monitored and treated. Similarly as much as 100 per cent and 67.57 per cent of households were aware of NTPC's management system of land pollution and air pollution respectively. But only 45.05 per cent and 30.63 per cent of them knew the detail of how the land pollution and air pollution are actually monitored and managed by the NTPC respectively. In this context our study reveals that after coming of NTPC generally there are three type of effluents are treated for water management i, e. main plant effluents, ash pond effluents and domestic effluents.

Table13: Awareness and Actual Knowledge on Management of Pollution

Affected Villages	Management of water Pollution		Management of land Pollution		Management of Air Pollution	
	Awareness	Details Knowledge	Awareness	Details Knowledge	Awareness	Details Knowledge
Bhimakanda	8	4	8	4	6	3
Rangabeda	17	6	21	11	10	5
Gadasila	25	10	39	19	22	10
Takua	9	3	14	6	12	5
Derang	15	5	29	10	25	11

Total	74(66.67)	28(25.23)	111(100)	50(45.05)	75(67.57)	34(30.63)

NB: Figures in Parenthesis denote percentage.
Source: Household Survey 2007-08.

Our focus group discussion reveals that earlier main plant effluents were discharged into nearby water sources because that entire water bodies used to be polluted as mentioned earlier. But NTPC claims there is zero level discharge maintained from the plant side. Thermal plant after burning coal transports the coal ashes to ash ponds and lets ash slurry to settles down in the ash lagoon. From the ash lagoon the clean waters are passed into clean water lagoon, and from there further the waters get passed into ash water recirculation system, and then that waters are pumped back to main plant for reuse in the ash handling system. The researcher like Sahaya (2008) argues that as a result of this recirculation system, no effluent is discharged to the nearby river. However, our FGDs reveal an alternative story on these facts. The affected people are well aware of the facts that the coal-fired plant, ash ponds and coal dusts pollute the entire environment in the Kaniha locality. The pollutant sources and polluted points conjointly affect the physical and social well-beings in the locality. As for an example, Tikira River gets polluted by its water canal which is flowing from Ash pond stage-2 in Derang area. The Tikira River then flows from the North (Tikira Bridge) toward north east. The polluted water from Tikira River not only pollutes the agricultural lands but also floods on the cultivable lands during rainy seasons. As a result, the cultivable lands are deposited with flood sands of the river. And flexible flow of Tikira River is blocked by NTPC plant and Samal barrage in the downward areas. The ash contained water spoils the productivity of the lands in between. Further, Ash and ash contained water from Ash ponds and mine contaminated waters from the thermal plant after being discharged to the Tikira River get drained into Brahmani River. The water sources stemming from above two rivers are highly polluted. And since there are no alternative water sources for washing, drinking, bathing, irrigation, etc the affected villagers cannot help using these polluted water sources for such purpose and become at risk of health problems. The release of hot water by thermal plants to the nearby Tikira River dissolves oxygen degree of the water. The flora and fauna sensitive to thermal hot water are adversely affected. Similarly, the release of ash pond water by NTPC each day early morning pollutes the water resources in the NTPC locality. Our study also reveals that the intensification of mining activities in the region has affected the floor water table and thereby causing acute water scarcity during summer. As stated earlier, as a result of insufficient numbers of water points and their non-functional conditions the affected villagers are compelled to depend upon NTPC provided water tanker services for potable water. However, that water is very meagre and supplied irregularly and also not free from pollution in the NTPC Kaniha locality.

The affected people argue that the NTPC tanker service is one of the important CSR activities but not NTPC's compulsory duty. They argue that what to speak about their right to clean and safe drinking water at present. Since they cannot access to water sources as primary stakeholders these are heavily used and misused by the Industries available there in and around NTPC locality. The Taku and Derang villagers argue that there has been no check gate to prevent the release of Ash pond water into their public rivers. They argue that the ash leakage from pipe lines- linked between main plant and ash ponds spoil animal lives and crops more often. The fly ash of uncovered ash ponds cover the villages with ash like an umbrella and spoil the whole crops, vegetable fields, water points, roads, etc. It becomes worst at the time of heavy ventilation is caused from ash pond side. In this context, the affected villagers argue that occasional installation and repair of tube wells through corporate social responsibility (CSR) activity cannot solve their drinking water problems at present. They are also quite pessimistic of getting clean and safe water in the future.

The sounds of motor vehicles and coal-loaded trains have been causing noise pollution in the affected villages. It adversely affects the healthiness of human, animal, birds and insects in plant areas. The area people do acknowledge the delivery of NTPC's CSR activities at present in some of the affected villages. However, within our focus group discussion they have different perception on these activities and their shortcomings too. In case of drinking water problems NTPC authority takes care of installation and repair of tube wells, piped drinking water supply and water tankers facility in nearby affected villages as stated earlier. The focus group discussion reveals that such CSR activities were not there previously and neither regularly ensured at present. In Takua and Derang villages the affected individuals were highly critical of the CSR activities for drinking water facilities in the villages. However, the villagers living near to Thermal plant need these facilities urgently. In focus group discussion they express their problems that how long they would depend on tanker's water supply, piped water supply and temporary arrangement of water points. They desire permanent solution nonetheless it is apparently impractical now. Other CSR activities include constructions of check dams/ ponds, talabs, community centres, cremation ground, etc and their renovation, construction of roads and their repairs, etc are inevitable philanthropic activities. The affected villagers argue they are once in a while and only for the face value purpose but truth is something else because they perceive that NTPC authority does it deliberately for keeping their image clean before the world. There are also problems that the government authority does not show serious concerns for the construction and repairing of village amenities. They argue that both NTPC and

government authority blame each other for not constructing and repairing of village amenities. The NTPC authority argues that the state government does not repair the NTPC constructed amenities in the affected villages. And similarly government authority argues and fixes responsibility to NTPC project for such amenities to be accessible and functional in the affected villages.

However, the amenities can be repaired and replaced with alternatives but air pollution in and around the plant locality cannot be wiped out at present. The coal-fired power plant generally produces dry fly ashes, bottom ashes and pond ashes. The ash water is discharged into ash pond through ash pipe line directly from the plant as previously mentioned. The dry fly ash is managed through water sprinkler system and bottom ash are utilised for cement and brick making materials. Although all affected households are aware of those management systems but many of them do not know as how these are managed. Our FGDs demonstrate that the affected households' poor understanding of the effluent management mechanism leading to their pessimistic attitude on health conditions in the NTPC locality. The farmers cannot carry on their agricultural production thinking of land pollution. And the vegetables producers believe their vegetables are contaminated by the fly ashes, so they cannot grow vegetables in their agriculture lands. The farmers therefore, argue preferring more about cash crops cultivation in the locality.

The NTPC also claims that it is successfully managing air pollution in the coal-fired power plant locality. The plant regularly monitors gases releases by the chimney through stack monitoring kit and flue gas analyser. The fugitive coal dusts and dry fly ashes are maintained through water sprinkling systems at ground levels. Compensatory plantation programmes are another strategies promoted by the NTPC controlling air pollution level in the locality. However, the Table-13 reflects that though 67.57 per cent of the affected people aware of it only 30.63 per cent of them knew how it activated actually as stated earlier. The air pollution is caused because of coal dusts released by mining operation and coal transportation, coal-fired gases emitted by thermal chimney and vehicular pollution. It is quite visible that the chimneys of Thermal plant more regularly emit burning ashes and hazardous gases into air making the entire physical environment a dusty cloud. During summer season the fly ashes rampantly spoil the villages, particularly those located nearby the ash pond area (Derang locality). It engulfs the cultivable lands and village infrastructures as well. Transporting of coal by trucks, burning of coal at homes abet pollution problems of the region by releasing more toxic gases like nitrogen oxide, sulphur dioxide, etc, as stated earlier. The affected people express as if these are now becoming common sense knowledge for them, and that everybody knows without even studying science subjects. They argue neither the project nor the state government bothers much to control the increasing degree of pollution and consequent temperature increase in the locality. The pollution of land, air and water has started generating many environment related diseases.

The focus group discussion reveals that NTPC's CSR activities such as distribution of mosquito nets in nearby villages, family welfare camps, health camps on respiratory diseases & TB awareness, individual toilets, mobile health clinics, organization of blood donation camp, provision of ECG machine, pulse oxy metre in Talcher, hospital, construction/ repair of drains, etc. The FGD among qualified and employed individuals from Rengabeda and Gadasila villages argue that a number of the diseases like malaria, diarrhea, jaundice, scabies, bronchitis, etc and lungs related diseases like tuberculosis, asthma, and respiratory tract infection have almost become endemic in the region. It is revealed from focus group discussions that many of affected villagers now suffer from other non-communicable diseases like cancer, paralysis, rheumatism, arthritis, diabetes, hypertension and heart diseases, which were little known diseases in the region in the past.

V. Conclusion

We can conclude that Thermal plants and coal as if engine and fuel together significantly contribute to the growth of environmental pollution and consequent health hazards in the mining area. The illness, sickness and bodily diseases are largely caused due to environmental pollution. Malaria, bronchitis asthma, skin problems, heart problems, lung problems, liver problems, etc are some of the health problems found among the affected villages at present. The coal-fired plants are quite potential forming of carbon dioxide, nitrogen oxides, sulfur dioxide, ozon and mercury and of releasing these into the local atmosphere. These pollutants cause health problems of asthma, nasal congestion, shortness of breath, coughing, wheezing, cardiac birth defects, premature birth, cold and heat related illnesses, infant death, low birth weight, etc. It has been increasingly challenges for the concerned doctors in the available government hospitals, private medicals, Ayurvedic dispensaries and homeopathic dispensaries, in the Angul district. The overall situation of people's health in polluted environment reflects four impacted outcomes- one-environmentally polluted outcomes, two-physically impacted outcomes, three-mentally disturbed outcomes and four-socially disrupted outcomes. Regarding the environmental polluted outcomes the affected families perceive that the coal and coal-fired plants polluting land, water and air also pollute the ecological ethics toward environments as now they tend to develop anti-ecology tendency in these days. Now the people residing in and around thermal plants cannot help supporting the pollution caused prosperity. Somehow or other their involvements in coal burning and ash pond activities promote solid, liquid

and gaseous wastes. Thus, the affected people are not less culprits than NTPC for their illness, sickness and diseases at present.

The affected villagers' perception on physically impacted outcomes is quite objective in our findings. They argue that since they finally agreed to allow the land acquisition for NTPC project and its operation they have to share both prosperity and adversity created by thermal plant. On the other hand the senior old people argue that NTPC caused adversity is far heavier than its prosperity to which they blame government and project authorities inclusively. As comparison to their past they are more physically weak and prone to frequent morbidity and unnatural mortality at present. Neither NTPC health facility nor government health institution can correct their sickness and emerging diseases which were not known to them earlier. Except NTPC employed people other villagers blame NTPC authorities that they cannot access free health facilities and reimburse medical bills. The inner dynamics of the affected people reveal that the NTPC has not simply divided the affected people such as substantially affected people and least affected people and employed and unemployed people but also accordingly has provided rehabilitation package with a discriminate strategy. A mental gulf is being created among these people since beginning of the project. Many argue that hyper tension and depression are mounting among the non-employed individuals and among least affected categorised families.

This visibly brings about their mentally ill health-outcome that may be diabetics. As we know that health is wealth and if we are not physically well we cannot be well mentally. A Sahara tribal who used to drink country made wine from the Sundi (wine sellor) or homemade Handia (rice wine) in Derang village now by drinking foreign liquor meet his pre-mature death. On the other hand the wine sellers- Sundi who lost their agricultural lands due to land acquisition exploit drinkers more in the absence of agricultural production. Similarly the landless fisher men no more carry on their hereditary occupation- fishing and selling fishes neither gets employed like substantially affected person (SAP) as stated earlier. The qualified SAPs get NTPC jobs whereas the non-qualified SAPs engaged as wage earners in the locality. As a result, the cohesiveness among family members is highly disrupted giving rise to their social disorganisation.

The socially disrupted outcomes- the immature politicians, unemployed youth, unmarried bachelors, college passed out boys, school dropout sons, spinsters, unskilled workers, and so on are more often wrongly motivated against the social well being in the locality. The senior citizens argue that the youth club funded by NTPC authority sometime undermines the importance of social and cultural capital that was generated by senior people through traditional patterns of kinship, friendship and neighbourhood relationship in the village. Many senior people argue that the politicians, touts and frustrated youth no doubt are going hyper active on village affairs but still are ignorant of many NTPC activities and their future and therefore contributing to the process of anomie, alienation and apathy around the NTPC locality. Thus, power plant caused environmental polluted outcomes, physically impacted outcomes, mentally disturbed outcomes and socially disrupted outcomes are mounting the health hazards in the NTPC locality.

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