Environmental Violations in and around Coalmines, Washeries and Thermal Power Plants of Tamnar & Gharghoda Blocks, Dist. Raigarh, Chhattisgarh

Report of Fact Finding Team

November 2016

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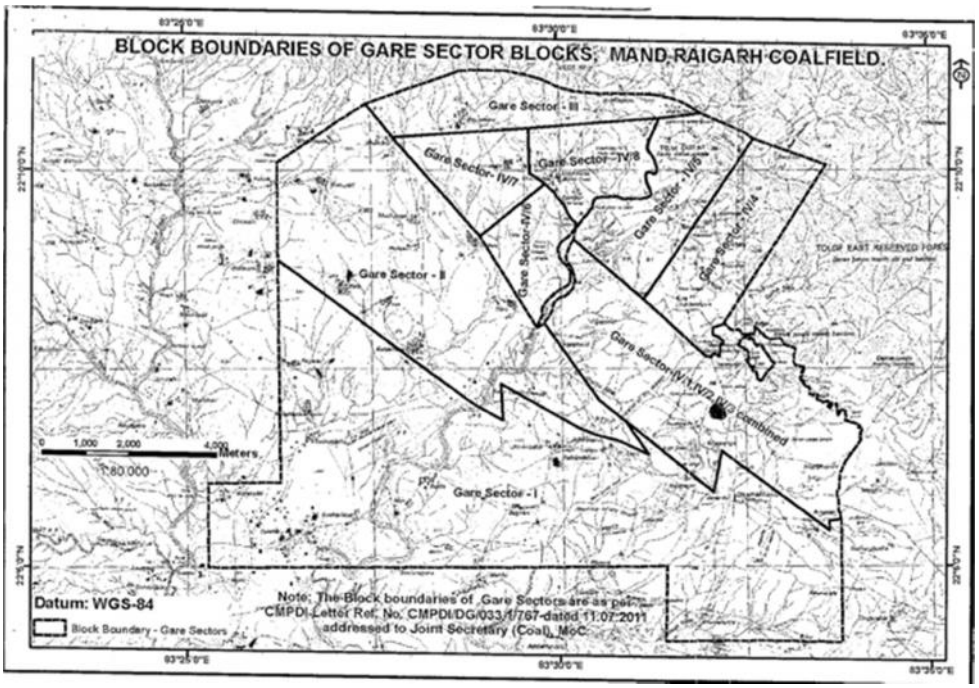
Executive Summary

A two-member fact finding team comprising of environmental and social researchers Shripad Dharmadhikary and Manshi Asher enquired into the complaints about environmental pollution, loss of land and livelihood, public health crisis and various violations and illegal operations of coal mines, coal-washeries and thermal power plants in the Tamnar and Gharghoda blocks of Raigarh district of Chhattisgarh. The team also conducted a field visit of the villages in these two blocks and interacted with residents and other stakeholders. The focus of the team was on impacts related to water.

Coal mines located in the Tamnar and Gharghoda blocks are part of the Gare Pelma coal block. Gare Pelma coal block is the largest among the 80 coal blocks in the Mand-Raigarh coalfields and is spread over an area of 16649 hectares. The Mand-Raigarh coalfield itself is spread over an area of more than 112000 hectares in Raigarh district with an estimated 21,117 Mt of coal.[1]

Most of these coal mines, located in the Tamnar and Ghargoda blocks, came up either on agricultural or forest and pasture lands. In addition to coal mines, this region has several coal based thermal power plants and coal washeries.



Source: http://coal.nic.in/sites/upload_files/coal/files/curentnotices/Gare_Palma-NA_0_0.pdf

[1] http://secl.gov.in/writereaddata/MRCF%20%20Report%202014.pdf

This report focuses on the various environmental impacts, and illegalities and violations carried out by industries present in this region. It also looks into the allegation that regulatory authorities have failed to monitor and enforce compliance with environmental conditions lawfully imposed on these industries and assess effects of these lapses on the ecology and livelihoods of adivasis who depend on the natural resources for survival.

Findings

During the visit the team observed that as in all mining and industrial areas it was the local people who paid a heavy price for these developments, living in black smog day after day, witnessing a rapid depletion of their natural resources and health. The primary occupation of the large population was agriculture, livestock rearing and collection of forest produce. Each and every aspect of the natural resource based economy has been adversely affected by the spread of industrial and mining activity in the region.

During the visit the team noted the following:

1. Extremely poor air quality in and around the villages bordering the mines, thermal power plants and coal washeries.

2. It was noted that there were several reports of drastic depletion of ground water levels owing to extraction by the industries. The team was informed that in some places the water table had fallen from 30- 40 feet to as low as 250 feet. At least 90 out the 116 villages in Tamnar block have been affected by the dropping water table.

3. It was also observed that there was a serious depletion and drying of surface water resources due to dewatering effect of mines.

4. Serious contamination of surface and ground water was noticed. It was primarily through :
    a. Direct discharge of pollutants and waste water streams from mines, TPPs and washeries, including the Captive Power Plant at Dongamahua, Gare IV/1, IV/2, IV/3, IV/4, IV/5 mines, the ash dumps of Jindal Power plant and Mahaveer Power plant, and several others sources.

    b. Contamination of surface and ground water and agricultural fields due to leaching and overflow of pollutants from ash ponds, ash dumps, coal dust, fly ash dust etc.

    c. Contamination of groundwater through leaching and other means

5. Drying of rivers and water sources due to diversions to industry.

6. Underground mine fire and smoke was noticed in Nagramunda village at the Gare IV/1 mine.

7. Coal ash from power plants was dumped in and near agricultural fields and places of habitation leading to contamination of water sources, which would ultimately enter the food cycle.

8. Coal mines have illegally expanded and are threatening places of habitation in villages like Kosampalli.
9. Rehabilitation of villagers displaced by expansion of mines was neither adequate nor complete.

10. Severe impact of all these taken together on the livelihoods, health and well-being of the local communities.

All through the interaction people complained of poor air and water quality, depletion of water resources, water resources being rendered impossible to use, death and depletion of fish, destruction of forests, discharge of contaminated waters like coal dust bearing water, mine drainage, ash slurry into agricultural fields and local water bodies, illegal expansions of mines and the failure of the local and the state administration in enforcing any standards or directions the erring units.

Recommendations of the team:

1. The Government should immediately initiate a comprehensive exercise to document and map all the serious environmental and social impacts of mining, washing, transport, power generation and related activities. Such an exercise must be undertaken with the inclusion of independent, credible experts and institutions, and local people. Our findings and observations show industrial activities are causing massive adverse impact on the region. There are gross violations of environmental conditions and norms. Water resources are being depleted and polluted. Hence, the need for an immediate comprehensive impact assessment.

2. Looking at the serious level of pollution and contamination, a health impact assessment should also be carried out in the affected areas.

3. Immediate assessment of the compliance and violations of conditions of Environmental Clearances, of the Consent to Establish and Operate and of other legal permissions given to various projects.

4. Immediate action should be taken to prevent, mitigate or compensate impacts already documented, particularly the release of untreated effluents into local water bodies and ambient environment, and the dumping of solid waste like fly ash, sludge etc. into the surroundings.

5. Accountability of the errant industry and the regulatory mechanisms must be ensured, and strict legal action should be taken on the errant industries and officers

of the regulatory agencies in-charge for monitoring and implementation of environmental conditions in the industries.

6. Given that scale of activities of mining, washeries, power plants is set to go up significantly, we also recommend that a prior, carrying capacity and overall cumulative impact assessment should be carried out, and any decisions for new activities should be based on the outcome of such exercise.

7. Finally, we recommend that MoEF and CECB make available all the relevant project documents (EIAs, DPRs, Consent etc) publicly, and in particular to all village panchayats and local administration offices in a proper and complete manner. This is critical for transparency in governance and indeed a basic right of the affected populations.

8. Chapter 1: Background: Raigarh, Two decades of destruction

Spread over an area of 6386 sq km and located in the eastern region of the state, bordering Odisha, is Raigarh district of Chhattisgarh. In the late 90s it emerged as one of the power, coal mining and sponge iron hubs for the State. Jindal Steel and Power Ltd (JSPL), formerly known as Jindal Strips Limited, started operations with the construction of a 5-lakh Tonnes Per Annum (TPA) sponge iron plant and captive thermal power plant in the region in the 90s. In the last two decades it went on to acquire coal mines, chromium ore mines and iron ore mines for captive use. Out of the then 150 lakh TPA production of sponge iron in India, Raigarh accounted for nearly 8% and JSPL and its subsidiary units accounted for a large amount of this. Following Jindals several small and big companies, private and public, jumped into the fray. By the middle of the last decade there were close to 26 sponge iron units in Raigarh. Today there are at least 17 operational/proposed mines and more than 13 operational/ under construction/ proposed thermal power plants in the district.

The Mand Raigarh coalfield spread over an area of more than 112000 hectares is located in this region with an estimated 21,117 Mt of coal[2]. Close to 80 coal blocks were identified in this coal field of which the Gare Pelma coal block was the largest spread over an area of 16649 hectares. Many of these were allotted to several public and private sector companies.

NAME OF BLOCK	TOTAL AREA
GAREI	6098.22
GAREII	2506.73
GAREIII	639.92
GAREIV/I	871.12
GARE IV/2	487.83
GAREIV/3	714.83
GAREIV/4	876.31
GAREIV/5	839.84
GAREIV/6	381.33
GAREIV/7	406.06
GAREIV/8	489.87
Pelma Block	1570.59
Pelma Ext	766.67
	16649.32

Area in Hectares. Source (CMPDI)

Most of these coal mines, located in the Tamnar and Ghargoda blocks, came up either on agricultural or forest and pasture lands. The tribal district, which is a Schedule V area (Scheduled Tribes are 33% of the total population) with Gonds and Oraons, being the main

[2] http://secl.gov.in/writereaddata/MRCF%20%20Report%202014.pdf

inhabitants, was once famous for its Kosa silk and tendu (bidi) leaf production. The primary occupation of the large population was agriculture, livestock rearing and collection of forest produce. Each and every aspect of the natural resource based economy has been adversely affected by the spread of industrial and mining activity in the district.

1. Agriculture and Private Land

The main occupation of the people in most villages is agriculture with 90% owning or working on the land, including the tribal communities. According to the 1991 census, 83.7% of the population of the Raigarh district was dependent on the farm sector for employment; of these 29% were agricultural labourers. In the 2011 census the number of agricultural labourers went up to 50% and about 30% are primarily cultivators. There seems to be a marginal decline in the dependence on land and there seems to be a substantial rise in agricultural labour – perhaps indicating a shift in land use and ownership. Local agriculture has been hit by the mushrooming of mines and factories in many ways.

1.1 Transfer of agriculture land to industries

Since the year 1991, almost 1244.5 hectares of agricultural land has been transferred to industry in Raigarh, most of it for sponge iron units[3]. The most transfers of land occurred after 1998, accelerated further after 2002, and still continue. Violation of Section 170 of the Chhattisgarh Land Revenue Code that restricts transfer of tribal land to non-tribals is very common and rampant and several such cases have been documented in last few years.

1.2 Encroachment by industries

Industries and mines have acquired agricultural land by using all kinds of tactics, from money to force and harassment. 'Encroachment' is one of the most common patterns used by the big as well as the small plants. The dumping of fly ash and wastes destroyed the fields of poor villagers who were left with no option but to selling their lands at cheap rates.

1.3 Impact of air pollution on soil and agricultural production

As in the rest of Chhattisgarh, rice is the popular agricultural crop here, with most of the farmers cultivating the *sarna* variety. This is a variety that grows over a long period and, according to the farmers, in adverse conditions *sarna* at least gives them a crop to fall back on. The farmers of the area have pointed out several problems occurring as a result of the pollution: especially air. The *sarna* variety of rice gets a longer exposure to dust, which affects the quality as well as quantity of production. Accumulation of the dust and residue in the fields makes the soil impermeable and solid. People spoke about how rice production has decreased in the past two decades. They also mentioned that to increase productivity the use of chemical fertilizers has seen a rapid rise.

People also reported that drumstick, referred to as *munaga* (moringa oleifera) is a tree grown commonly in villages and is dying at an alarming rate due to excessive air pollution. *Munaga's* leaves, flowers, and fruit are all consumed as vegetables and it is traditionally considered as a medicine for gynecological problems.

[3] Source: Asher.M and Mumtaz.R, Infopack on Sponge Iron Industry in India, 2007

In many villages the agricultural fields were carved out traditionally in such a way that there was natural irrigation during the monsoons. With the mines coming up in these regions this system has been broken and large tracts of land have been rendered barren. We witnessed this first hand in Kosampalli where the Gare coal block is located.

2. Non- Timber Forest Produce (NTFP) and Forest Land

Almost half the area of Raigarh district – about 3200 sq. km - is under the jurisdiction of the forest department, according to information available on the Raigarh forest division website. Of this, almost 50% is reserved forest. The Mand Raigarh coalfield contains a large number of demarcated coal blocks in dense forest area, including several that overlap or adjoin elephant and leopard habitat[4].

Forests that fall in the Deccan biogeographic zone are dominated by tropical dry deciduous forests. The most common tree species are Shorea robusta (Sarai), Tectona grandis (Sagon), Pterocarpus marsupium (Beeja), Terminalia alata (Saja), Terminalia bellirica (Bahera), T. Chebula (Harra), Madhuca sp. (Mahua), Lannea coromandelica, Garguga pinnata, Soymida febrifuga (Rohan), Adina cordifolia (Haldu), Bombax ceiba (Semra) etc. Smaller trees and shrubs include Bridelia squamosa, Cleistanthus, Cassia fistula, Schleichera oleosa (Kusum), Caryea arborea, Dillenia pentagyna[5].

These forests play an important role in the day-to-day life of the people as they provide timber, fuel, fodder, and wood for household and agricultural implements. Many of the species are used for medicinal purposes too.

Since the year 2000 almost 1000 hectares of forestland has been diverted to private companies for setting up sponge iron Sponge Iron Plant in Forest lands[6]. Thousands of trees have been cut for industrial construction and scarcely any have been planted to compensate. This has not only meant felling of forests which have been diverted but also encroachment on forest lands that are close to the boundaries of the industrial campus.

2.1 Impact on Forest and Wild Biodiversity

A rapid assessment conducted in 2005 in Raigarh by Pankaj Oudhia[7], a Raipur based agriculture scientist, revealed some of the below:

• Deposition of thick layers of black dust on the surface of the plants and their leaves results in a kind of slow death since it hinders stomatal activity and reduces the effective photosynthesis area. This, in turn, affects other species dependent on the plants for their survival. Many Lepidopteron insects feed on *mahua* plant parts, for instance. These insects are used as a source of medicine as well as food.

• Layers of black dust can be seen in all ponds and water sources in close proximity to these factories. Most of these ponds are becoming graveyards of aquatic flora like *Hydrilla* that

[4] http://www.greenpeace.org/india/Global/india/report/How-Coal-mining-is-Trashing-Tigerland.pdf
[5] http://www.worldwildlife.org/ecoregions/im0201
[6] Infopack on Sponge Iron Industries, NCAS 2007
[7] http://www.pankajoudhia.com/newwork47.html

serves as food for aquatic fauna. Like *mahua*, *sarai* is also a tree well known for its religious and medicinal importance in the Raigarh region. The locals use all parts of the *sarai* tree. An oleoresin called *saldammar* (*ral, guggal, laldhuna*) is obtained by tapping the tree's trunk, used to caulk boats, in paints, varnishes and as incense. This tree serves as host for the *tasar* silkworm and *kusumi* strain of the lac insect. The dust, according to locals, is causing irreparable damage to the *sarai* trees as well.

The Mand Raigarh coalfield region along with its neighbouring districts is also known to be elephant corridors. In fact, the state government had secured approval for the elephant reserves in August 2007 from the National Board for Wildlife (NBW). The reserves were to be spread across Raigarh, Korba, Sarguja and Jashpur districts[8]. However, the proposal was put on hold after desperate lobbying by the mining companies[9].

2.2 Decline in *Mahua* collection

Collection of *mahua* flowers is one of the major livelihood activities every year, besides agriculture. Most families have these trees on their private lands. Extraction is also done from the wild. *Mahua* is used for preparing country liquor. It is rich in iron content and used as local medicine for young women and children and as a dietary supplement. Another product of the *mahua* tree that is commonly extracted is *dori*, the seed of the *mahua*. This is an oil seed. Its fruit is used to make edible oil used primarily for cooking. *Mahua* collectors also raised the issue of deposition of black dust on the flowers, as well as the reducing number of trees as more and more forestland is been diverted for industries.

2.3 Decline in size and quality of *Tendu*

According to local communities *tendu* leaf collection has been affected by the massive industrialization in Raigarh. Forestlands have been encroached upon and diverted to industries resulting in felling of *tendu* trees. The quality of *tendu* leaves, determined by the size of the leaf, has deteriorated due to excessive black dust deposits. Dependence on the forest is reducing due to increased construction activity[10]. People get equal or higher payment for working on construction sites and coal mines. Some 70% of *tendu* leaf collectors are women.

Another NTFP that is collected is *sarai* leaves, which are used for make plates and bowls. The increasing dust deposits on the leaves means that the women who harvest the leaves have to go through the additional labour of washing and drying the leaves before moulding them into plates etc.

2.4 Impact on Sericulture

Pollution is becoming a curse for both host plant and the silk insects. This is because the leaves have dust deposition and the silk worms cannot feed on these leaves affecting the quality (size) of the larva. Additionally the destruction of the *Arjun* and *sarai* trees, which

[8] http://www.livemint.com/Politics/z6RA9Ix7jG6E2NCxQ8vMDO/Coal-blocks-may-scuttle-elephant-corridor-plan.html
[9] http://archive.indianexpress.com/news/for-coal-blocks-chhattisgarh-dropped-elephant-reserve-plan/1004187/
[10] http://www.videovolunteers.org/chhattisgarh-rapid-industrialisation-threatens-tribal-livelihood/

are the main host plants, is happening with direct felling or destruction of plantations by dumping of fly ash as was visible opposite the Jindal Power Thermal Plant.

3. Livestock rearing and grazing lands

Apart from the designated forestlands, much of the land being diverted for the mines and industries is revenue forest and pasture land. The increasing non-availability of green pastures for the animals is now a real problem as forest and grazing lands are shrinking apart from getting covered with pollutants.

4. Water Resources: Depletion and Pollution

This entire region is part of the Mahanadi river basin. According to the Chhattisgarh Biodiversity Strategy and Action Plan (2002-03) of the State Forest Department, of the four major river basins in the state, the Mahanadi is the largest, covering 56% of the total area under the four river basins. "It forms one of the biggest carbon sinks of the country and contributes to the soil and water security of the neighbouring state." (http://cg.nic.in).

Raigarh district is rich in water resources. The entire Raigarh district falls in the Mahanadi basin. Important tributaries of the Mahanadi like the Mand, Kurket and Kelo flow through the district. The historical average annual rainfall (1975 to 2012) for the district is 1169 mm [11]leading to significant surface and groundwater availability. The water flows in the various tributaries of Mahanadi are not available separately in the Ministry of Water Resources' data. However, the EIA report for the Kelo project[12] gives the 75% dependable water availability in Kelo near Raigarh to be 388 million cubic meters (MCM). We have estimated the 75% dependable run-off for Mand river at Kurubhata (which is after confluence of Kurket) at 1823 MCM per annum[13]. According to the Central Ground Water Board[14], annual available groundwater resource in the state was close to 499 million cubic meters (MCM).

Now, the Mahanadi and its tributaries Kelo and Mand, face a severe crisis as industries extract huge quantities of water affecting both availability of water for drinking and irrigation and the riverine ecology. The Kelo river runs through Tamnar and is upstream of Raigrah town. Streams feeding into the Kelo, for instance the Bendra Nallah has effluents and tailings from the mines Gare IV/1, IV/2, IV/4 and IV/5 being released into it. The wastewater stored in mines and ponds is also being directly discharged into local nallas and water bodies, or leaching into the ground and affecting the quality of ground water as well as the fertility of the soil.

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[11] Chhattisgarh: Water Year Book 2013, at http://www.cgwrd.in/r-data/doc_view/400-water-year-book-2013.html Downloaded 3 Oct 2016

[12] http://www.cgwb.gov.in/Regions/GW-year-Books/GWYB-2014-15/GWYB%2014-15%20Chhattisgarh.pdf Downloaded 3 Oct 2016

[13] This should be treated as a rough estimate, as we have estimated it based on 21 years data, with the data set made from two disjointed sets of years 1986-87 to 1996-97, and 2003-04 to 2012-13, taken from the Integrated Hydrology Data publications of CWC for years 2005 and 2016.

[14] CGWB, *Ground Water Brochure of Raigarh District, Chhattisgarh 2012-2013* http://cgwb.gov.in/District_Profile/Chhatisgarh/Raigarh.pdf Downloaded 16 Sept 2016

5. Environmental Issues

Environmental compliances especially related to air and water pollution are very poor. An easygoing state pollution control board has failed to monitor or bring the non-compliant industries to account. This document has an account of the non-compliances and violations in the Tamnar and Ghargoda blocks that need urgent attention of the authorities.

Chapter 2: Mines, Power Plants and Washeries in Raigarh

Given the huge coal deposits, ample availability of water and land that has high population of tribals or is under forests, with a resultant presumption of easy acquisition, it is not surprising that there have been massive plans for mining of coal and coal based power plants in the district. Apart from the district's own water resources, it may be noted that the main Mahanadi river also flows on the boundary of the district and the projects in the district are also drawing water from Mahanadi for their needs.

In 2011[15], a study by the Prayas Energy Group, Pune documented the thermal power plants in pipeline (those which had applied for environmental clearance to the central Ministry of Environment and Forests (MoEF)). It highlighted that Raigarh district, with 24,380 MW of projects in pipeline, was the district with the second highest capacity of plants in pipeline[16].

In line with this, there are a large number of power plants already built or proposed in the district, along with the associated mines, washeries and other infrastructure. The tables below give the details of each of these.

Table 1: Summary of Thermal Power Plants in Raigarh District

Status	Number of Plants	Capacity (MW)
Operational	6	4912
Under Construction	4	4300
In Pipeline	3	5612
TOTAL	**13**	**14,824**

Source: CEA, MoEF Environmental Clearance Data and Field Visit Information. Note that some of the captive power plants are not listed by the CEA.

Table 2: Summary of Coal Mines in Raigarh District

Status	Number of Mines/Blocks	Capacity (MTPA)
Operational	7	21.95
In-Pipeline*	10	78.32
TOTAL	**17**	**100.27**

*Note: In pipeline capacity includes only that which has applied for environmental clearance. Other proposed capacity expansion is not included.

[15] "Thermal Power Plants On The Anvil - Implications and Need for Rationalisation", Prayas Energy Group, 2011. Available at http://www.prayaspune.org/peg/publications/item/164-thermal-power-plants-on-the-anvil-implications-and-need-for-rationalisation.html

[16] The one with highest capacity was the neighbouring district of Janjgir-Champa, also in Chhatisgarh.

Table 3: Summary of Coal Washeries in Raigarh Districts

Status	Number of Plants	Capacity (MTPA)
Operational	2	6.96
In Pipeline	6	22.6
TOTAL	8	29.56

It may be noted that almost every mine in the region also plans to have a washery unit, and with the washery unit, also a captive power plant based on washery rejects. However, the status of these washeries and the associated captive power plant is not clear, except for the two operational ones.

Detailed break-up of the operational and in-pipeline power plants, coal mines and washeries, with names of plants are given in Annexures A, B and C respectively.

The Map at Figure 1 shows the locations and layout of the Gare-Pelma coal blocks, as well as the Tamnar Power Plant. This is a small section of the Mand-Raigarh Coal field.

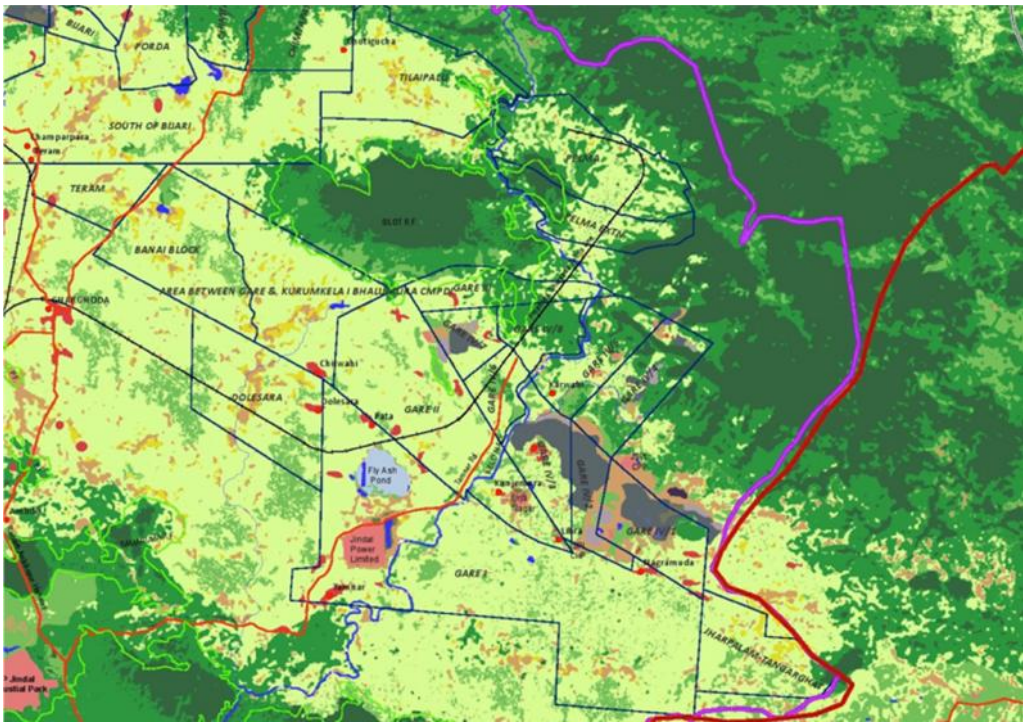

Figure 1 : Gare-Pelma Section of the Mand-Raigarh Coal Field. Source, SECL Website, http://secl.gov.in/writereaddata/MRCF%20Claasified%202014%20Map.pdf

Chapter 3: Impact - Depletion and Destruction of Water Resources

Massive Impacts
The operation of large number of mines, power plants and washeries, with the related infrastructure has had a massive social, environmental and health impacts on the local area and communities.

This and the following chapter primarily aims to document the impacts on the water resources of the region, though we have also included other impacts where we have been able to observe them.

The major impacts that we could see during the fact-finding visit include the following:

1. Severe depletion of groundwater and sharply falling groundwater levels, depriving people of their important source of water.

2. Depletion and drying of surface water resources due to dewatering effect of mines.

3. Serious contamination of surface and ground water through

    a. Direct discharge of pollutants and waste water streams from mines, TPPs and washeries

    b. Contamination of surface and ground water due to leaching and overflow of pollutants from ash ponds, ash dumps, coal dust etc.

    c. Contamination of groundwater through leaching and other means

4. Drying of rivers and water sources due to diversions to industry

Depletion of Groundwater and Falling Water Levels
One of the most serious impacts of mining, particularly open cast mining is the depletion of groundwater in the surrounding areas. This is because the digging of massive pits for the mines allows water to seep in from the surroundings, depleting the surrounding groundwater. Moreover, this in turn also impacts surface water sources as the surface and ground waters are intimately connected.

Our team saw this impact wherever we visited coalmines in the area.

In village Kosampalli, next to the Gare IV/2 and Gare IV/3 mines, people told us about the problem both, in individual discussions and during a common village meeting. The gist of what we were told is as follows:

> "Mining started in the area around 2006. After the start of the mining, there was a serious impact on the water.

> "There are five ponds in the villages, which earlier would not even dry up in the summers. Now, by February, these ponds are totally dried up. In the entire surroundings, there are 15 ponds, and they are all facing the same situation.
> "The water levels in the handpumps, which was earlier hardly 30-40 feet below ground, has now gone very low, even upto 200-250 feet. We had 20 handpumps in the village, out of which 5 have now gone totally dry. In the others, we get very polluted, yellow coloured water, so they too are useless.
>
> "In neighbouring Libara village, the water from borewells has gone totally bad. Now, they have had to bore down to 600 feet to get drinking water.
>
> "In our fields, earlier, in the monsoon, when it rained, the water would stay for a long time. [The area has paddy cultivation, and fields are bunded to create pondage for the paddy crop.] But now, the fields dry up just a few days after the rains. This ruins our crops."

In fact, the people told us that the impacts of water drying up go far beyond just a few villages near the mines.

> "Out of 116 villages in Tamnar block, close to 90-95 village are facing depletion of groundwater and have been marked as 'dry'.
>
> "Even the Kelo River, which was earlier having lots of water even in the summer, is now drying up in the summers."

We heard similar stories by people at village Kondkel, which is close to Gare IV/4 mine. They told us that, "Just 2-3 months after the monsoon, the wells go dry. This was not the case before the mining started." People in Nagaramuda, which is near the Gare IV/1 mine, also narrated similar stories.

The observations of our team and study of the official documents both corroborate strongly what the villagers narrated to us. The following photographs capture some of these aspects.

Figure 2: Pond on road from Kosampali to Libara. 14 Aug 2016. Earlier, by this time, the pond would be filled to the top given good rainfall. However, now, the water level goes down within days after filling up, as the water drains away to the mine. Notice the Over Burden dump in the background.

Figure 3: Abandoned hand pumps in Kosampalli village. Earlier, these hand pumps had water at hardly 30-40 feet below ground levels, but they had to be abandoned as the water levels fell sharply and now the bores are dry.

Government Reports showing a rapid decline in groundwater

In Dec 2015, the PHE Department of Gharghoda, Dist. Raigarh provided the findings of measurements of fall in water levels in 119 villages of the Tamnar block. These show drastic falls in water levels in the villages in the block. The following map shows the villages and the extent of fall in water levels, in relation with the location of the actively mined coal blocks.

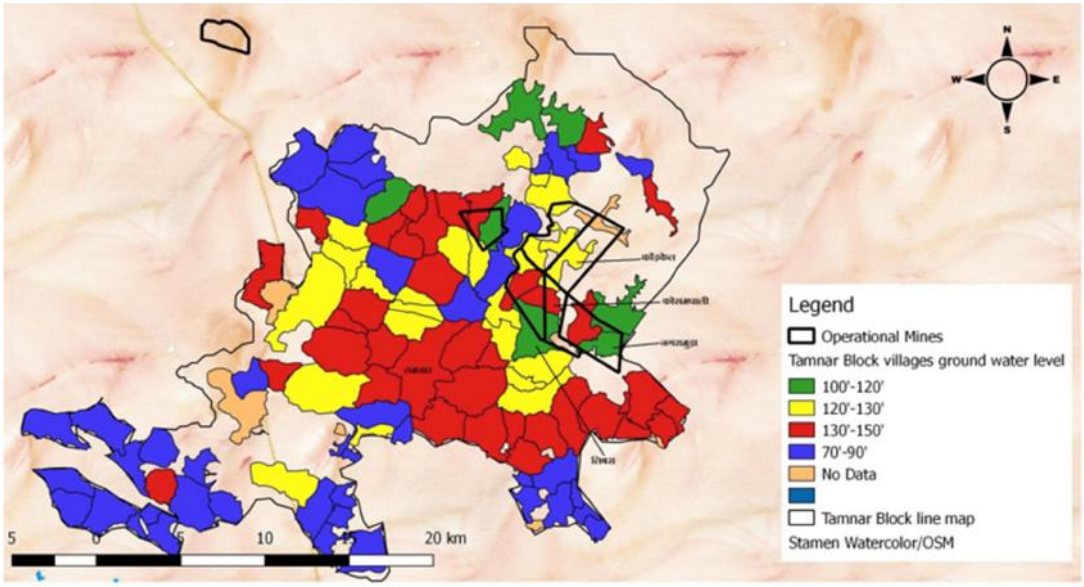

Figure 4: Map Showing Fall in Groundwater Levels and Active Coal Mining Blocks. PHE Data, Dec 2015

The map clearly shows that the dewatering of groundwater due to mining has impact at distances of even 10 kms and more. In fact, virtually 50% of the block appears to be affected. Some of the worst affected villages seem to at a distance from the coal mines. This could be due to various factors like higher elevation of these villages, use of groundwater for agriculture in some of the villages and off-take of water by other industries, all factors which the PHE report notes. These factors, superimposed on the dewatering due to the mines, aggravate the impact of the mines. It may be pointed out that the area in the vicinity of mine is severely affected, as per this data, and this is corroborated by the observations of our team

Shoddy Environmental Impact Assessment

While there is ample evidence that the impact of groundwater dewatering on both ground and surface water has been extensive, it is also seen that the Environmental Impact Assessments (EIA) studies of these mines have been shoddy in assessing the impacts on water, or have chosen to deliberately downplay the issue when seeking environmental clearances (EC).

The MoEF has identified groundwater depletion as a major issue in mining. The "*Environmental Impact Assessment Guidance Manual for Mining of Minerals*" prepared by Administrative Staff College of India for the MoEF as a part of its EIA Guidance Manual series, says[17]:

> "Mining and its associated activities not only use a lot of water but also likely to affect the hydrological regime of the area. The major impact of deep and large mines (both underground and open cast) is of natural groundwater table. Lowering of water table may result in reduced groundwater availability... Deep underground mines directly affect the water table of the area. However, the impact of mining project on groundwater hydrology and surface water regime are site specific and depends upon the characteristics of the mineral, hydrogeology and requirement of groundwater for other uses."

In spite of this, most EIAs treat the issue of impacts on water very lightly.

This is what the Executive Summary of the Draft EIA[18] of the Gare IV/2 and IV/3 mines says about this issue:

> "The pumping tests have shown a low value of transmissivity of aquifer present in the area (16.24 m2/day) resulting in moderate radius of influence (448.66 m). The annual seepage of ground water at the end of 30 years of mining has been worked

[17] Page 33-34

[18] One of the serious issues is that even the basic documents like EC, amended EC, EC for original projects and expansions, EIAs, EMPs are not available for most of the projects. Often entire sets of documents are unavailable or only some of the documents may be available. This is a serious issue in environmental governance and ensuring transparency in developmental projects. In case of Gare IV/2 and IV/3 mines which have been operational now for 10 years, the only impact assessment related document we could get was the Executive Summary of the Draft EIA. Draft EIA downloaded on 26 Sept 2016 from http://www.enviscecb.org/84/Exe%20sum%20English.pdf

> out as 1.778 MCM which is hardly 4% of annual ground water resource. No adverse impact on ground water is anticipated on account of mining activity." (Emphasis added)

First of all, it is not clear how the EIA concludes that no impact is anticipated, when groundwater depletion is a recognised impact of mining, and the EIA itself talks about a radius of influence of 448.66 m. It does not mention what is likely to happen in this radius of influence. In fact, subsequent developments have shown that the radius of influence has gone much beyond this, and villages many kilometers away have also been affected. This clearly indicates that either the EIA has been done in a shoddy manner, or that it deliberately suppressed or downplayed the possible impact.

The groundwater dewatering figures in almost all analysis do not include the rainwater which the mine pit intercepts, which otherwise would have partly recharged the groundwater, and partly been converted into run-off (and partly evaporated). Now this run-off accumulates in the mine pit. This intercepted run-off will have implications for both, the surface and groundwater regime in the area, which have not been assessed in most documents.

The picture becomes more complicated when one sees that Gare IV/2 and IV/3 are not the only mines in the area. For example, the Jindals themselves were operating another mine Gare IV/1, which is adjoining these two. The Rapid EIA[19] for the Gare IV/1 Open Cast Mine Extension brought out in Sept 2008 says that:

> "The average transmissivity of formation in the area has been worked out to be 16 m2/day… and mine seepage would be 11200 m3/day or 4.09 MCM (million cubic meters) annually which is 11.38% of the balance groundwater available.
> "In the long term no major change in the ground water level is expected." (Emphasis added)

Again, there is no explanation as to why there won't be any change in the groundwater level when the project is dewatering such a large amount of water. The developments after mining started showed this rather optimistic prediction to be false.

Further, the impact of this dewatering of 4.09 MCM is in addition to the impact of Gare IV/2 and IV/3 mines, and also other mines expected to come up in the area.

Thus, to get the true picture of the impact, a Cumulative Impact Assessment is necessary. But such an impact assessment has not been done yet.

Estimates of Cumulative Impacts of Mining on the groundwater:

Some indication of a cumulative impact is available in the Gare IV/1 Open Cast Mine Extension EIA[20], where they have put together both, the mine seepage (groundwater dewatering due to mine) and the rainfall interception, for all the mines of Jindal's, including

[19] http://www.indiaenvironmentportal.org.in/files/Gare%20IV-1%20Ext_EIA.pdf Downloaded 27 Sept 2016
[20] Page 4-10 of the EIA.

Gare IV/1, IV/2&3 and IV/6. These figures show that in case all three mines become operational, the total groundwater dewatering would be 10.3 MCM per year, which is around 30% of the total groundwater availability of Tamnar block[21].
Even without the Gare IV/6 mine, which is not operational, the dewatering of groundwater could be 5.86 MCM, which is about 17.5% of the block's groundwater availability. Note that if we look at the two EIAs separately (Gare IV/1 Ext and Gare IV/2&3), then each one gives a lesser groundwater depletion, but together they add up to more, and will have a bigger impact as their areas of influence are largely common. It may be recollected that there are several other mines operational and planned in the area other than just these three mines of Jindals.

This indicates the absolute need for a Comprehensive Cumulative Impact Assessment of all the mines in the region, without which each individual mine will be able to downplay its impact, but the communities will have to bear, as they are bearing, a much larger impact of all the mines together. This is even more urgent considering the large expansion of mining activity on the cards in the area.

Impacts on Surface Water
Apart from the depletion of groundwater, there are serious impacts on the surface water too. These happen in several ways. One, since some of the surface water, particularly the stream and river flows in the non-monsoon months, comes from groundwater; the depletion of groundwater affects surface water sources.

Second, lowering of groundwater levels also drains away surface storage structures like ponds and bunded fields. We have already seen earlier how local people have complained that ponds no longer store water beyond the monsoons, and also lose water levels within days of filling; and even paddy fields do not accumulate water to allow proper paddy cultivation.

Another way in which the fields are affected is that mines cut-off and intercept the run-off. This cuts off water supply to fields. In a paddy cultivation area, typically the lower fields receive the overflow or run-off from the fields at the higher side. However, the mines have broken this drainage patterns for many farms, and now the mines have intercepted the flow, which the farms earlier received. Moreover, falling groundwater levels mean that fields cannot retain even the water they receive, which drains off to the ground very soon. For example, people at Nagaramuda told us that the mines suck away the waters from their fields, and the fields dry up, making farming impossible.

Use of Water Accumulated in the Mines
One question that arises is if a mine is accumulating ground and rainwater, why this water can't be given to the people who are otherwise facing the problem of depletion. While this can be done – albeit only to some extent – even this is not being done properly.

The mines can pump up the water (called mine drainage) and supply it to the local communities. However, this will involve expenses for pumping the water, and for creating

[21] Total groundwater availability in Tamnar block as per "*Ground Water Brochure of Raigarh District, Chhattisgarh 2012-2013*", Central Ground Water Board, is 33.4 MCM per year. Downloaded from http://cgwb.gov.in/District_Profile/Chhatisgarh/Raigarh.pdf on 16 Sept 2016 Page 10 of the Report.

channels for supplying the water. Second, it should be noted that the people affected by the depletion of ground and surface waters may not always be close to the mines. Third, the mine drainage itself can have several contaminants and can even be acidic. In both the cases, it needs proper treatment before supplying to people.

We found that while earlier the Gare IV/2 and Gare IV/3 mines were supplying some of their accumulated water to people, this has now been discontinued. In fact, we saw that the pump house itself had submerged in the mine water. Moreover, the treatment of possible contaminants was not proper (more details on this in the section on water contamination). Local people informed that when the mine water was being supplied to the fields, it was okay in the monsoons, but after that the quality was bad, there was dirt (*kachra*) in the waters. This affects the yield from the farms.

Figure 5: Pump house in the mine pit of Gare IV/3 submerged in mine pit water.

In fact, it appears from what we have seen that the mines are mostly discharging the mine drainage directly into the surroundings or local water bodies, mainly to avoid the extra effort of treating it and creating channels if it has to be given to local farms or communities (more on this in the section on water contamination).

It should be mentioned here that the EC for the Gare IV/2 and IV/3 mines (Expansion), which also applies to the entire mine and not just the expansion, clearly specifies that:

> *"Project authorities shall meet the water requirement of nearby village(s) in case the village wells go dry due to dewatering of the mine."*

However, this is not being ensured (more on this in the section on overall impacts).
The same EC letter also has the condition that requires that

> *"…measures shall be taken for recharging ground water in and around the mine in the study area and for agricultural use. A plan for water conservation and recharge measures of ground water along with budgetary provisions be prepared and implemented in consultation with the Central / State Ground Water Board to mitigate the adverse impact of mining which may lead to depletion of ground water in the area. The company shall put up artificial ground water recharge measures for augmentation of ground water resource in case monitoring of ground water levels indicate decline of water table."*

The National Green Tribunal, in its Order[22] dated 1 Sept 2015, has reiterated that this condition must be followed. Our observations of depleted groundwater levels indicate that these measures of groundwater recharge do not seem to have been undertaken by the company, or if undertaken, have been done in a manner that is completely ineffective.

Depletion of Surface and Groundwater due to Overdrawal by Mahaveer Thermal Power Plant

The 12/24 MW Biomass based Mahaveer power plant near village Bhengari, Gharghoda block, is drawing ground water for its use. The EC for the plant does allow it to draw ground water for its use, but local people informed the team that they suspect the plant is drawing much more groundwater than permitted, as the ponds of surrounding areas as well as ponds and wells used for drinking are drying up. They also informed the team that the local PHE department had not given the permission for the power plant to draw groundwater. However, the team has not seen any formal document by the PHE indicating the same.

[22] Order No. 13, dated 1 Sept 2015, in Original Application No. 319/2014 (CZ), Dukalu Ram & 5 Ors. V/s Union of India & 5 Ors., National Green Tribunal, Central Zonal Bench, Bhopal

Chapter 4: Impacts - Contamination of Water

Contamination and pollution of water sources, by direct and indirect discharge of pollutants by coal mines, power plants, ash dumps and other sources is rampant in the regions visited by the team. The following sections document some of the important observations of the team.

1. Contaminated water in the borewell in Kosampalli and other villages:

We have already noted that the groundwater levels in the village have fallen sharply after the advent of mining. The villagers told us that even where water was found at greater depths, it is extremely contaminated. We observed the water being pumped out for us from a borewell in the village. The depth of the borewell is around 400 ft, according to the villagers. The water in the borewell was reddish in colour.

Figure 6: Red coloured water from a borewell in Kosampalli. (Right) Residents of Kosampalli. (Left).

The reason for the discolouration is not clear, and we recommend that the water be tested by a competent agency with taking the people and people's organisation into confidence to determine the reason for the contamination.

Clearly, the discolouration is linked to the mining, as the water was found at much smaller depths, was of very good quality and not discoloured at all before the mining. The mining has a direct role to play in the contamination of the groundwater, by possible seepage from the mine sump, or by lowering the water table to expose it to contaminants.

2. Direct Discharge of Mine Pollutants into Water sources at Kosampalli:

At several places we found that the water accumulated in the mines was being pumped directly into water sources like *nallas*, or into farmers' fields, from where it enters the water sources.

While pumping of water accumulated in the mines can be useful especially for areas that have seen water resources depleted due to mining, it must be kept in mind that the mine sump water can be contaminated with several suspended solids, coal dust, and can even be highly acidic in nature. The latter is known as **Acid Mine Drainage**. Hence, water pumped up from mine accumulation must be treated before it is let out in the surroundings. However, we found that this may not be happening at present.

The MoEF's "*Environmental Impact Assessment Guidance Manual for Mining of Minerals*" says[23]:

> "There is also positive impact of mining on agriculture, as sufficient water is discharged from the mine, which can be utilized for irrigation, increasing the productivity. Mine drainage water, in many mines, are not contaminated except high suspended solids, which can be removed by simple settling."

However, our field visit showed that this settling process was not being done properly. The photo at Figures 7 shows the "settling tank" into which the mine water from Gare IV/3 Mine was being pumped before being given to the farmers through a channel on the other side. This settling tank is little more than a large pit, whereas a proper settling tank would need a baffled path to allow slow movement of water to allow higher retention times, to settle the suspended solids and to ensure that they do not flow onto the fields or into the water sources where the water is discharged. The photo at Figure 9 shows a settling tank as given by the MoEF's "*Environmental Impact Assessment Guidance Manual for Mining of Minerals*". The difference between what is expected and what is being done is clear.

Figure 7: The "settling tank" where the mine discharge from Gare IV/3 is pumped before giving to farmers. The red arrow indicates the inlet point from the mine.

[23] Page 32 of the document

Figure 8: The outlet point of the "settling tank".

Figure 9: Photo of a settling tank to treat mine water, from the MoEF EIA Guidance Manual (Page 35).

Thus, it seems that the water from the mine is being given to the farmers without proper treatment. There is also a more serious issue. Apart from suspended solids, mine drainage

can often have the more serious problem of being severely acidic. In such cases, it is called **Acid Mine Drainage**. The MoEF EIA Guidance Manual states[24]:

> "Acid Mine Drainage (AMD) also called as acid rock drainage (ARD) / acid rock water (ARW) refers to outflow of acidic water, from a mine of any type … where sulfides are present in the ore or rock. An array of complex physical and chemical processes, involving a number of factors result in the formation of such highly acidic drainage…Such drainage is primarily associated with mining because many coal…deposits occur in sulphide bearing rocks. It is also to be noted that all sulphide-bearing rocks exposed due to mining do not produce acid drainage.
>
> "The mine drainage, if it is acidic and containing toxic constituents, not adequately treated when discharged to nearby land would affect the soil quality adversely; when discharged untreated into streams effects the quality of water and make in unfit for agricultural use. Agriculture is also directly linked to soil. If soil quality deteriorates, the agricultural productivity of the land decreases".

The local people at Kosampalli village informed our team that when the mine water was being supplied to the fields, it was okay in the monsoons, but after that the quality was bad, there was dirt (*kachra*) in the waters. They also told us that their yields were impacted when they used this water, but they had little choice, they were dependent only on the mine discharge since other sources of water had been badly affected. This indicates clearly that the impurities in the mine discharge are not being removed properly in the settlement tank – not surprising given that it is nothing more than a deep pit, but the fall in yield also indicates that the water may be acidic in nature.

Unfortunately, neither the EIA nor the EC of the Gare IV/2 and IV/3 mines discuss whether these mines have pyrites (sulphide bearing rocks) and whether their mine drainage would be prone to become acidic. This is one more indication that the EIA has not been done properly.

However, the EC letter for pit head captive washery of Gare IV/8 mine, which is adjacent to the Gare IV/2 and IV/3 mines, clearly and unambiguously notes that[25]:

> "ii. The entire water of the area is acidic due to presence of Pyrites. People use carbonate to increase alkanity. Proponent shall take measures to reduce the acid in water."

However, we did not see any kind of treatment for neutralising the acids, either at the Gare IV/2 and IV/3 mines, or at any of the other several places where we saw the mine waters being discharged directly in the nallas, or water bodies or onto farmers' fields.

Untreated acid mine drainage can have serious impacts on the water quality, on the aquatic life, and on human health. The June 2016 Draft of "*Best Available Techniques Reference Document for the Management of Waste from the Extractive Industries*" published by the

[24] Page 10 and Page 32 of the document
[25] EC Letter dated 10 June 2013, No. No. J-11015/76/2010-IA.II (M)

European Commission states the following about Acid Rock Drainage (same as Acid Mine Drainage)[26]:

> "The release of ARD to surface- and groundwater deteriorates the water quality and may cause a number of impacts, such as depletion of alkalinity, acidification, bioaccumulation of metals, accumulation of metals in sediments, effects on habitats, elimination of sensitive species and unstable ecosystems."

It appears that such release of untreated ARD/AMD is rampant in the coal mining areas in Raigarh district. There is an urgent need to check this and assess the impacts of the same through a systematic, participatory and independent survey.

3. Discharge of Coal Dust laden water from mine into fields on Kosampali-Libra Road:

On the Kosampali-Libra road, our team saw another instance of direct discharge of polluted water from the mines into the fields of farmers. In this case, the water appeared to have large quantities of coal dust. Photo in Figure 10 shows this.

Figure 10: Coal dust laden water being discharged directly from the mine into farmers' fields on Kosampalli-Libra road.

[26] http://susproc.jrc.ec.europa.eu/activities/waste/documents/MWEI_BREF_Draft.pdf Downloaded 9 Sept 2016. Quote at Page 29. This publication is a draft, work in progress. However, the impacts of ARD mentioned by it are widely acknnowledged.

Similarly, on the Kosampalli-Libra road, we found the local *nalla, Karra nalla*, polluted with coal dust, indicating that coal dust containing water was being discharged into this *nalla*. We were informed that the effluents from the captive power plant at Dongamahua and the washery were being discharged into the *Karra nalla*. Photos in Figure 11 show this.

Figure 11: The *Karra nalla*, showing coal dust deposits and coal dust laden waters

4. **Discharge of Coal Dust laden wastewater from Hindalco Gare IV/4 Mine near Kondkel Village**: We observed extensive discharge of coal dust laden waters into the fields and into a local *nalla* near Kondkel village. This *nalla* is the Bendra nalla which later on meets the Kelo river, carrying all these and other effluents into the Kelo. The local people informed us that these effluents are coming from Hindalco's Gare IV/4 mine. They told us that due to this, the fields were getting very slushy and they were not able to use tractors in the field and were not able to farm properly. The photos at Figure 12 show this.

Figure 12: Coal dust laden water being discharged into fields and local stream near Kondkel village.

In addition to our direct observations, we were informed by local people of many, ongoing instances of discharge of waste water directly into local nallas, rivers and fields by several mines, washeries and power plants. These are the specific instances:

A. Discharge of waste water into *Bendra nalla* by the following units:
    a. Dongamahua Captive TPP
    b. Gare IV/4 and Gare IV/5 Mines (now with Hindalco)
    c. Gare IV/2 and IV/3 mines (earlier with Jindal)
    d. Gare IV/1 mine (earlier with Jindal)
B. Discharge of waste water of washery and mines (both not identified) into the nalla near Libara

C. Waste Water from Jindal TPP's ash pond at Rehgaon being discharged into the surroundings.

5. Dumping of Fly Ash in the Open, Contaminating Land and Water: Jindal TPP

Our team was witness to a very strange form of ash dumping that was taking place right behind the Jindal Thermal Power Plant (TPP) in Tamar. The ash was also from the Jindal TPP. Huge quantities of ash were being dumped on to large extents of existing, good plantations, on low-lying land. At places, the trees were being cut down, at places the trees were just being buried under the ash. These ash dumps were seen to be about 30 feet high, bringing the land up to the level of the neighbouring land. Then, a layer of soil was being spread on the top of the ash, and replanting was being done on this.

This practise is creating serious problem of contamination of land, surface water and ground water, as the toxic elements from the ash are certain to leach out to the surroundings. This is also a clear violation of the conditions of the environmental clearance granted to the plant. (Details later).

The photos in Figure 13 to 16 shows this ash dumping in progress.

Figure 13: Ash being dumped on existing plantations behind Jindal TPP.

Figure 14: Ash being dumped on low lying plantations behind Jindal TPP (Above and Below).

Figure 15: (Above) Ash dump covered with layer of soil and new plantation on top.

Figure 16: Ash from the ash dump mixing and leaching into water in the surroundings.

Regulations of MoEF regarding fly ash generated at power plants are clear; they require the plants to fully utilise the ash, to the extent of 100%, within four years of commissioning. In case of the Jindal TPP, the Environment Clearance letter additionally states[27]:

> "(xvii) Fly ash shall be collected in dry form and storage facility (silos) shall be provided. Unutilized fly ash shall be disposed off in the ash pond in the form of slurry form. Mercury and other heavy metals (As,Hg, Cr, Pb etc.) will be monitored in the bottom ash as also in the effluents emanating from the existing ash pond. No ash shall be disposed off in low lying area." (Emphasis added)

Thus, it's clear that the ash dumping witnessed by us and documented above, even if justified as "filling of low lying areas", is clearly a violation of the EC conditions.

Some further clarifications may be in order. While the MoEF's regulations require 100% utilisation of ash in four years of a plant's commissioning, "filling of low lying areas" is one of the methods of "utilisation" that the MoEF had accepted earlier. However, this method has the serious repercussion of leaching of toxic elements from the ash into water. Hence, it is environmentally an unsafe method. Considering this, lately, the Expert Appraisal Group (EAC) of the MoEF on Thermal Power Plants has been specifically mentioning, in its conditions while according Environment Clearance to coal power plants, that such a method of "utilisation" should be avoided. Thus, for the newer power plants, there is no ambiguity about this. However, since MoEF itself has not issued any circular or notification to the effect that filling of low lying areas shall not be counted as "utilisation", the plants whose EC does not mention this condition may justify continuing such practises. However, this is not tenable, particularly in case of plants like Jindals, where the EC for the earlier phase of the project did not mention this condition, but the EC letters for the expansion of the plant clearly prohibits such a practice. To clarify, the first phase of the project, 4x250 MW, was given EC in two stages, with EC letters dated 24.09.1997 (Stage-I) and 08.06.2006 (Stage-II). We have been able to obtain and see only the first EC letter, which does not have the condition of no disposal to low lying areas. The second EC letter we have not been able to see due to unavailability of such document in public forum.

However, it's clear that the disposal of ash in low-lying area is not coming only from the first phase of the project. The report of the CEA which documents the utilisation of ash[28] shows that the Expansion project has been "utilising" ash by disposing in low lying areas, which is clearly a violation of its EC conditions.

6. Dumping of Fly Ash in the Open, Contaminating Land and Water: Mahavir TPP

The team also witnessed a similar dumping of fly ash in open ground near village Bhingari, Tehsil Gharghoda. This is the ash from the 12/24 MW Biomass based Mahavir power plant.

The dumping of ash, going on since 2014, is seriously contaminating the land and water bodies in the area. Photos in Figure 17-19 show the dumping.

[27] EC Letter dated 18th March, 2011, for expansion by 2x600 MW the capacity at Jindal's Tamnar TPP.
[28] Report on Fly Ash Generation at Coal/Lignite Based Theremal Power Stations and its Utilisation, 1st Half of 2015-16. Pdf Page 21. Available at http://cea.nic.in/reports/others/thermal/tcd/flyash_201516-firsthalf.pdf

Figure 17: (Above) Dumping of fly ash from the Mahaveer TPP near Bhengari village.

Figure 18: Dumping of fly ash from the Mahaveer TPP near Bhengari village.

Figure 19: Ash dump of Mahaveer TPP near Bhengari village contaminating local fields and water bodies.

This dumping of ash by the power plant is completely illegal. The Environment Clearance letter for the project (Expansion from 12 MW to 24 MW) puts this condition on the project[29]:

> "v) 100 % fly ash utilization shall be ensured from as per Fly Ash notification, 2009. The ash shall be disposed off in the lined ash dyke using High Concentration Disposal method."

While we were not able to get the EC letter for the first phase of the project (12 MW), it is clear that the first phase was also bound by this same condition of 100% ash utilisation and disposal only in the lined ash dyke. This is clear from the Minutes of the 23rd Meeting of state level expert appraisal committee, (SEAC) Chhattisgarh[30] held on 7 Feb 2009, which approved the grant of EC first phase of the project. Given below are excerpts from the conditions detailed in the Minutes regarding fly ash:

> "No ash dyke shall be constructed for disposal of ash. Project proponent shall incorporate total ash utilization as integral part of the project. Project proponent shall install dry fly ash extraction systems so that ash generated during the power generation, is collected in dry form and it shall be utilized 100% for other beneficial uses…. Project proponent shall adopt dry ash disposal system for disposal of unutilized fly ash and bottom ash in environmentally sound manner". (Emphasis added)

[29] Letter dated 5 May 2011 fromm the MoEF.
[30] http://www.seiaacg.org/seac%20meeting/23rd%20Meeting%20%20of%20minutes.doc

What our team witnessed cannot be called disposal in "an environmentally sound manner" by any stretch of imagination. **It is a clear violation of the EC for both Phase 1 and Phase 2 of the project.** Further, it is clearly contaminating large areas of land, and water bodies on which local populations depend. Ironically, the Environment Management Plan for the Mahaveer TPP states that[31]:

> "Ash generated from plant should not be stored on land in open areas under any circumstances. The ash generated should be collected in dry form for storage in silos as temporary arrangement."

We were informed by the local people that the ash is leaching out and also carried by the rain into the local *nalla* called Bagbahara Jinda *nalla* (Bhengari *nalla*). There are five villages, which are dependent on this *nalla*, namely Bhingari, Panikhet, Charmar, Yedu and Bakchaba. They told us further that due to the pollution they are now not able to use the *nalla* water for agriculture, drinking, bathing or washing needs any longer. The fish have also died out in the *nalla*. They mentioned also that the effluent from a poultry farm is also contaminating the *nalla*. This latter issue highlights the need for a cumulative impact assessment for a given region.

7. Pollution from Ash dyke of Jindal Power Plant

The team also visited the ash pond(s) of Jindal TPP which is near Rehgaon. The local people informed the team that there was lot of ash blowing out from the ash pond particularly during the summer months. This led to ash deposition and contamination of their houses, villages and farms. Apart from this, they also complained of seepages from the ash dykes contaminating local water bodies. They said that they are facing problems with their crops because of these reasons.

Figure 20: Ash pond of the Jindal TPP near Rehgaon.

[31] Executive Summary of the EIA and EMP of the 12 MW Biomass based Mahaveer TPP, downloaded from http://www.enviscecb.org/Ms.%20Mahavir%20Energy%20&%20Coal%20Benefication%20Ltd%20MECBL-village%20Bhengari,%20District%20-%20Raigarh,%20Chhattisgarh/english%20summary.pdf Accessed 31 Oct. 2016

Other Important Observations:

1. Underground and Overground Fires in Mines

The team also visited a mine – Gare IV/1 - near village Nagaramuda, that has raging underground fires; fires that have also come near the surface. These fires have been reported to start around 2015. These fires present tremendous risks to the villages, which lie above the mines, particularly if the fires spread further. The risks include risks of elevated temperatures making it difficult to live there, land subsidence and others. Moreover, the fires also represent a huge economic loss to the nation, and also add to the pollution load in the area. Local groups informed the team that similar fires were there in the Gare IV/ 2 and 3 mines but through the intervention of the National Green Tribunal, there have been efforts to contain them and work is under process. We recommend that all the mines be surveyed immediately for fires and the existing fires be brought under control right away, before they spread more and become uncontrollable.

Figure 21: Fire visible from surface in the Gare IV/1 mine near Nagaramuda village.

Figure 22: Smoke emanating from the Gare IV/1 mine with fire inside. Note the collapsing of mine sides due to fire.

2. Coal dust, Fly Ash resulting in air and water pollution

One of the major issues in the entire area is the emissions of coal dust from the mines, the power plants and the washeries, from their coal handling areas and from the transport of coal by road. Fly ash falling directly from power plant stacks, or being blown from dried ash in ash ponds adds to this. Figure 22 below shows fly ash being deposited on the terrace of a house near the Dongamahua (Jindal) Captive power plant. This raises the suspicion about the proper functioning of the electrostatic precipitators or other measures taken by the plant to trap fly ash from the flue gases. Earlier, we have also noted locals talking about how fly ash from the ash pond of the Jindal power plant near Tamnar blows onto their houses, fields and villages especially during summer.

We were quite surprised to see during our trip on all major roads near mines a number of sweepers who were sweeping the roads all the time. Their work was to sweep away the coal dust from the roads onto the side. This was presumably so that the vehicles plying on the roads did not blow the dust into the air. However, to us it seemed somewhat of a futile exercise with limited benefits, as the sweepers were merely sweeping the dust to the sides of the roads. From here, any gust of wind was sure to blow it back on the road or into the air. Moreover, rain would take it into the local water bodies.

Figure 23: (Above) Fly ash deposited on the terrace of a house near the Dongamahau (Jindal) Captive Power Plant and Washery .

Figure 24: Road covered with layer of coal dust.

The EC conditions and environmental protection measures require mines and power plants to have a green belt around them, partly to precisely prevent such dust from going out of the mine/plant area. However, the Gare IV/2 and Gare IV/3 mines did not have this greenbelt, a clear violation of the EC conditions. We are not sure if other mines had the green belt or not. Verification of green belt from all mines should be taken up immediately. It is only after an order of the National Green Tribunal in 2015 that the mine has started making the green belt, some ten years after the mine has been operational.

Figure 25: "Green belt" being planted next to the Gare IV/3 Mine, ten years after its operations began. The mine boundary is the embankment to the right of the plantation.

No wonder, the people around these mines – e.g. people from Kosampalli – complained about the severe problems caused by coal dust. They told us that the coal dust is contaminating their water sources, including their well waters as the dust settles into the water. Similarly, the coal dust settles onto their crops, affecting yields badly. This is particularly true of the flowering season, when the dust settles on the flowers and disrupts pollination.

In Kondkel, we were informed by Permanand Patel, Masterji, that the mine water was being discharged into a stream that met the Bendra nala. The mine authorities had some large pits

as sedimentation tanks. However, they were not able to control the coal dust at all, which was going into the water.

We are also annexing (as **Annexure D**) air quality report of air samples taken by local residents with assistance from NGOs from March and April 2016. These samples were taken from villages of Dongamoha, Libra, Kosampali, Tamnar and Saliya Bata.

Samples of dust in ambient air were taken from the villages in the vicinity the plant and were analysed for the PM2.5 levels and the presence of toxic heavy metals in the air.

Sampling locations were spread over the entire district of Tamnar primarily around the Gare Palma IV mines and the JSW Thermal Power plant. All samples were from the premises of local resident's houses in the village. All samples were located downwind of the source and samples were taken on days with clear and normal weather and not on heavy/gusty windy days.

All of the levels of very fine particulate matter in the filtered air sample (PM2.5) greatly exceed the 24-hour WHO standard of 25 $\mu g/m^3$; the 24-hour USEPA standard of 35 $\mu g/m^3$; and the Indian MoEF standard of 60 $\mu g/m^3$. **These levels exceeded the Indian standards by 2.74 to 8.97 times**. In addition the sample results also found alarming levels of Silica, Manganese and Nickel in the dust.

Chapter 5: Conclusions & Recommendations

Overall Impact

Overall, it is clear that the activities of mining, washing, transportation and power generation are adversely impacting the region. Water sources are being severely depleted, with ground water levels falling in large areas due to the draining away of ground water by mines. This is also impacting surface waters. This has severely affected people's drinking and domestic water supplies as well as water for agriculture.

At the same time, these activities are discharging untreated or inadequately treated effluents into local water bodies like *nallas*, rivers and people's fields. This includes mine drainage, including possibly acid mine drainage, water contaminated with suspended solids, coal dust, fly ash and other pollutants. Moreover, solid waste like fly ash are being dumped into the open, from where they are getting into the air and water, and pose the threat of PM2.5 dust and toxic elements like heavy metals leaching out. Fly ash is also being blown onto farms, villages and houses from ash ponds, and such ash again ends up in the air and local water bodies thus adversely impacting the human and environmental health in the region.

All this has also affected local populations in terms of public health and livelihoods. While the impacts of individual violations, and of individual plants discharging pollutants are serious enough, what is more serious is the combined impacts of all of these violations, further aggravated by the lack of proper enforcement, regulation, mitigation and governance measures. The local people face the brunt of all the violations and governmental inaction.

In Kosampali, for example, people told us that the yields of their farms have gone down by more than 30%. This is for the monsoon crop. For the post monsoon crop, the yields have fallen by as much as 50%. This is a combined impact of depleting ground and surface waters, surface waters flows to fields being cut off due to mining, coal dust pollution, and use of untreated mine discharge on the fields.

At the same time, other means of livelihoods are also being destroyed due to mining and related activities. People of Kosampalli told us how forest produce was a critical part of their support system. This included produce like *mahua, chaar, chironji, tendu* leaves and so on. But there has been extensive deforestation due to the mining and related activities, and this has impacted their incomes from forests. Agriculture is also adversely affected.

Moreover, even the fish in the local streams is disappearing, mainly due to depleting waters and pollution. While earlier they used to get plenty of fish, the quantities have gone down in the last few years. Some of the species also are no longer found. Thus, all sources of livelihood and nutrition have been negatively affected.

Similarly, water for drinking and domestic use has also been adversely affected. As the water levels have plummeted, hand pumps have stopped working. As we found in

Kosampali, earlier good quality water was found at 30-35 feet, but now bores had to go down to 200 feet and more to find water. There too, they are returning contaminated water unfit for most uses. So people have become dependent on other sources of water like that provided by water supply schemes of the panchayat, or in some cases, the mining companies. Access to the water from these schemes is directly dependent on the availability of electricity, as all the pumps run on electricity. We were told and we ourselves witnessed, the area faces long and many power cuts. An irony of the lives of people living next to power plants! The frequent power cuts severely disrupt the water supply.

In Kondkel village, we were told that the water is now being supplied as filtered water from the underground mine, but it is neither enough, not fully clean. They don't have individual tap connections, but there are only 20-25 public stand posts for a population of about 1000.

Thus, the communities have lost their independent, reliable and good quality water supply sources, which were in their own control, and have become dependent on the gram panchayat, the mining companies for water, and electricity for water supply, water from which also is often inadequate and not of good quality.

In addition to the water related impacts, there is a serious issue of air pollution. Though we have not measured the air quality in the region, we have enough experiences to state that the air quality in the area is exceptionally poor and is causing several health impacts. This has been corroborated by the results of the air quality tests carried out by other NGOs which we have seen (and annexed to this report).

Last but not the least, since the scale of mining, washing and power generation and related activities is set to go up several folds, it is clear that these impacts are likely to intensify greatly.

Recommendations:

1. The Government **should initiate immediately a comprehensive exercise to document and map all the serious environmental and social impacts** of mining, washing, transport, power generation and related activities. Such an exercise must be undertaken **with the inclusion of independent, credible experts and institutions, and local people**. Our findings and observations show these activities adversely impacting the region. There are gross violations of environmental conditions and norms. Water resources are being depleted and polluted. Our report, due to the limitations of time and resources, captures only a small part of the impacts. Hence, the need for a comprehensive impact assessment.

2. Looking at the serious level of pollution and contamination, **a health impact assessment** also should be carried out in the affected areas by the Government **with the inclusion of independent, credible experts and institutions, and local people.** It can be carried out as a part of the mapping of environmental impacts recommended in (1) above, or as a separate exercise.

3. Immediate assessment should be carried out of the **compliance and violations of conditions of Environmental Clearances, of the Consent to Establish and Operate and of other legal permissions** given to various projects.

4. **Immediate action should be taken to prevent, mitigate or compensate impacts** already documented, particularly the release of untreated effluents into local water bodies and ambient environment, and the dumping of solid waste like fly ash, sludge etc. into the surroundings. This would include cases we have specifically documented in this report.

5. **Accountability of the errant industry and the regulatory mechanisms** must be ensured, and strict legal action should be taken on the errant industries and officers of the regulatory agencies in-charge for monitoring and implementation of environmental conditions in the industries.

6. Given that scale of activities of mining, washeries, power plants is set to go up significantly, we also recommend **that a prior, carrying capacity and overall cumulative impact assessment be carried out,** and any decisions for new activities should be based on the outcome of such exercise.

7. One of the difficulties we found in understanding the impacts of various projects in the region was the uneven availability of key and basic documents like Environmental Clearance letters, their amendments, EIAs, EMPs, their supporting studies, Compliance Reports, Monitoring Reports etc. In some cases, these were available for the second or expansion phase but not for the first phase. In some cases only draft or summary EIA was available. In some cases, no documents were available**.** We recommend that **MoEF and CECB make available all the relevant project documents (EIAs, DPRs, Consent etc) publicly, and in particular to all village panchayats and local administration offices in a proper and complete manner**. This is critical for transparency in governance and indeed a basic right of the affected populations.

ANNEXURE A

Operational and in-pipeline thermal power plants in Raigarh district.

Table 4: Operational Power Plants in Raigarh District

S No	Name of the Plant	Company Name	Village	Capacity (MW)
1	Avantha Bhandar	Korba West Power Company Ltd	Bade Bhandar, Chote Bhandar	600
2	Nawa Para TPP	M/s TRN Energy Pvt Ltd.	Nawapara	300
3	O P Jindal TPS	Jindal Power Ltd	Tamnar	1000
4	Tamnar TPP	Jindal Power Ltd	Tamnar	2400
5	Dongamahua Captive TPS	Jindal Power and Steel Ltd	Dongamuha	600
6	Mahaveer TPP	M/s Mahavir Energy & Coal Beneficiation Ltd	Bhengari	12
	Total			**4912**

Table 5: Under Construction Power Plants in Raigarh District

S No	Plant Name	Company Name	Village Name	Capacity (MW)	Expected Date of Commission
1	Lara STTP	National Thermal Power Corporation Ltd.	Lara	1600	September 2017
2	Binjkote TPP	SKS power Gen. (Chhattis.) Ltd	Binjkote	1200	May 2017
3	Nawapara TPP	M/s TRN Energy Pvt Ltd.	Nawapara	300	November 2016
4	Deveri TPP Raigarh TPP	M/s VISA Power Ltd.	Deveri and Dumarpalli	1200	Uncertain
	Total			**4300**	

Table 6: In Pipeline Power Projects in Raigarh District

S No	Name of Plant/ Company	Village	Status	Capacity (MW)
1	Expansion of existing 12 MW Bio-mass Based TPP to 24 MW by addition of 12 MW	Bhengari	EC Granted	12
2	Korba West Power Company Limited	Bhandar	TOR Granted	1000
3	5x800mw Mahatamil thermal power project	Gharghoda	TOR Granted	4000
	Total			**5012**

ANNEXURE B

Operational and in-pipeline coal mines in Raigarh district.

Table 7: Operational Coal Mines in Raigarh District

S No	Name of the mine	Status	Village	Capacity (MTPA)	Remarks
1	Gare IV/ 1	Operational	Dongamuha	6	
2	Chhal Opencast	Operational	Lat, Tehsil Dharamjaigarh	3	There is a proposed expansion of 1 MTPA existing coal mine to 3 MTPA
3	Baroud Opencast	Operational	Baroud, Tehsil Gharghoda	3.5	Present capacity of 1 MTPA; Proposed addition of 2.5 MTPA in expansion
4	Gare IV/2 and IV/3 Opencast and Underground	Operational	Gahrghoda	6.25	
5	Gare IV/7	Operational	Karwahi	1.2	
6	Gare IV/5	Operational	Kondkel, Lamdarka, Milupara	1	
7	Gare IV/4 Opencast	Operational	Tehsil Gharghoda	1	Expansion from 0.48 MTPA to 1 is proposed
	Total			**21.95**	

Note: The Chhal and Baroud mines are operated by SECL. The others had been allocated to various private developers, and were operational at the time when the allotments were cancelled by the Supreme Court in Sept. 2014. After that, these mines have been auctioned to new owners, but not all of them have started operations due to a variety of reasons. But we have classified these mines as operational as they were so as of Sept. 2014.

Table 8: Proposed Coal Mines in Raigarh District

S No	Name of the Mine	Status	Village	Capacity (MTPA)
1	Jampali Opencast	Proposed	Jampali	3
2	Gare IV/6	Proposed	Lamdarha	4
3	Durgapur II Sariya	Proposed	Taraimar, Bayasi, Medarmar, Dharam Colony and Bayasi Colony	2
4	Gare Pelma Captive coal mines IV/8	Proposed	Gare Pelma	1.8
5	Gare Pelma Sector III Opencast & Underground	Proposed	Dholnara	5
6	Talaipalli OCP	Proposed	Mand	18.72
7	Durgapur II Taraimar	Proposed	Taraimar, Bayasi basti, Bayasi Colony, Dharma Colony and Rupunga, Tehsil Dharamjaigarh	4
8	Gare IV/8	Proposed	Khamaria and Karwahi, Tehsil Gharghoda	1.2
9	Gare Pelma Sector II	Proposed	Bhalumura, Chitwahi, Dholnara, Dholesara, Gare, Jhinkabahal, Kunjemura, Libra, Murogaon, Pata, Radopali, Saraitola, Sarasmal, Tehlirampur	23.6
	Total			**78.32**

Note: Proposed capacity includes only that which has applied for environmental clearance. Other proposed capacity expansion is not included.

ANNEXURE C

Operational and in-pipeline washeries in Raigarh district.

S No	Proposal Names with associated mines	Type	Status	Capacity (MTPA)	Village	Company/ Proponent
1	Pithead Washery (JSPL)		Operational	6		JSPL
2	Karwahi Coal Washery		Operational	0.96		Sarda Energy & Mineral Division
	Total			**6.96**		
	In-Pipeline Proposals					
1	Gare IV/6 coal mine and coal washery	Coal Mine and Washery	EC Granted	4	Lamdarha	M/s Jindal Steel & Power
2	Gare Pelma Captive coal mines IV/8, coal washery	Coal Mine and Washery	EC Granted	1.8	Gare Pelma	M/s Jeyswal Neco Industries Ltd
3	Durgapur II Taraimar Coal block (4 MTPA) and linked coal washers (4 MTPA)	Coal Mine and Washery	EC Granted	4	Taraimar, Bayasi Basti, Bayasi Colony, Rupunga, Thesil Dharamjaigarh	M/s Bharat Aluminum Company Ltd
4	Gare IV/1 coal mine (6 MTPA) and expansion of coal washery from 2.4 MTPA to 3.2 MTPA	Coal Mine and Washery	EC Granted	0.8	Dongamuha	M/s Jindal Power Ltd
5	Mahaveer Coal Washery (5 MTPA)	Coal Washery	TOR Granted	5	Bhengari dist Raigarh	
6	Coal Washery 800 TPH at Tamnar Coal mines Gare IV/2 and Gare IV/3	Coal Washery	TOR Granted	7	Tamnar	Jindal Power Ltd
	Total			**22.6**		

Note: (1) The Project Proponents are as per EC, but these would now change with the change in mine developer after the auctions. (2) The exact information about washeries is not available, including their current status and whether various EC granted are for parts of the same washery (for e.g. whether washery at Tamnar and Dongamahua refer to the same location/unit.)

ANNEXURE D

A Note on Air Quality in Tamnar, Chhattisgarh

May 2016

Introduction

Following frequent complaints by residents of air pollution in the Tamnar district of Chhattisgarh, members of Chhattisgarh Bachao Andolan in the presence of local community members and leaders took 7 Air samples in March and April 2016. the samples were collected from villages of Dongamoha, Libra, Kosampaly, Tamnar and Saliya Bata.

Methodology:

Samples of dust in ambient air were taken from the villages in the vicinity the plant and were analysed for the PM2.5 levels and the presence of toxic heavy metals in the air.

Sampling locations were spread over the entire district of Tamnar primarily around the Gare Palma IV mines and the JSW Thermal Power plant. All samples were from the premises of local resident's houses in the village. All samples were located downwind of the source and samples were taken on days with clear and normal weather and not on heavy/gusty windy days.

The equipment used is a low volume air-sampling device called the MiniVol[32]. All samples were taken continuously over a period of 24-hour. The samples were sent for analysis to the Chester LabNet[33], a laboratory based in Oregon, USA. The laboratory tested the samplers for Particulate Matter ($PM_{2.5}$) using the Gravimetry technique[34] and used the X-ray Fluorsescence (XRF) technique to detect the presence of heavy metals. XRF is a US EPA approved technique.

[32] http://www.airmetrics.com/index.html

[33] http://www.chesterlab.net/index.php

[34] http://www.chesterlab.net/service.php#gra

Details of the samples:

Date/Time	Location	Weather Conditions
10 - 11 March 2016	Dongamoha (In the premises of the house of Mr. Jagbandhu Patel; House located in the center of the village opposite the power plant)	Clear
11 - 12 March 2016	Libra (In the premises of the house of Mr. Sadanand Palnayak, in the southern side of the village)	Clear
17 - 18 March 2016	Kosampaly (On the northern side of Loharpara Basti in the premises of the house of Mr. Nehru Adhriya)	Clear
8 -9 April 2016	Kosampaly (In the premises of Mr. Shivpal Agal about 400-500 mts from the coal mines in the area)	Clear

Date/Time	Location	Weather Conditions
13 - 14 April 2016	Tamnar (On the roof top of the house of Mr. Jayshankar Prasad Dadsena about 1 km on the eastern side of the power plant in Tamnar)	Clear
15 - 16 April 2016	Tamnar (On the house of Mr. Krishna Sai, about 4 km south of the power plant in Tamnar)	Clear
20 - 21 April 2016	Saliya Bata (On the rooftop of a resident in the village)	Clear

Lab ID	A Site	B Sample Date	F PM2.5	G Si	H Mn	I Ni
13-T3287	Dongamoha	10-11 March 2016	236.5	27.2	0.424	0.010
13-T3289	Libra	11-12 March 2016	538.7	81.8	0.695	0.028
13-T3288	Kosampaly	17-18 March 2016	206.0	22.1	0.167	0.014
13-T3284	Kosampaly (2)	8-9 April 2016	164.4	20.4	0.581	0.011
13-T3285	Tamnar (1)	13-14 April 2016	193.3	31.2	0.362	0.012
13-T3292	Tamnar (2)	15-16 April 2016	196.4	30.7	0.922	0.012
13-T3283	Saliya Bata	20-21 April	234.1	36.3	0.604	0.019
		Average Levels	252.8	35.7	0.537	0.015
		Health-based standards				
		U.S. EPA 24-hour	35	none	none	none
		U.S. EPA annual	12	none	none	none
		WHO 24-hour	20	none	none	none
		WHO annual	10	none	0.15	none
		India 24-hour	60	none	none	none
		India annual	40	none	none	0.020
		California 24-hour	none	none	none	0.200
		California annual	12	3*	0.09	0.014

Results of the Air Samples:

Analysis:

PM2.5: All of the levels of very fine particulate matter in the filtered air sample ($PM_{2.5}$) greatly exceed the 24-hour WHO standard of 25 µg/m^3; the 24-hour USEPA standard of 35 µg/m^3; and the Indian MoEF standard of 60 µg/m^3. **These levels exceeded the Indian standards by 2.74 to 8.97 times**.

The U.S. EPA has also developed an Air Quality Index for episodic (daily) exposures to levels of particulate matter and other pollutants, categorizing Air Quality as: Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, Very Unhealthy, and Hazardous. In December 2012, the U.S. Environmental Protection Agency revised the thresholds (breakpoints) for 24-hour levels of $PM_{2.5}$ for its Air Quality Index as follows:

The revised AQI breakpoints are outlined in the table below:

AQI Category	Index Values	Previous Breakpoints (1999 AQI) (µg/m$_3$, 24-hour average)	Revised Breakpoints (µg/m$_3$, 24-hour average)
Good	0 - 50	0.0 - 15.0	0.0 – 12.0
Moderate	51 - 100	>15.0 - 40	12.1 – 35.4
Unhealthy for Sensitive Groups	101 – 150	>40 – 65	35.5 – 55.4
Unhealthy	151 – 200	> 65 – 150	55.5 – 150.4
Very Unhealthy	201 – 300	> 150 – 250	150.5 – 250.4
Hazardous	301 – 400	> 250 – 350	250.5 – 350.4
	401 – 500	> 350 – 500	350.5 – 500

As one can see in the analysis, the levels of very fine particulate matter ($PM_{2.5}$) in six of the seven air samples would be categorized by the U.S. EPA as **very unhealthy.** "This would trigger a health alert signifying that everyone may experience more serious health effects." The seventh sample – collected on 11-12 March 2014 at 'Libra'– would be categorized as **hazardous**. "This would trigger a health warnings of emergency conditions. The entire population is more likely to be affected."[35]

About PM 2.5: Particles less than 2.5 micrometers in diameter (PM2.5) are referred to as "fine" particles and are believed to pose the largest health risks. Because of their small size (less than one-seventh the average width of a human hair), fine particles can lodge deep into the lungs.

"Health studies have shown a significant association between exposure to fine particles and premature mortality. Other important effects include aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions, emergency room visits, absences from school or work, and restricted activity days), lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems such as heart attacks and cardiac arrhythmia. Individuals particularly sensitive to fine particle exposure include older adults, people with heart and lung disease, and children."[36]

The Indian Ministry of Environment and Forests (MoEF), the U.S. EPA and the World Health Organization have all adopted health-based air quality standards for exposure to fine particulate matter. They have also adopted short-term (24-hour) and long-term (annual average) standards for exposure to fine particulate matter in order to prevent both acute and chronic effects of exposure to particulates.

Silicon/Silica

The California standard for exposure to crystalline silicon dioxide (silica) is 3 $\mu g/m^3$ for the prevention of respiratory effects[37]. Coal/coal dust is known for having relatively high quantities of crystalline silica.

The method used for analysis or air samples from Tamnar District quantifies **silicon** levels, not silica levels. However, considering that silicon levels averaged 35 $\mu g/m^3$, and that silica is the predominant form of silicon in the environment, it is safe to assume that ambient air in the area has unsafe crystalline silica levels above 3 $\mu g/m^3$.

[35] https://airnow.gov/index.cfm?action=aqibasics.aqihttps://www3.epa.gov/pm/2012/decfsstandards.pdf

[36] http://www.epa.gov/ttn/naaqs/pm/pm25_index.html

[37] California Office of Environmental Health Hazard Assessment "All OEHHA Acute, 8-hour and Chronic Reference Exposure Levels (chRELs) as of June 2014" Chronic REL for silica. http://oehha.ca.gov/air/hot_spots/2008/AppendixD3_final.pdf#page=486 (Accessed on 7 October 2014)

Manganese Results: Manganese levels in the seven samples average well above 0.5 µg/m^3 compared to annual (chronic exposure) standards of 0.15 µg/m^3 (WHO) and 0.09 µg/m^3 (California)[38]. The samples here are 24-hour samples whereas the health-based standards are for an exposure over an annual period. However, considering all seven samples are much higher than the chronic standards, it is likely that long-term (generally prevailing) ambient air in the area has unsafe manganese levels above the WHO and California chronic exposure standards.

Manganese is a neurotoxin. With regards to its health impacts, the U.S.EPA has observed that:

"Chronic (long-term) exposure to high levels of manganese by inhalation in humans may result in central nervous system (CNS) effects. Visual reaction time, hand steadiness, and eye-hand coordination were affected in chronically-exposed workers. A syndrome named *manganism* may result from chronic exposure to higher levels; *manganism* is characterized by feelings of weakness and lethargy, tremors, a mask-like face, and psychological disturbances."[39]

Nickel results: The California Environmental Protection Agency (CalEPA) has calculated a chronic inhalation reference exposure level of 0.014 µg/m^3 for nickel to prevent impacts to the respiratory and immune systems. Nickel levels in the seven samples averaged just above the California annual exposure standard (0.015 µg/m^3 compared to 0.014 µg/m^3), suggesting that prevailing levels of nickel in the Tamnar district are unsafe.

According to US EPA:

"Nickel dermatitis, consisting of itching of the fingers, hands, and forearms, is the most common effect in humans from chronic (long-term) skin contact with nickel. Respiratory effects have also been reported in humans from inhalation exposure to nickel. Human and animal studies have reported an increased risk of lung and nasal cancers from exposure to nickel refinery dusts and nickel subsulfide. Animal studies of soluble nickel compounds (i.e., nickel carbonyl) have reported lung tumors. EPA has classified nickel refinery dust and nickel subsulfide as Group A, human carcinogens, and nickel carbonyl as a Group B2, probable human carcinogen."[40]

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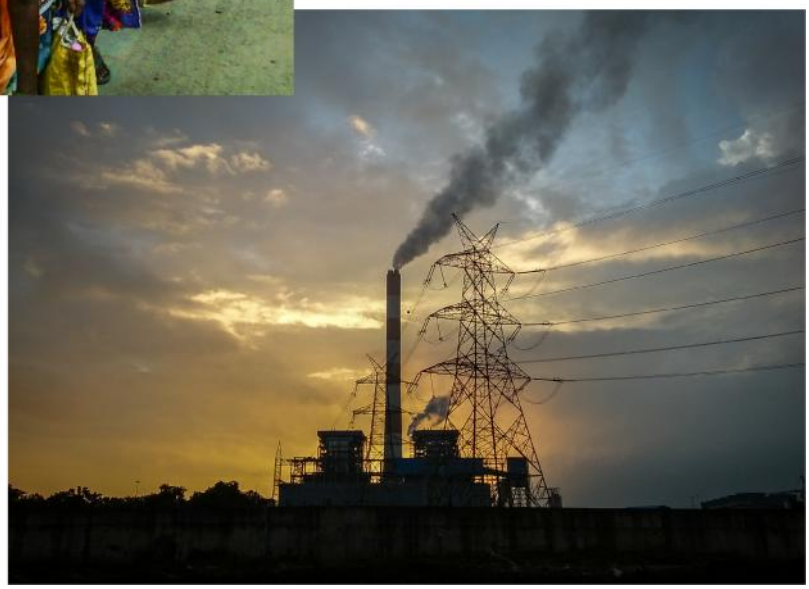
[38] California Office of Environmental Health Hazard Assessment "All OEHHA Acute, 8-hour and Chronic Reference Exposure Levels (chRELs) as of June 2014" Chronic REL for Manganese. http://oehha.ca.gov/air/hot_spots/2008/AppendixD1_final.pdf#page=429

[39] http://www.epa.gov/ttn/atw/hlthef/manganes.html

[40] https://www3.epa.gov/airtoxics/hlthef/nickel.html



About the Fact-finding Team:

Shripad Dharmadhikary, a B.Tech in mechanical engineering from IIT Bombay (now Mumbai) is a senior researcher engaged in analysis and advocacy of water and energy issues. He is the founder coordinator of Manthan Adhyayan Kendra. His work areas include energy-water nexus, impact of coal on water, dams, rivers, irrigation, hydropower, privatisation and commodification of water, analysis of water and energy policies, and environmental flows. In 2010-11, he was a Member of Government of India's Planning Commission's two *Working Groups* for 12th Plan on *Urban and Industrial Water Supply*, and on *Model Bill for State Water Regulatory System.* He was also an activist with the Narmada Bachao Andolan for many years. He can be reached at manthan.shripad@gmail.com

Manshi Asher is a researcher and activist, with Himdhara, Environment Research and Action Collective based in Himachal Pradesh. She works on issues of water, environment, development. She can be reached at manshi.asher@gmail.com

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