Report of the Committee Constituted by Hon'ble National Green Tribunal, Principal Bench, New Delhi in the Case No. 667/2014 arising out of O.A. No. 102/2014, M/s. Sandplast India Pvt. Ltd., Vs. MoEF and Others

Submitted by the Committee

15th January, 2015

1.0 Introduction

The issues raised in the M.A. No 667/2014 in the matter of Sandplast (India) Pvt. Ltd., Vrs Ministry of Environment, Forest & Climate Change (MoEFCC) and Others relates to Fly Ash Management in Thermal Power Plants. The attention has been drawn by the applicant for encouraging / maximizing utilization of fly ash in accordance with the existing Rules / Notification of MoEFCC.

2.0 Orders of Hon'ble Tribunal

2.1 The Hon'ble National Green Tribunal (NGT) vide its order dated10th November, 2014 in Application No. M.A.667/2014 arising out of O.A. No.102/2014 by Sandplast (India) Pvt. Ltd. Vrs MoEF & Others constituted a Team to oversee the fly ash management in Thermal Powers Plants of Angul and Talcher areas of Odisha. In this order, representative of CSIR-NEERI, Nagpur is a Member of the Committee alongwith representatives of MoEFCC, CPCB and SPCBs. Vide this order, the Committee has been directed to visit the sites of NTPC, NALCO and other Thermal power Plants located in Angul and Talcher area of Odisha and to collect samples of fly ash from the disposal sites, ground water from the areas around ash disposal sites and stack emissions and analyse the same. The Committee has been further directed to visit the mine areas, where the fly ash is being dumped by these industries. The analysis report along with the opinion regarding adverse impact on environment and human health etc. is to be placed before the Hon'ble Tribunal.

2.2 In another order dated 24th December, 2014, the Hon'ble Tribunal again directed the MoEF, CPCB and a representatives from Indian Bureau of Mines (IBM) to carry out a study in the mine areas of Jagannath, OCP and Talcher and submit analysis report to know

whether there is any contamination in the ground water as a result of dumping of fly ash in these mine areas. It was further directed that the Committee shall suggest if the disposal is being done appropriately by these plants so as to avoid environmental degradation or damage.

2.3 The Hon'ble Tribunal in its order dated 07.01.2015 constituted a single committee for the above mentioned purpose. The Member Secretary, CPCB shall be the Chairman of the Committee.

3.0 Composition of the Committee

Accordingly, as directed by the Hon'ble Tribunal, the Committee represented by the following members:

1) Dr. A. B. Akolkar, Member Secretary, Central Pollution Control Board, New Delhi - Chairman
2) Ms. Sanchita Jindal, Director, MoEFCC, New Delhi – Member
3) Shri Rajiv Kumar, Member Secretary, State Pollution Control Board, Odisha – Member
4) Dr. Paras Ranjan Pujari, Nominated Scientist, CSIR-NEERI, Nagpur – Member
5) Shri Mantu Biswas, Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar – Member

4.0 Scope of study of Committee

The Committee has drawn its mandate from the above mentioned orders of Hon'ble Tribunal, which include -

1) Visiting of ash disposal sites of thermal power plants in Angul-Talcher area.
2) Visiting of coal mine void where fly ash is being disposed.
3) Collection & analysis of ground water samples around the ash disposal sites and other areas.

4) Collection & analysis of stack emission samples.

5) Collection & analysis of ash samples from the disposal sites.

6) Observations on human health and environment.

5.0 Visit of the Committee

The members of the Committee visited the sites during 3rd to 6th December, 2014 and 12th to 15th January, 2015. The following ash disposal sites of Thermal Power Plants were visited –

1) NALCO, CPP, Angul
2) Talcher Thermal Power Station (NTPC), Talcher, Angul
3) Talcher Super Thermal Power Plant, NTPC, Kaniha, Angul
4) Nava Bharat Ventures Ltd., Dhenkanal
5) GMR Energy, Kamalanga, Dhenkanal
6) Bhushan Energy Ltd., Dhenkanal
7) South Balanda Coal Mine Void area, Talcher
8) Jagannath Coal Mine Void area, Talcher

The list of Officials of the Thermal Power Plants present during the field visit is enclosed at **Annexure-A.**

6.0 Methodology of Study

6.1 The Committee discussed the strategy to be followed for execution of the study. It was agreed to visit the areas in question. Since the collection and analysis of samples of Emissions, Ground Water and Ash requires considerable time and to have further view on the results, the Committee requested State Pollution Control Board, Odisha to collect the samples and analyze at their laboratory in advance. Accordingly, sampling and analysis was carried out by SPCB, Odisha during 24th to 27th November, 2014.

6.2 The Committee also referred the available documents, various studies and other references placed before it by various agencies.

7.0 Method of Sampling and Analysis

Ground Water samples were collected from 36 locations /sites and these were analysed for Physico-Chemical properties in the Laboratory of Odisha State Pollution Control Board. The analysis was carried out following the Standard Method of APHA (2005) which includes acid extraction and Inductive Coupled Plasma Mass Spectroscopy (ICPMS) for heavy metals.

Stack samples were collected from 6 Power Plants under Isokinetic conditions and analysed for Particulate Matter (PM).

Ash samples were collected from 12 sites. The composite samples were analysed by extractive method for metals contents.

8.0 Information About Industries

8.1 Captive Power Plant (CPP) of M/s NALCO Ltd., Angul

The power generation capacity of M/s NALCO, CPP is 1,200 MW (10x120 MW). The total ash generation from this plant was about 1.92 Million Tonne during the financial year 2013-14. At present, the Power Plant generates about 5,000 TPD of ash, out of which, about 3,800 TPD is being sent to the ash pond. Balance ash of about 1,200 TPD is supplied to fly ash brick manufacturers, asbestos products manufacturers and also used in dyke raising, quarry filling and low lying land development.

The fly & bottom ash of Unit-1 to Unit-6 are disposed off in lean slurry mode in the existing ash ponds. Bottom ash of Unit-7 to Unit-10 is being collected in dry form and disposed off in lean slurry form. The fly ash from Unit-7 to Unit-10 is disposed off in the ash pond in High Concentration Slurry Disposal (HCSD) mode. The industry has constructed its ash pond in an area of 800 Acre which is located at a distance of 6.5 km from the plant. It has 3 compartments which are as follows at present.

Lean Slurry Ash Disposal in Ash Pond, NALCO, CPP

a) Ash Pond-I -210 acre
b) Ash Pond-II-211.5 acre
c) Ash Pond-III-51.5 acre

The decanted water from ash ponds is taken to the treatment plant and reused for ash slurry making. For creating additional space for ash disposal a new ash pond-IV with HDPE lining has also been constructed near the existing Ash Pond in an area of 46 Acre. The location of all ash ponds is presented in **Figure-1.**

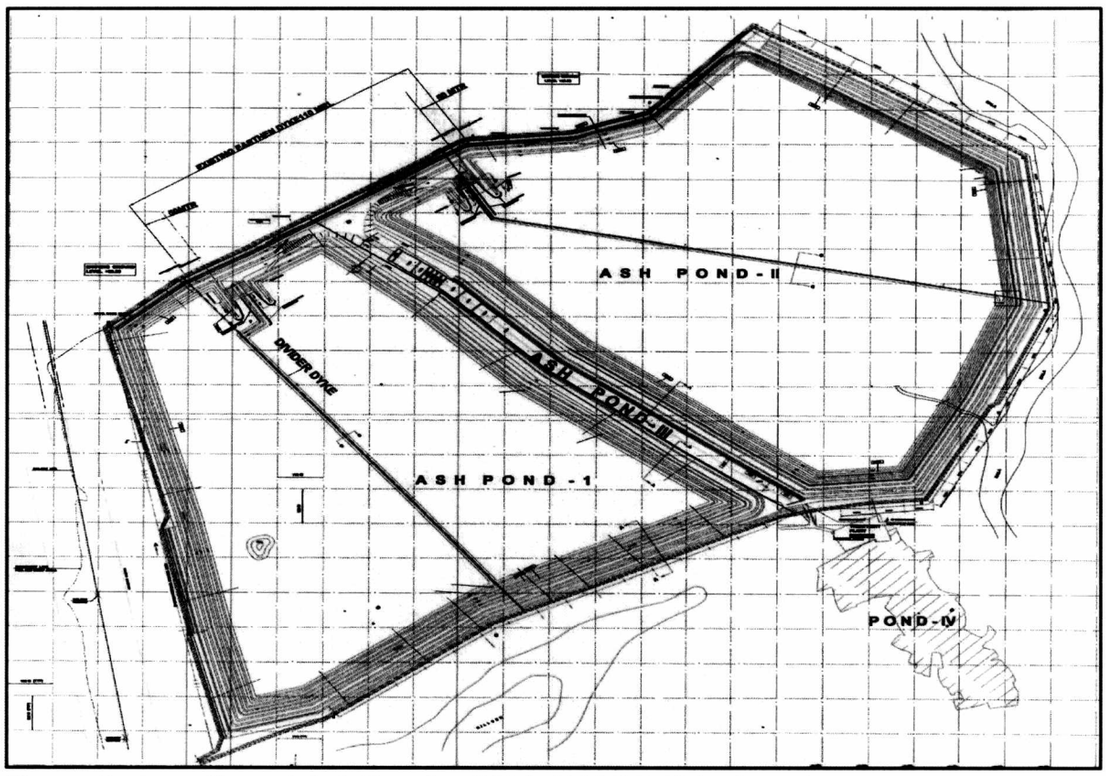
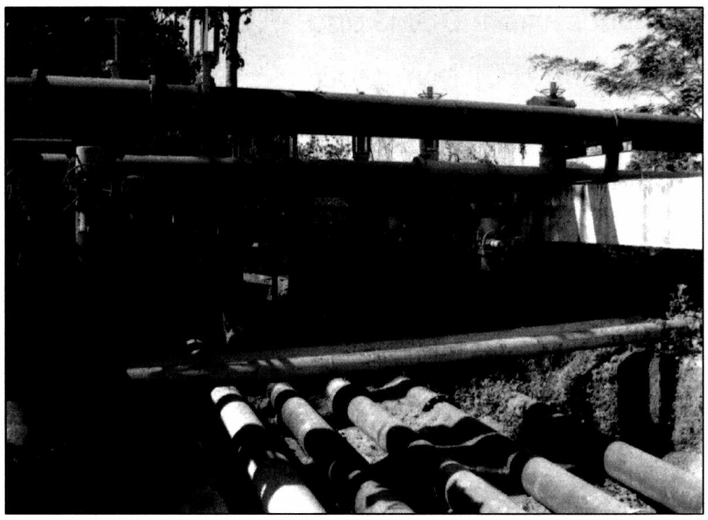


Figure 1 : Location of Ash Ponds of M/s NALCO Ltd., Angul

However, in future the CPP will be using fly ash for reclamation of coal mine void allotted to them at Bharatpur South Quarry of Mahanadi Coal Fields Limited (MCL). They have been granted Consent to Establish by SPCB, Odisha and permission from MoEF for one year as pilot project for this mode of disposal. It was gathered by the Committee that the Consent to Establish was given to them after extensive studies on Base Line, Micrometeorology, Hydrogeological Study & TCLP Studies through Central Mine Planning and Design Institute (CMPDI), Ranchi. Further, the Mine Void Core Drilling Study through Mineral Exploration Corporation Ltd. (MECL), Nagpur, Relative Porosity Study through Nuclear Dual Probe Method by MECL, True Porosity Study of the Core Material through University of Petroleum and Energy Studies (UPES), Dehradun, Permeability Study through UPES, Dehradun, Heavy Metal Study through BARC, Mumbai, Nucleoid study of ash pond thorough BARC have been carried out. As per the above studies carried out by the industry

through various agencies, it was found that ash disposal in the ash pond is safe.

The thermal power plant also has reclaimed stone quarries at Parang and Taltalia with fly ash of 1,38,000m^3 and 1,65,000m^3 respectively with the permission of SPCB, Odisha.



Pumping Station inside NALCO, CPP for Mine Void Filling

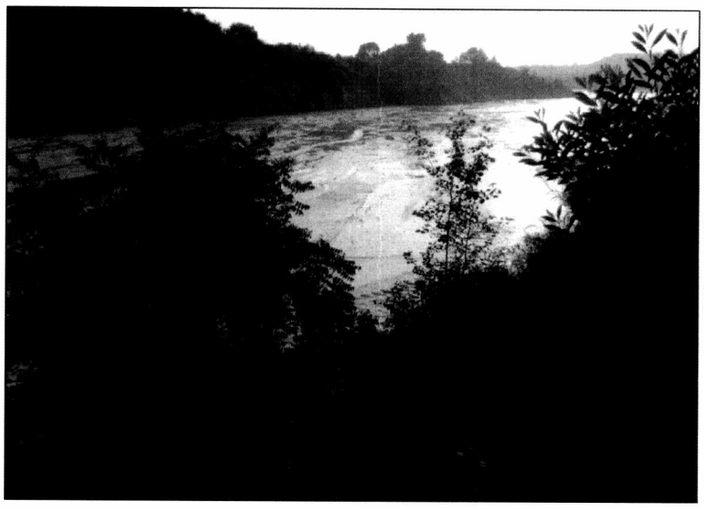
The lean slurry transportation system (pipeline) for mine void filling at Bharatpur South Quarry is in advanced stage of construction. Pipeline of 15 km has already been laid down.

8.2 Talcher Thermal Power Station (TTPS), NTPC, Talcher, Angul

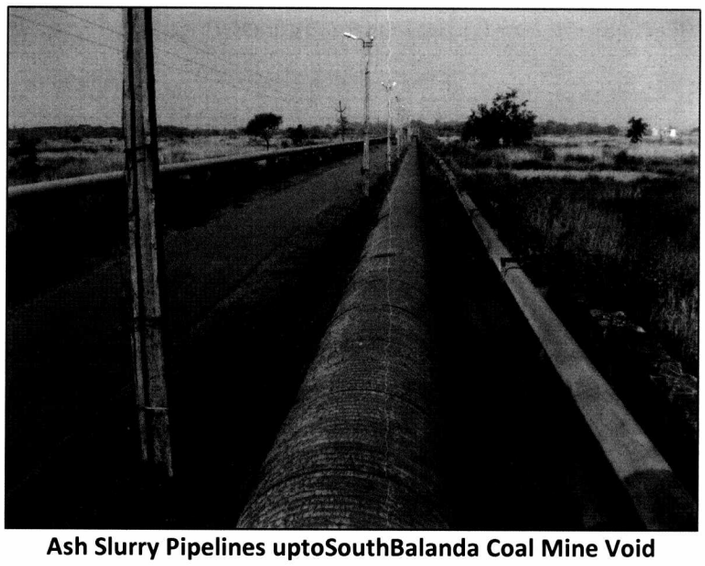
M/s Talcher Thermal Power Station (TTPS), NTPC, Talcher, Angul is the first Thermal power station in the State of Odisha established by Govt. of Odisha which was commissioned with its Unit-I on 17.12.1967. The thermal power plant (TPP) is having a total installed capacity of 460 MW (four units of 60 MW each in stage-I and two units of 110 MW each in stage-II). The plant was taken over by National Thermal Power Corporation (NTPC) on 30.06.1995.

The TPP consumed 3.12 Million Ton of coal during the year 2013-14 and generated 1.21 Million Ton of total ash. Hence, the power plant generates about 3,300 TPD of ash. About 20 TPD of dry ash is utilised for fly ash brick manufacturing and about 80 TPD is supplied to asbestos plants. The plant has 3 fly ash brick plants inside its premises and fly ash is supplied to 18 outside fly ash brick plants. Balance ash is used in mine void filling.

The power plant has been allotted abandoned coal mine void of South Balanda coal mine of MCL. They have obtained Consent to Establish from the State Pollution Control Board, Odisha, clearance from DGMS and permission (EC) from MoEF on pilot basis for one year for filling the void with ash. South Balanda has 3 voids in an area of 70.75 Ha and volume of the void is 14.73 Mm^3. The void filling has started since 2005 and the estimated life of this void is 14 years. There are three ash slurry disposal pipelines (2 Working + 1 Standby) of about 9 kilometers length each for transportation of ash to mine void. The ash slurry discharged at mine void travels through gravity towards a lower level and ash particles settle down while travelling. The decanted water is partly being circulated back to the plant and partly for irrigation, as per the demand of farmers. The industry has been analyzing the decanted water samples quarterly and the quality of water is within the permissible limit. The mine void at South Balanda is shown in the schematic map at **Figure - 2.**



Ash Disposed off into the South Balanda Coal Mine Void in Lean Slurry Form, TTPS (NTPC), Talcher



Ash Slurry Pipelines uptoSouthBalanda Coal Mine Void and Return Raw Water Pipeline, TTPS(NTPC), Talcher

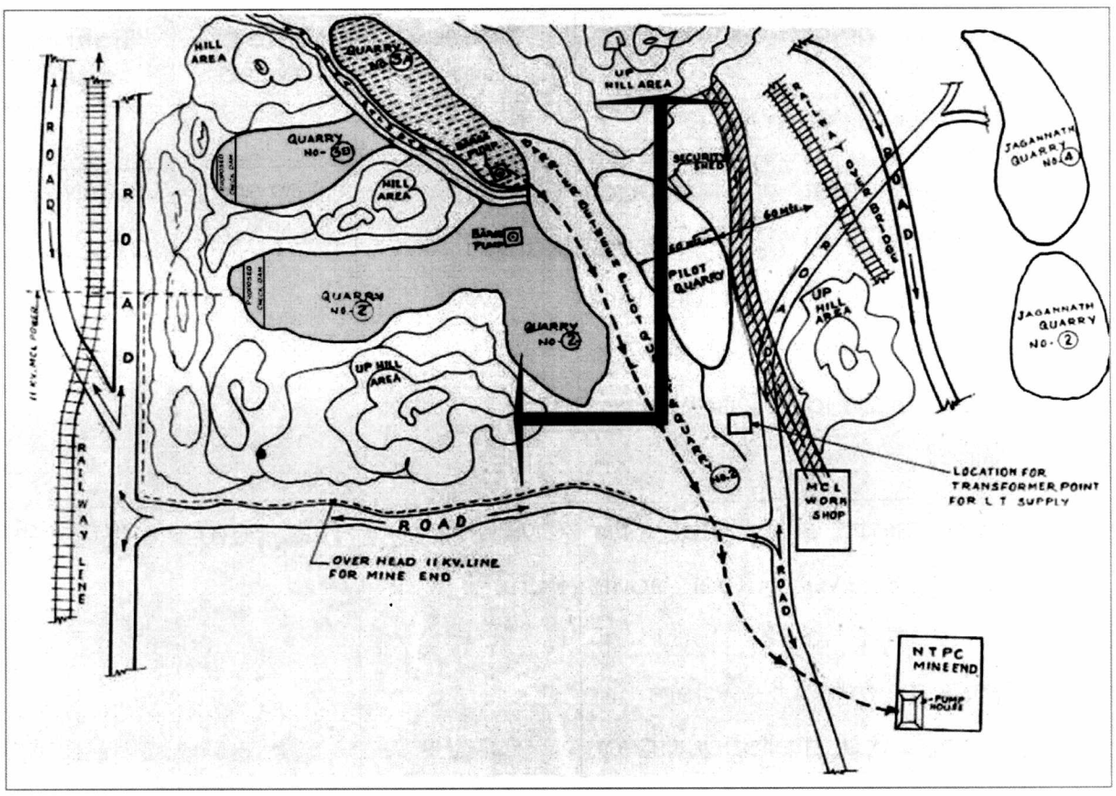


Figure-2 : Schematic Map of South Balanda Coal Mine Void for disposal of Fly Ash by TTPS.

The plant has carried out various environmental studies for mine void filling, which are given below in **Table-2.**

Table 2 : Studies carried out by TTPS on Impact of Mine Backfilling on Environment

Sl. No.	Name of the study	Agency	Date of Award	Status of study
1	Hydro-geological investigation of south Balanda mine area	CMPDI, Ranchi	21.01.2003	Completed
2	Ash Characterisation Environmental Baseline data & Feasibility report for	CMPDI, Ranchi	21.01.2003	Completed

Sl. No.	Name of the study	Agency	Date of Award	Status of study
	disposal of Ash in Mines			
3	Environmental Impact Assessment cum Environmental Management Plan for disposal of Ash in South Balanda Open Cast Mines	CMPDI, Ranchi	13.02.2003	Completed
4	Assessment of safety for proposed over burden earth fill barrier and study of existing ash fill system in quarry 2,3 and pilot quarry of South Balanda OCP	CMPDI, Ranchi	18.03.2010	Completed
5	Impact Assessment of ash fill sites of NTPC Ltd./Tacher Thermal on water resources in the surrounding area of South Balanda mine pit and old ash pond area.	CSIR-NEERI, Nagpur	27.12.2011	Completed
6	Report on Isotope hydrochemical investigation on the impact of fly ash disposal in open cast coal mine quarries to groundwater quality at Talcher, Odisha.	BARC, Mumbai	09.06.2012	Completed
7	Study of fly ash characterization such as its	CSIR-NEERI,	04.09.2012	Completed

Sl. No.	Name of the study	Agency	Date of Award	Status of study
	Reactivity and Movement of Ash fill site of TTPS at South Balanda Area and leaching characteristics of mine pit water at SB Mine pit.	Nagpur		
8	Study of fly Ash of Talcher Thermal Power Station, NTPC and its leachability characteristics with reference to mine water and Brahmani river	CSIR-IMMT, Bhubaneswar	09.08.2012	Completed
9	Study of Effects due to ash fill sites of TTPS on Flora & Fauna in the surrounding area of South Balanda Mine pit and Jagannath mine pit.	CSIR-NEERI, Nagpur	25.08.2012	Completed
10	Testing of Fly Ash samples for Radiological & Tracer elements Analysis.	BARC, Mumbai	27.09.2013	Completed
11	Radiological survey around Talcher Thermal Power Station, NTPC, Odisha	BARC, Mumbai	08.09.2011	Completed
12	Impact Assessment of ash fill sites ash pond on Ground water quality surrounding area of South Balanda mine pit.	CSIR-NEERI, Nagpur	30.10.2013	Draft Report Submitted

Sl. No.	Name of the study	Agency	Date of Award	Status of study
13	Hydrogeological Investigation in mine voids quarry nos. 4,7 and 8 in Jagannath area of MCL and quarry Nos. 2,3A & 3B of South balanda OCP of Talcher for disposal of ash	CMPDI, Ranchi	27.11.2012	In progress

8.3 M/s Talcher Super Thermal Power Station (NTPC), Kaniha, Angul

The Talcher Super Thermal Power Station of NTPC at Kaniha is having 6X500 MW unit (2x500 MW in Stage-I & 4x500 MW in Stage-II). The power plant consumes about 17 million tonne of coal and the ash generation from the plant was about 6.31 million tonne during the year 2013-14. The average total ash generation is 20,000 TPD. About 200 TPD of fly ash is utilized for brick manufacturing (5 plants inside and 25 plants outside), about 80 TPD is supplied to asbestos units and 5,500 TPD of ash is used for dyke raising. Balance amount of ash is disposed off in the ash pond in lean slurry form through pipelines.

The ash pond of the industry is situated at Takua village. The detail of ash pond and slurry pipeline are summarized in **Table 3.**

Table 3 : Details of Ash Ponds, NTPC, Kaniha

Details	Stage # I	Stage # II
Total Area	750 Acres	850 Acres
Lagoon-1	230 Acres	144 Acres
Lagoon-2	280 Acres	109 Acres
Over Flow Lagoon (OFL) for recycling of over flow water from ash pond	45 Acres	56 Acres

Details	Stage # I	Stage # II
Others facilities	195 Acres	541 Acres
Design height of each raising	3.00 M	5.00 M
No. of raising designed for	Seven	Nine
Present stage of raising	6th	4th
No. of pipelines	4	6
Distance from plant	10.8	13.2
Operating since	01.01.1997	01.08.2003
Ash deposited as on 4.12.2014 i.e. date of inspection	322 lakh m^3	319 lakh m^3

The ash pond of TSTPS, NTPC, Kaniha is shown in the schematic map in **Figure-3.**

(Stage-I) **(Stage-II)**

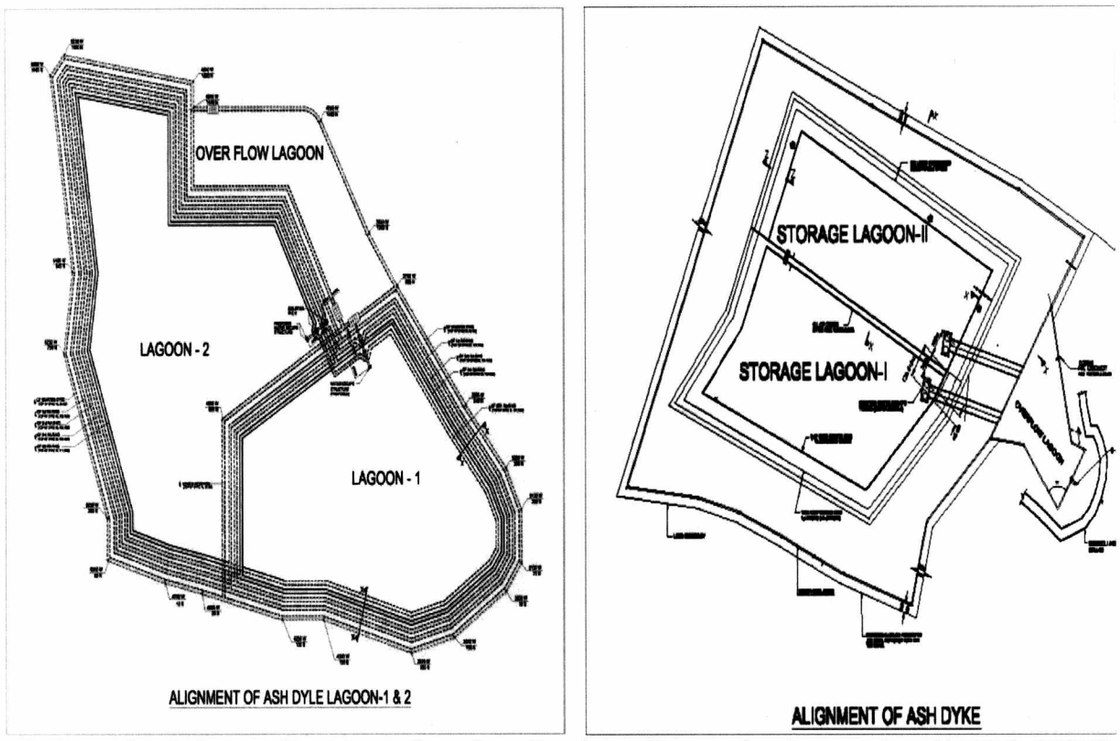
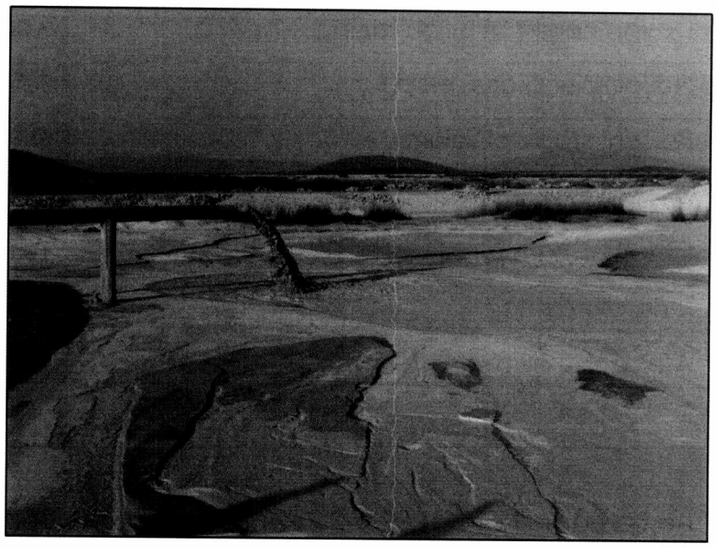


Figure -3 : Schematic Map showing the locations of ash ponds of TSTPS, NTPC, Kaniha.

In general, one lagoon is kept in service. Presently the Stage-I ash pond is in 6th raising and Stage-II ash pond is in 4th raising. The Lagoon-I of Stage-I and Lagoon-II of Stage-II were found to be active during the visit. They have installed 2 pump houses consisting of 36 ash slurry pumps for 6 Units. It was observed that buttressing of Stage-I ash pond and periphery filling of Stage-II ash pond was going on. They have estimated to use 200 lakh m^3 of ash for both the works.



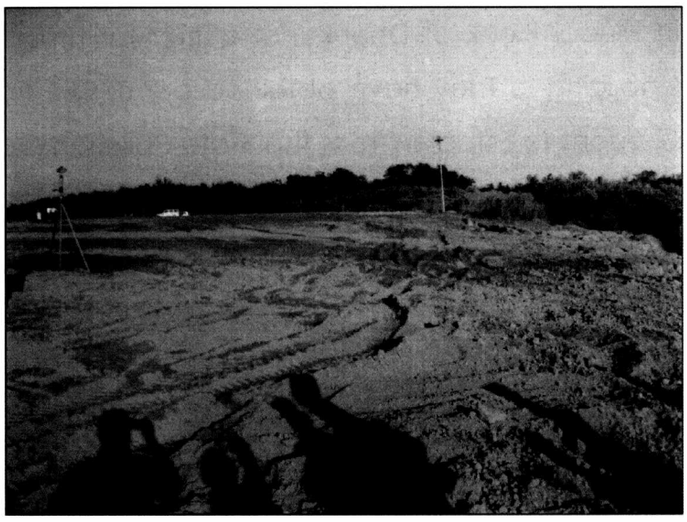
Ash Disposal through Lean Slurry Mode in Ash Pond of TSTPS (NTPC), Kaniha

In addition to the above, the power plant has been allotted abandoned Quarry No.8 of Jagannath Coal mine of MCL having void capacity of 17.8 million m^3. The plant has initiated several studies and is in the process of obtaining various clearances for mine void filling.

8.4 M/s Nava Bharat Ventures Ltd., Khadagprasad, Dhenkanal

The power generation capacity of M/s. Nava Bharat Ventures Ltd. is 158 MW (2x64 MW + 1x30 MW). The ash generation during the year 2013-14 was 2,00,871 Tonne, which was totally utilized for fly ash brick manufacturing and filling of coal mine void, abandoned stone quarry and low land area. However, presently the plant is producing only 30 MW, which is mostly for its Ferro Alloys Plant and ancillary units located inside their premises. Therefore, the present ash generation from the power plant is about 350 TPD only. The ash is collected in dry form pneumatically in the silos (2 silos of 75 Tonne capacity for 30 MW and 4 silos of 150 Tonne capacity for 2x64 MW). About 75

tonne of ash is being supplied to fly ash brick manufacturers, about 25 tonne is utilized for filling of the allotted coal mine void and balance about 250 tonne is utilized in filling of abandoned stone quarries. This is carried out with the permission from SPCB, Odisha. The power plant has been allotted an abandoned coal mine void of South Balanda Coal Mine of MCL in Talcher area. The allotted area is 49.42 Acre and it has the holding capacity of approximately 34 lakh tonne of ash. The ash is transported in moist condition by covered trucks to the allotted mine void which is located at a distance of about 40 km from the plant by road since the year 2007-08. The moistened ash is unloaded at mine void site and leveled by dozer. Six mobile water sprinklers have been provided to suppress fugitive dust emission during handling of fly ash. After leveling, the area is reclaimed simultaneously by covering it with soil and plantation over it. They have so far filled 3,93,780 tonne of ash in this coal mine void since the year



Dry Ash Disposal in Sounth Balanda Mine Void by Nava Bharat Ventures Ltd.

Stabilization of Ash Disposal Site in South Balanda Mine Void with Plantation by Nava Bharat Ventures Ltd.

2008-09 upto November, 2014 and stabilized 5 acres of the void. It was informed by the representatives of the plant that the estimated life of this void is upto the year 2022.

The power plant has also been allotted four abandoned stone quarries in Hindol Block of Dhenkanal district for utilising ash for filling the void and stabilizing it. They have obtained permission from District Administration and Consent to Establish from the State Pollution Control Board, Odisha. The total area of the allotted stone quarries is 13.69 acres (Bramhanabasa-4.57 Acre, Baghalunda-0.82 Acre, Badalo-3.02 Acre and Rabibania-5.28 Acre). The distance of these stone quarries is about 18 KM from the plant. At present, they are disposing the ash at the Badalo site. They have so far disposed off 97,000 tonnes of ash at Badalo site from November, 2013 upto November, 2014.

In addition to the above, the plant has also disposed off fly ash on an area of 82.89 Acre at Nimidha, approximately 12 KM from the plant by road. The ash was disposed off at this site in dry form to make ash mound. Out of this area, the power plant has exhausted only 30 Acres however, now the site is no more being used for ash disposal since December, 2013. However, the industry has reclaimed the exhausted area by stabilizing the mound with grass turfing on the slopes and making plantation on the top of the mound.

8.5 M/s GMR Kamalanga Energy Ltd., Kamalanga, Dhenkanal

The power generation capacity of M/s GMR Kamalanga Energy Ltd. is 1050 MW (3x350 MW). Presently, the industry is operating 2 units and is generating about 470 MW of power. The industry is blending indigenous coal with 40% of imported coal having less ash content thus reducing the overall ash content of the coal. Presently they generate about 2,000 TPD of ash out of which about 350 TPD is supplied to 21 fly ash brick manufacturing units and balance fly ash is separately collected and pneumatically transferred to 4 silos of 1,000 Tonne capacity each. There are six hydro bins for slurry making of

bottom ash. The ash pond of the plant is shown in the schematic map given in **Figure-4.**

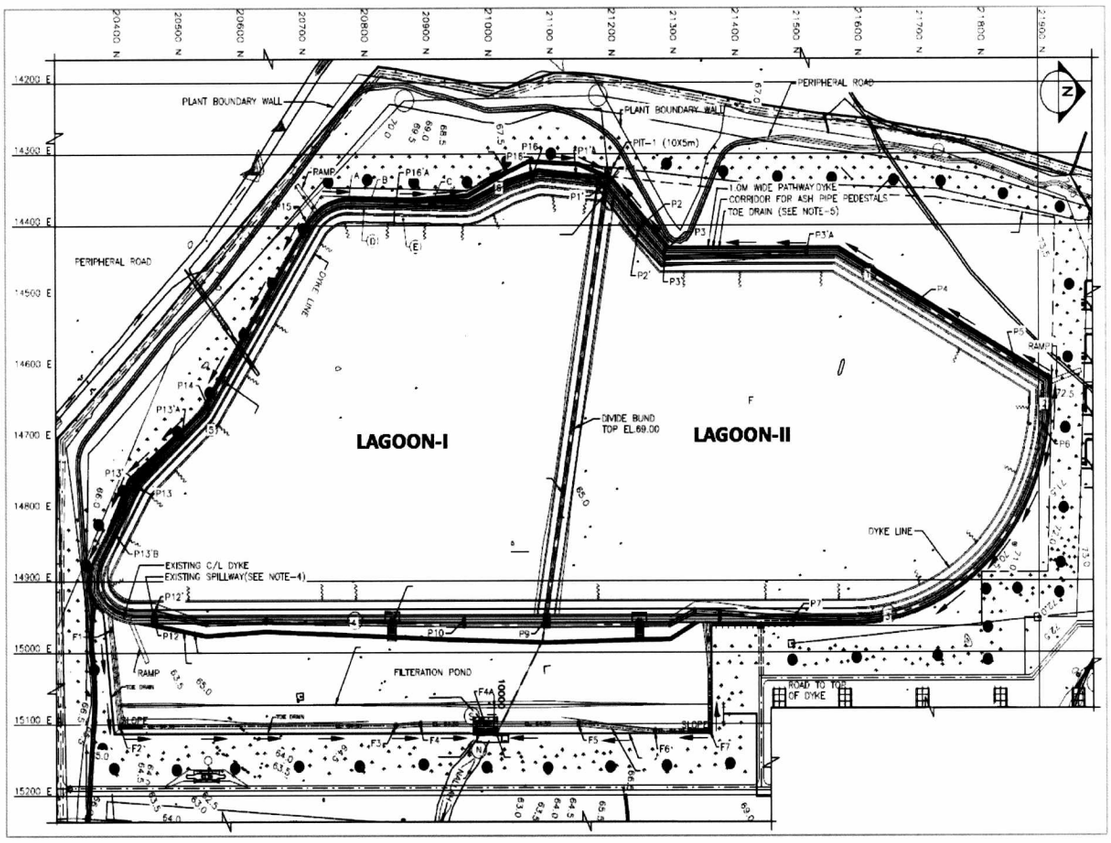
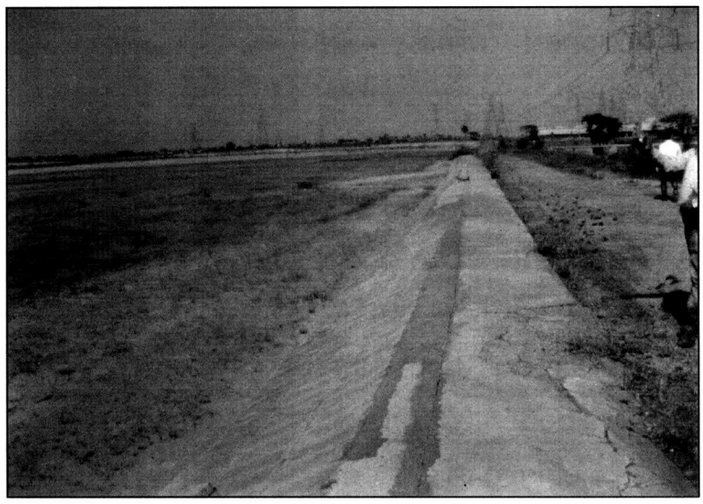


Figure-4 : Schematic Map showing the location of ash ponds of GMR Kamalanga Energy

Both fly and bottom ash is mixed with water in the slurry tank. The slurry is then pumped to ash pond located within the plant premises through High Concentration Slurry Disposal (HCSD) mode. The area of the ash pond is 185 Acres and is located



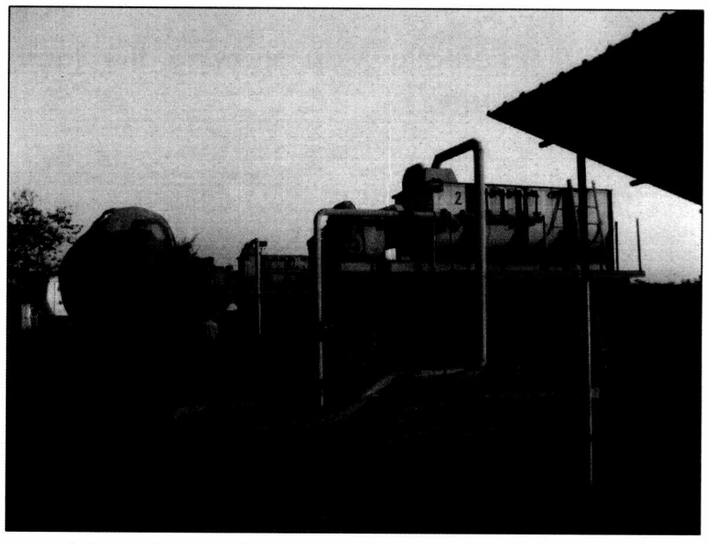
Disposal of ash in the Ash Pond by HCSD System by GMR Kamalanga Energy Ltd.

at a distance 250 mtrs from the ash handling system. It is divided into Lagoon-I (95 Acres) and Lagoon-II (90 Acres). Four pipelines (2 for each lagoon) have been laid down for carrying the ash slurry. HDPE Liner of 75 micron thickness has been provided at the bottom and sides of the Ash Pond. The overflow water from both the lagoons is collected in a common filtration pond of 38 Acres having geo-textile membrane on water face. The filtered water will be pumped for recycling from this pond.

8.6 M/s Bhushan Energy Ltd., Dhenkanal

The power generation capacity of M/s. Bhushan Energy Ltd. is 300 MW. The industry generated 5,86,784 tonne of ash during the year 2013-14. Earlier, the industry was disposing ash in dry form at Sibpur ash mound in an area of 22 Acres. The mound has been reclaimed by maintaining the slopes and undertaking plantations. A garland drain with catch pits have also been provided around the ash mound for collection of the surface-run off.

The plant is generating about 2,000 TPD of ash at present out of which about 100 TPD is used for brick manufacturing inside the plant premises. Remaining fly ash is being disposed off in six abandoned stone quarries and the abandoned mine void (Quarry-4 of Jagannath OCP). The stone quarries have an area of 19.37 Acres and are at Karanda village which is about 12 km by road from the plant. About 400 TPD of ash is being disposed off in these stone quarries. The ash is transported in covered vehicles in stone



Ash brought in Bulkers, Pneumatically conveyed to Mixer and disposed to Quarry No.4 of Jagannath OCP, Bhushan Energy Ltd.

quarries and through bulkers in mine void. Ash from the bulker is evacuated pneumatically on the site of mine void and is converted in to slurry in three mixers by adding water. The slurry is then released to the mine void by gravity. Water from the mine is used for slurry making. The distance of mine void is about 37 km by road. The area of mine void is 294.19 acres having capacity of 17 million M^3. The practice of mine void filling has started since 15th March, 2014. It has obtained permission from MoEF for one year as pilot project and Consent to Establish from SPCB, Odisha. The detail of the ash disposal areas of the plant is given in **Table-4.**

Table 4 : Details of Ash Disposal Sites

Name of the ash disposal sites	**Area in Acre**	**Volume in M^3**
Quarry no. 4 of Jagannath OCP, MCL	294.19	17000000
Stone quarry at Karanda	2.56	54149
Stone quarry at Karanda	4.71	99792
Stone quarry at Karanda	2.35	49778
Stone quarry at Karanda	2.93	61914
Stone quarry at Karanda	2.24	47350
Stone quarry at Karanda	4.58	96876
Ash Pond	4.78	145102

9.0 Observations and Findings of Committee

The locations of the power plants along with mine void and ash pond are given in **Figure-5**. The map also indicates the locations of ground water sampling points.

Figure 5 : Locations of Thermal Power Plants, Mine Void, Ash Pond and GW sampling in Angul-Talcher Area

10.0 Ground Water Monitoring:

Ground Water (GW) samples were collected around the Thermal Power Plants ash disposal sites. Details of GW sampling locations are presented in **Table 5.**

Table 5 : Location of Sampling Stations

Sl. No.	Nomenclature of GW Sampling Locations	Description of Sampling Locations	Industry/Ash Pond/ Mine Void/ Stone Quarry
1	A1	Kaniha Market, Gandhi Statue	2 Km distance from ash pond in south-east direction
2	A2	Masunihata near temple	1 Km distance from ash pond in south-west direction
3	A3	Derang village near shiva temple	1.5 Km distance from ash pond in North-west direction
4	A4	Takua Village	2 Km distance from ash pond in north-east direction
5	M1	Birsamunda Square South- Balanda	1 Km distance from mine- void filling in East direction.
6	M2	MCL Staff Quarter No.-6	1.5 Km distance from mine- void filling in East direction.

Sl. No.	Nomenclature of GW Sampling Locations	Description of Sampling Locations	Industry/Ash Pond/ Mine Void/ Stone Quarry
7	M3	Dera ME School	1 .5 Km distance from mine- void filling in North-East direction.
8	M4	NeheruSatabdi Hospital	1.8 Km distance from mine- void filling in East direction.
9	M5	Karadapalli	1 Km distance from mine- void filling in South direction.
10	M6	Badasingada Village	1.5 Km distance from mine- void filling in South-West direction.
11	M7	DeraAnganbadi Kendra	1 Km distance from mine- void filling in South- East direction.
12	N1	Kendudhipa, Balaramprasad	400 Mtr distance from ash pond in South-East Direction.
13	N2	Balaram Prasad Chowk(Bus stop)	1 Km distance from Ash pond in south east direction(in Between ash pond –I & II)
14	N3	Girang, Sidhheswar Temple	1.5 Km distance from ash pond in east direction
15	N4	Kurdul, MatigudiaSahi	800Mtr distance from ash pond in North-west direction
16	N5	Koipasisahi	1 Km distance from Ash pond in north direction
17	N6	Nalco Township (Daily Market)	2 Km from distance ash pond in west direction.
18	T1	Tolkolondi Village	1 Km distance from Ash pond in South East direction
19	T2	Santhapada Village	500 mtr distance from ash pond in East directi;on
20	T3	Jadiamba Village	500 mtr distance from ash pond in south east direction.
21	T4	Santhapda Village	2 Km distance from ash pond in north direction
22	T5	Gurujangli village	1 Km distance from ash pond in west direction
23	G1	Maniabedachowk	1 Km distance from ash pond in east direction
24	G2	Bhagamunda Village	1.5 Km distance from ash pond in North direction
25	G3	Pandarabarenia village	1 Km distance from ash pond in west direction
26	G4	Manpur village	2.0 Km distance from ash pond in south direction
27	B1	Narendrapur Village	1.5 Km distance from ash pond in north west direction
28	B2	Talbahal , Near Boundry wall	1 .5Km distance from ash pond in South-west direction

Sl. No.	Nomenclature of GW Sampling Locations	Description of Sampling Locations	Industry/Ash Pond/ Mine Void/ Stone Quarry
29	B3	Kantabania Primary school	1.5 Km distance from ash pond in west direction
30	B4	Sibpur Gate No-10	2.0 Km distance from ash pond in South east direction
31	D1	NimidhaGadiaSahi Primary School	1 Km distance from ash mound in east direction
32	D2	Chintapokhari Bazar Chhak	1.5 Km distance from ash mound in North direction
33	K1	Karandachowk	2 Km distance from stone quarry in South west direction
34	K2	BaramundaChowk	1.5 Km distance from stone quarry in North east direction
35	K3	Badalo village entrance	2 Km distance from stone quarry in east direction
36	K4	BadaloGhodadian U.P school	2 Km distance from stone quarry in North direction

Industry wise ground water samples were collected around the ash disposal sites and the analysis result is presented in **Table No. 6 to 11**.

Table 6 : Analysis Results of GW around Ash Pond, NALCO, CPP

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result				
			pH -	EC (µS/cm)	T.Fe (mg/l)	Cr^{+6} (mg/l)	T.Cr (mg/l)
1.	Kendudhipa, Balaramprasad	N1	7.4	1089	0.05	0.025	0.177
2.	BalaramprasadChowk (Bus stop)	N2	7.3	771	2.49	0.026	0.117
3.	GirangSidhheswar Temple	N3	7.2	1069	0.27	0.033	0.083
4.	Kurdul, MatigudiaSahi	N4	7.1	465	0.46	0.035	0.145
5.	Koipshisahi	N5	7.1	1361	0.36	0.036	0.120
6.	Nalco Township (Daily Market)	N6	7.3	1487	0.01	0.035	0.098

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result							
			Cd (mg/l)	Pb (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	As (mg/l)	Hg (mg/l)
1.	Kendudhipa, Balaramprasad	N1	<0.002	<0.002	0.002	0.005	0.102	<0.002	<0.002	0.00032
2.	BalaramprasadChowk (Bus stop)	N2	<0.002	<0.002	0.043	0.003	0.388	<0.002	<0.002	0.00013

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result							
			Cd (mg/l)	Pb (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	As (mg/l)	Hg (mg/l)
3.	GirangSidhhesw ar Temple	N3	<0.002	<0.002	0.039	<0.002	0.142	<0.002	<0.002	0.00032
4.	Kurdul, MatigudiaSahi	N4	<0.002	<0.002	0.002	<0.002	0.011	<0.002	<0.002	0.00032
5.	Koipshisahi	N5	<0.002	<0.002	0.077	0.002	0.056	<0.002	<0.002	0.00013
6.	Nalco Township (Daily Market)	N6	<0.002	<0.002	0.047	0.003	0.002	<0.002	<0.002	0.00023

It may be seen from the above analysis results that all the parameters meet the permissible limit of drinking water standard (IS10500:2012). Copy of BIS standard is enclosed as **Annexure-B.**

Table 7 : Analysis Results of GW around South Balanda Coal Mine Void, TTPS (NTPC), Talcher

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result				
			pH -	EC (µS/cm)	T.Fe (mg/l)	Cr^{+6} (mg/l)	T.Cr (mg/l)
1.	Tolkolondi village	T1	7.6	1143	0.17	0.015	0.129
2.	Santhapada village	T2	6.9	270	108.5	0.030	0.192
3.	Jadiamba village	T3	7.7	1081	0.01	0.020	0.127
4.	Santhapada village	T4	7.1	507	0.29	0.021	0.119
5.	Gurujanguli village	T5	7.4	2066	6.46	0.020	0.080

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result							
			Cd (mg/l)	Pb (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	As (mg/l)	Hg (mg/l)
1.	Tolkolondi village	T1	<0.002	<0.002	0.007	<0.002	0.022	<0.002	<0.002	0.00081
2.	Santhapada village	T2	<0.002	0.011	0.086	0.024	1.672	<0.002	<0.002	0.00032
3.	Jadiamba village	T3	<0.002	<0.002	<0.002	0.012	0.003	<0.002	<0.002	0.00013
4.	Santhapada village	T4	<0.002	<0.002	0.002	0.004	0.219	<0.002	<0.002	0.00019
5.	Gurujanguli village	T5	<0.002	<0.002	0.012	0.014	0.127	<0.002	<0.002	0.00006

It may be seen from the water quality results that the parameters are within the permissible limit of IS 105000-2012.

Table 8 : Analysis Results of GW around Ash Pond of TSTPP, NTPC, Kanhia

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result				
			pH -	EC (µS/cm)	T.Fe (mg/l)	Cr^{+6} (mg/l)	T.Cr (mg/l)
1.	Kaniha Market, Gandhi Statue	A1	6.9	971	0.25	0.020	0.112
2.	Masunihata, Near Temple	A2	6.9	794	4.19	0.020	0.082
3.	Derang, Near Shiva Temple	A3	6.8	1146	0.78	0.021	0.167
4.	TakuaVillage	A4	6.7	528	1.26	0.026	0.105

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result							
			Cd (mg/l)	Pb (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	As (mg/l)	Hg (mg/l)
1.	Kaniha Market, Gandhi Statue	A1	<0.002	<0.002	0.085	0.004	0.221	<0.002	<0.002	0.00069
2.	Masunihata, Near Temple	A2	<0.002	<0.002	0.018	<0.002	0.059	<0.002	<0.002	0.00006
3.	Derang, Near Shiva Temple	A3	<0.002	<0.002	<0.002	0.003	0.057	<0.002	<0.002	0.00084
4.	TakuaVillage	A4	<0.002	<0.002	0.073	<0.002	0.016	<0.002	<0.002	0.00085

It may be seen from the water quality results that the parameters are within the permissible limit of IS 105000-2012.

Table 9 : Analysis Results of GW around Nimidha Ash Mound, Nav Bharat Ventures Ltd.

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result				
			pH -	EC (µS/cm)	T.Fe (mg/l)	Cr^{+6} (mg/l)	T.Cr (mg/l)
1.	NimidhaGadiaSahiPrimary School	D1	6.9	234	**6.83**	0.005	0.055
2.	Chintapokhari Bazaar Chhak	D2	7.1	664	0.24	0.005	0.154

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result							
			Cd (mg/l)	Pb (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	As (mg/l)	Hg (mg/l)
1.	NimidhaGadia SahiPrimary School	D1	<0.002	<0.002	0.031	<0.002	1.280	<0.002	<0.002	0.00006
2.	Chintapokhari Bazaar Chhak	D2	<0.002	<0.002	0.019	<0.002	0.061	<0.002	<0.002	0.00013

Concentration of total Iron was found to be high (6.83 mg/l) whereas, other parameters are within the permissible limit.

Table 10 : Analysis of Ground Water around Ash Pond of M/s. GMR Kamalanga Energy Ltd.

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result				
			pH -	EC (µS/cm)	T.Fe (mg/l)	Cr^{+6} (mg/l)	T.Cr (mg/l)
1.	ManiabedaChhak (East side), 0 km distance from Ash pond	G1	7.3	822	0.29	0.01	0.072
2.	Bhagamunda Village (North side), 1.5 km distance from Ash pond	G2	7.2	834	0.36	0.013	0.087
3.	PandaraBarenia Village (West side), 1.0 km distance from Ash pond	G3	7.3	818	0.07	0.011	0.107
4.	Manapur Village (South side), 2.0 km distance from Ash pond	G4	7.3	599	1.28	0.016	0.082

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result							
			Cd (mg/l)	Pb (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	As (mg/l)	Hg (mg/l)
1.	ManiabedaChhak (East side), 0 km distance from Ash pond	G1	<0.002	<0.002	0.017	<0.002	0.158	<0.002	<0.002	0.00013
2.	Bhagamunda Village (North side), 1.5 km distance from Ash pond	G2	<0.002	<0.002	0.041	<0.002	0.554	<0.002	<0.002	0.00006
3.	PandaraBarenia Village (West side), 1.0 km distance from Ash pond	G3	<0.002	<0.002	0.021	0.003	0.104	<0.002	<0.002	0.00032
4.	Manapur Village (South side), 2.0 km distance from Ash pond	G4	<0.002	<0.002	0.018	0.018	0.074	<0.002	<0.002	0.000057

It may be seen from the water quality results that the parameters are within the permissible limit of IS 105000-2012.

Table 11 : Analysis Results of GW around Karanda Stone Quarry and Sibpur Ash Mound by M/s Bhushan Energy Ltd.

Sibpur Ash Mound:

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result				
			pH -	EC (µS/cm)	T.Fe (mg/l)	Cr^{+6} (mg/l)	T.Cr (mg/l)
1.	NarendrapurVillage	B1	7.1	1922	0.11	0.036	0.095
2.	Talbahal, Near Boundary Wall	B2	7.5	1085	5.35	0.031	0.037
3.	Kantabania Primary School	B3	7.3	964	2.12	0.030	0.102
4.	Sibpur, Gate No-10	B4	8.1	392	3.82	0.020	0.098

Sl. No.	Sampling Locations	Nomen clature	Parameters (with Unit) & Result							
			Cd (mg/l)	Pb (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	As (mg/l)	Hg (mg/l)
1.	NarendrapurVillage	B1	<0.002	<0.002	0.028	0.010	0.005	<0.002	<0.002	0.00014
2.	Talbahal, Near Boundary Wall	B2	<0.002	<0.002	0.054	0.003	0.210	<0.002	<0.002	0.00014
3.	Kantabania Primary School	B3	<0.002	<0.002	0.012	0.003	0.064	<0.002	<0.002	0.00076
4.	Sibpur, Gate No-10	B4	<0.002	0.006	0.070	0.003	0.008	<0.002	<0.002	0.00019

Karanda Stone Quarry

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result				
			pH -	EC (µS/cm)	T.Fe (mg/l)	Cr^{+6} (mg/l)	T.Cr (mg/l)
1.	KarandaChowk	K1	7.0	761	4.9	0.035	0.05
2.	BaramundaChowk	K2	7.5	1003	0.24	0.035	0.120
3.	BadaloVillage Entrance	K3	7.1	955	0.86	0.038	0.120
4.	BadaloGhodadian UP School	K4	7.3	917	0.05	0.040	0.090

Sl. No.	Sampling Locations	Nomen clature	Parameters (with Unit) & Result							
			Cd (mg/l)	Pb (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	As (mg/l)	Hg (mg/l)
1.	KarandaChowk	K1	<0.002	<0.002	0.027	0.004	0.068	<0.002	<0.002	0.00019
2.	BaramundaChowk	K2	<0.002	<0.002	0.007	0.009	0.056	<0.002	<0.002	0.00019
3.	BadaloVillage Entrance	K3	<0.002	<0.002	0.032	0.002	0.009	<0.002	<0.002	0.00019
4.	BadaloGhodadian UP School	K4	<0.002	0.004	0.042	0.007	0.019	<0.002	<0.002	0.00037

It may be seen that the parameters are within the permissible limit of IS 105000-2012.

Besides ground water samples collected around individual ash disposal sites of thermal power plants, ground water samples were also collected at other strategic locations to assess and compare the quality. The analysis results are given in **Table-12.**

Table 12 : Analysis Results of GW in Common Areas of Ash Disposal Sites by the Thermal Power Plants

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result				
			pH -	EC (µS/cm)	T.Fe (mg/l)	Cr^{+6} (mg/l)	T.Cr (mg/l)
1.	Birsamunda Square, South Balanda	M1	6.5	303	**38.25**	0.01	0.028
2.	MCL Staff Quarter No-6	M2	6.7	211	19.4	0.006	0.055
3.	Dera M.E. School	M3	6.1	752	0.16	0.006	0.052
4.	Nehru Shatabdhi Hospital	M4	7.2	805	2.5	0.006	0.092
5.	Karadapalli	M5	7.1	2303	1.2	0.008	0.078
6.	Badasidngada village (Back side of Master Camp)	M6	7.2	888	0.15	0.010	0.088
7.	Dera Anganbadi Kendra	M7	6.5	314	1.48	0.01	0.083

Sl. No.	Sampling Locations	Nomenclature	Parameters (with Unit) & Result							
			Cd (mg/l)	Pb (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	As (mg/l)	Hg (mg/l)
1.	Birsamunda Square, South Balanda	M1	<0.002	0.002	0.088	0.002	0.599	<0.002	<0.002	0.00013
2.	MCL Staff Quarter No-6	M2	<0.002	<0.002	0.088	<0.002	0.077	<0.002	<0.002	0.00044
3.	Dera M.E. School	M3	<0.002	0.002	0.013	0.008	1.050	0.002	<0.002	0.00032
4.	Nehru Shatabdhi Hospital	M4	<0.002	<0.002	0.035	0.014	0.017	<0.002	<0.002	0.00013
5.	Karadapalli	M5	<0.002	<0.002	0.030	0.003	0.689	<0.002	<0.002	<0.00006
6.	Badasidngada village (Back side of Master Camp)	M6	<0.002	<0.002	0.012	<0.002	<0.002	<0.002	<0.002	0.00006
7.	DeraAnganbadi Kendra	M7	<0.002	0.010	<0.002	0.036	2.023	<0.002	<0.002	0.00006

It can be seen from the above table that the concentration of total Iron is very high at the Birsamunda square, South Balanda.

11.0 Ash Analysis Result

The ash samples were collected from ash disposal sites of these power plants in the area and the analysis results are presented in **Table 13**.

Table 13 : Ash Analysis Results

Sl. No.	Sampling location	pH (1:5)	Cr^{+6}	Cd	Pb	Co	Mn	Cu	Zn	Ni	As
			(mg/kg)								
1.	Ash sample from Kranda Stone Quarry , Bhusan Energy Ltd.	9.6	ND	9.97	170.6	3.73	197	305.5	62.1	13.9	17.9
2.	Ash from Ash Pond of Bhushan Energy Ltd.	7.1	0.81	4.1	58.8	3.7	1301.9	296.4	48.6	13.2	12.5
3.	Ash sample from NALCO CPP, Ash pond I	7.8	ND	26	72	8	11.2	256.9	10.4	2.8	8.9
4.	Ash sample from NALCO CPP, Ash pond II	5.8	ND	37.3	115.9	0.6	29.2	228.1	8.8	3.9	4.7
5.	Ash sample from Nimidha ash mound of Navabharat Ventures Ld.	6.5	ND	2.1	69.3	3.7	247.7	222.6	36.6	12.7	18.3
6.	Ash sample from Ash Pond TTPS(NTPC), Talcher	6.7	ND	26.6	310.4	1	3.7	166.2	3.9	3.7	14.1
7.	Ash sample from mine void filling of TTPS (South Balanda)	6.6	0.718	11.2	159.6	0.5	10.8	166	3.8	3	10.7
8.	Ash sample from mine void filling of Navabharat (South Balanda)	6.1	ND	2.9	66.6	2.4	135.8	169.3	35.3	8.5	8.9
9.	Ash sample from Lagoon I GMR Kamalaga Energy Ltd	8.4	0.37	10	71.6	1.7	54.3	151.4	15.7	23.8	9.1
10.	Ash sample from lagoon II GMR	7.5	ND	91.2	1789.7	1.5	215	142.3	22.3	6.3	9
11.	Ash sample from Ash Pond NTPC, Kaniha	7.1	ND	6.6	130.6	0.6	43.3	126.8	24.1	2.8	11.9
12.	Ash sample from mine void ofBhushan Energy Ltd. (Jagannath Quarry No 4)	9.4	ND	0.248	12.7	5.186	--	21.24	156.9	16.26	29.4

It has been observed that the concentration of heavy metals in all fly ash samples are within the limit specified in Schedule-2 of Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 indicating that fly ash is non-hazardous in nature.

12.0 Stack Emission Monitoring

All the thermal power plants have installed Electro-static Precipitator (ESP) as air pollution control measures to control Particulate Matter emission. The outlets of ESPs are connected to stacks of adequate height. The flue gas volume and height of the stacks is given in **Table 14**. Stack emission monitoring data alongwith the prescribed standard w.r.t. Particulate Matter is given in **Table 15.**

Table 14 : Unit wise Power Generation Capacity with Flue Gas Volume & Stack Height of Thermal Power Plants in Angul-Talcher Area

Sl. No.	Name of the Power Plants	Unit	Flue Gas VolumeNm^3/ hr	Stack Height in meter
1.	NALCO Ltd, Captive Power Plant, Angul	Unit-1 (120 MW)	9,82,500	150
		Unit-2 (120 MW)	9,82,500	
		Unit-3 (120 MW)	9,82,500	150
		Unit-4 (120 MW)	9,82,500	
		Unit-5 (120 MW)	9,82,500	150
		Unit-6 (120 MW)	9,82,500	
		Unit-7 (120 MW)	9,82,500	220
		Unit-8 (120 MW)	9,82,500	
		Unit-9 (120 MW)	9,82,500	220
		Unit-10 (120 MW)	9,82,500	
2.	Talcher Thermal Power Station Ltd. (NTPC) , Talcher, Angul	Unit-1 (60 MW)	2,71,920	60
		Unit-2 (60 MW)	2,71,920	
		Unit-3 (60 MW)	2,75,557	60
		Unit-4 (60 MW)	2,75,557	
		Unit-5 (110 MW)	6,02,261	125
		Unit-6 (110 MW)	6,02,261	

Sl. No.	Name of the Power Plants	Unit	Flue Gas VolumeNm³/ hr	Stack Height in meter
3.	TSTPS, Deepsikha, KanihaAngul	Unit-1 (500 MW)	28,40,000	275
		Unit-2 (500 MW)	28,40,000	
		Unit-3 (500 MW)	27,99,900	275
		Unit-4 (500 MW)	27,99,900	
		Unit-5 (500 MW)	27,99,900	275
		Unit-6 (500 MW)	27,99,900	
4.	Nava Bharat Ventures Ltd., Dhenkanal	Unit-1 (30 MW)	2,17,800	75
		Unit-2 (64 MW)	4,68,000	95
		Unit-3 (64 MW)	4,68,000	95
5.	GMR Kamalang Energy Ltd, Dhenkanal	Unit-1 (350 MW)	23,07,600	275
		Unit-2 (350 MW)	23,07,600	
		Unit-3 (350 MW)	23,07,600	275
6.	Bhushan Energy Ltd., Dhenkanal	Unit-1 (150 MW)	10,22,256	125
		Unit-2 (150 MW)	10,22,256	125

Table 15 : Stack Emission Analysis Data of Thermal Power Plants of Angul – Talcher Area

Sl. No.	Thermal power plant	Location of sampling		Particulate Matter (mg/Nm³)	Prescribed standards (mg/Nm³)
1.	M/s. NALCO (CPP) , Angul	Unit-1	Pass-A	32	**100**
		Unit-1	Pass-B	26	**100**
		Unit-3	Common	91	**100**
		Unit-4	Pass-A	36	**100**
		Unit-4	Pass-B	68	**100**
		Unit-4	Pass-C	57	**100**
		Unit-8	Pass-A	42	**100**
		Unit-8	Pass-B	81	**100**
		Unit-9	Pass-A	24	**80**
		Unit-9	Pass-B	37	**80**
		Unit-10	Pass-A	23	**80**

Sl. No.	Thermal power plant	Location of sampling		Particulate Matter (mg/Nm^3)	Prescribed standards (mg/Nm^3)
		Unit-10	Pass-B	75	**80**
2.	M/s. Talcher Super Thermal Power Station (NTPC), Kaniha, Talcher, Angul	Unit-2	Pass-A	72	**100**
		Unit-2	Pass-B	45	**100**
		Unit-3	Pass-A	68	**100**
		Unit-3	Pass-B	32	**100**
		Unit-4	Pass-A	89	**100**
		Unit-4	Pass-B	28	**100**
		Unit-5	Pass-A	24	**100**
		Unit-5	Pass-B	32	**100**
		Unit-6	Pass-A	29	**100**
		Unit-6	Pass-B	43	**100**
3.	M/s. Talcher Thermal Power Station (NTPC), Talcher, Angul	Unit-1	-	56	**100**
		Unit-2	-	73	**100**
		Unit-3	-	30	**100**
		Unit-4	-	45	**100**
		Unit-5	Pass-B	74	**100**
		Unit-5	Pass-C	57	**100**
4.	M/s. Nava Bharat Ventures Ltd., Kharagprasad, Dhenkanal	Unit-1	Boiler-II	18	**50**
5.	M/s. GMR Kamalanga Energy Ltd., Kamalanga, Dhenkanal	Unit-1	-	36	**50**
		Unit-2	-	23	**50**
6.	M/s. Bhushan Energy Ltd., Narendrapur, Meramandali, Dhenkanal	CPP	Boiler-II	39	**50**

It may be seen from the monitoring results that the Particulate Matter (PM) emissions from all the power plants are within the prescribed standard. This indicates that the pollution control equipments are working effectively.

13.0 Ash Generation & Utilisation

The status of the ash generation and utilisation by the six thermal power plants for the year 2013-14 is enclosed at **Annexure-C**. Present method of ash utilization and disposal practices adopted by these thermal power plants is compiled and given in **Annexure-D. It may be seen that three TPPs (TTPS, Talcher, Nav Bharat Ventures Ltd. & Bhushan Energy) are able to utilize 100% of fly ash due to mine void filling**.

14.0 Legal Provisions

The Ministry of Environment and Forest has issued Notification for Fly Ash Utilization vide S.O. No. 763(E) on 14th Sept, 1999 which was amended on 27th Aug, 2003 and 3rd Nov, 2009 vide S.O. No. 979(E) and 2804(E) respectively. As per this notification, use of fly ash in construction activities such as in road making, embankments or use as landfill to reclaim low lying areas including back filling in abandoned mines or pitheads is permissible. Further according to this notification, at least 25% of fly ash on volume to volume basis has to be used with overburden for back filling of open cast mines. This activity has to be undertaken under the guidance of Directorate General of Mines Safety (DGMS).

15.0 Conclusion

Based on the observations and findings, the Committee concludes the following:

1) Analytical results of ground water samples collected from 36 locations show that the values are within the permissible levels of BIS guidelines except Iron. The Iron concentration exceeds the BIS limits at 15 locations. This could be due to the geogenic factors. The samples collected around fly ash disposal locations particularly in the contiguous area of ash pond also did not show any values higher than the guidelines.

2) The Committee also noted that the results of the study conducted by CSIR-NEERI (Impact assessment of ash filling by TTPS on water resources in the surrounding of South Balanda Mine pit and Old ash pond area) also did not indicate higher concentration of heavy metal in the observation wells surrounding the ash filled mine voids.

3) The stack samples collected from six (6) power plants were found to be complying with the prescribed norms of particulate matter (PM) of 100 mg / Nm^3 & 50 mg / Nm^3, as prescribed by SPCB, Odisha.

4) All the power plants have installed electrostatic precipitators (ESP). It has also been noted that the On-line Emission monitoring devices and continuous AAQ monitoring stations have been installed by the power plants.

5) Fly ash samples analyzed from 12 locations also show the parameters within the specified limits of Scheduled-2 of Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 with respect to heavy metals.

6) The activity of mine void / stone quarry filling being carried out by M/s. TTPS (NTPC), M/s. Bhushan Energy Ltd. and M/s. Nava Bharat Ventures Ltd. is one of the permitted options under the existing Fly Ash Utilization Notification, 1999 (vide S.O No. 763(E)) as amended thereafter.

7) The Committee noted that the Ministry of Environment and Forests has given permission on 5th Sept, 2013 to M/s. NALCO, M/s. TTPS, Talcher and M/s. Bhushan Energy Ltd. for disposal of fly ash into respective mine voids as pilot project for one year.

8) As per the study conducted by CSIR-NEERI during 2012-14, titled "Study of Effects due to Ash Fill Sites of Talcher Thermal Power Plant on Flora and Fauna in the surrounding area of South Balanda Mine Pit and Jagananth Mine Pit", there is no ecological sensitive flora or fauna in the study area. Leaf injury symptoms due to fly ash were also not observed. Although, dust deposition was observed on leaves, microscopic studies revealed that there was stomata indicating that deposition of dust / fly ash is not having an adverse impact on the flora surrounding the ash dumping sites.

9) During the field visit of the Committee, good vegetation was observed around the ash disposal sites. Further, plantation was seen on fly ash mound at Sibpur dump area of M/s. Bhushan Energy Ltd., and South Balanda abandoned pit by M/s. Nava Bharat Ventures Ltd.

10) The Committee could see a few birds in the ash ponds of NALCO and GMR.

11) The ash disposal area is either above ground level in Ash Pond / Ash Mound or below ground level in Coal Mine void of MCL, Talcher or quarry filling. Mode of disposal is different, i.e. dry form and slurry form. The consolidation time in case of slurry disposal is different at different places depending on slurry density. However, there is a requirement of need based operating procedure.

16.0 Opinion

1) Since, the generation of fly ash by these thermal power plants is too high and scope of its utilization in bricks manufacturing and infrastructure projects is limited, mine void and quarry reclamation by back filling with fly ash seems to be the most feasible option for utilization of fly ash in the area.

2) The filling of the void created in the coal mine of M/s. MCL would require huge quantity of overburden / external soil / sand to be transported from some other sites. This would create air pollution and environmental effects at some other sites. To avoid this, filling up of these voids by the available fly ash seems appropriate. However, the thermal power plants should be asked to monitor the ground water quality (pre & post-monsoon every year) around the ash disposal sites and submit the same to State Pollution Control Board, who would in turn carryout the trend analysis.

3) It has been observed that, huge area of land is acquired for ash ponds and still there is no system available for major uptake of fly ash. Utilization of fly ash by manufacturing bricks / road construction / cement manufacturing is not encouraging. Hence, the Committee felt that, filling of fly ash in voids of abandoned mine seems to be the only option.

4) Disposal of fly ash in the form of slurry is found to be the better option as it avoids plying of large number of vehicles on the road leading to traffic congestion. This method also facilitates recycling / reuse of decanted water back to the plant for preparation of ash slurry.

5) High Density Slurry Disposal (HDSD) for mine void filling is preferred for quick consolidation of slurry. However, techno economic feasibility is to be evaluated.

6) The Committee however, has not ignored other options like making bricks, road construction or manufacturing cement. The back filling of mine void should be considered only after exploring all these options.

7) The studies of CSIR-NEERI have not shown any signs of heavy metal contamination in the ground water. However, the Committee strongly felt that there is a need for comprehensive monitoring (pre-monsoon and post-monsoon) of ground water quality surrounding the ash disposal sites. This monitoring should be carried out on a study area delineated on the watershed principle.

Dr. A. B. Akolkar,
Member Secretary,
Central Pollution Control Board, New Delhi

Shri Rajiv Kumar,
Member Secretary,
State Pollution Control Board, Odisha

Ms Sanchita Jindal,
Director,
MoEF, Govt. of India, New Delhi

Dr. Paras Ranjan Pujari,
Nominated Scientist,
CSIR-NEERI, Nagpur

Shri Mantu Biswas,
Regional Controller of Mines, Indian Bureau of Mines, Bhubaneswar

Annexure-A

List of Officials of TPPs present during the field visit of the Committee

Sl. No.	Thermal Power Plant	Name of the Officials & Designation
1.	NALCO, CPP, Angul	Shri K. K. Panda, General Manager & Other Officials
2.	Talcher Thermal Power Station (NTPC), Talcher, Angul	Shri K. R. C. Murthy, General Manager & Other Officials
3.	Talcher Super Thermal Power Plant, NTPC, Kaniha, Angul	Shri N. K. Kothari, Group General Manager & Other Officials
4.	Nava Bharat Ventures Ltd., Dhenkanal	Shri N. P. Patra, Vice President & Other Officials
5.	GMR Energy, Kamalanga, Dhenkanal	Shri Arindam Chatterjee, Vice President & Other Officials
6.	Bhushan Energy Ltd., Dhenkana	Shri C. B. S. Sengar, Vice President & Other Officials

Annexure-B

INDIAN STANDARD SPECIFICATIONS FOR DRINKIN G WATER (IS: 10500)

Sl. No.	Parameters	Desirable Limit
1.	Colour	5
2.	Turbidity	10
3.	pH	6.5 to 8.5
4.	Total Hardness	300
5.	Copper as Cu	0.05
6.	Iron	0.3
7.	Manganese	0.1
8.	Nitrates	45
9.	Mercury	0.001
10.	Cadmium	0.01
11.	Arsenic	0.05
12.	Lead	0.1
13.	Zinc	5.0
14.	Chromium as Cr^{+6}	0.05

Annexure-C

STATUS OF UTILISATION OF ASH BY THERMAL POWER PLANTS OF ANGUL-TALCHER AREA, IN ODISHA FOR THE YEAR 2013-2014

Sl. No.	Name and address of the unit	Total Ash Generated (MT)	Modes of Utilization									Total ash utilized (MT)	% of Utilization
			Brick manufacturing (MT)	Cement	Asbestos	Quarry filling	Coal Mine Void filling	Dyke Raising	Land Development	Road Making	Aggregates		
1	NALCO Ltd, Captive Power Plant, Angul	1921804	265179	0	81390	22800	0	785992	222000	0	0	1377361	71.67
2	Talcher Thermal Power Station Ltd.(NTPC), Talcher, Angul	1217254	6755	33160	2545	0	1174794	0	0	0	0	1217254	100
3	TSTPS(NTPC), Deepsikha, KanihaAngul	6313000	55000	0	26000	0	0	1860000	565000	0	0	2506000	39.69
4	Nava Bharat Ventures Ltd., Dhenkanal	200870	460	65700	0	28827	65335	0	40548	0	0	200870	100
5	GMR Kamalang Energy Ltd, Dhenkanal	318145	22680	0	0	0	0	0	129778	0	0	152458	47.92
6	Bhushan Energy Ltd., Dhenkanal	586784	32000	0	0	0	5575	14000	525209	10000	0	586784	100
	Total	**10557857**	**382074**	**98860**	**109935**	**51627**	**1245704**	**2659992**	**1482535**	**10000**	**0**	**6040727**	**57.21**

Annexure-D

Mode of Ash Disposal Practices Adopted By the Thermal Power Plants

Sl. No.	Name of the Power Plant	Scope & Present mode of disposal of ash												
		Brick Manufacturing		Supply to Cement / Asbestos Units		Low land filling		Abandoned Quarry filling			Ash Pond / Ash Mound Disposal		Coal Mine Void Filling	
		Scope	Present Status	Scope	Present Status	Scope	Present Status	Scope	Form of disposal	Present Status	Mode	Present Status	Mode	Present Status
1	Nalco Ltd, Captive Power Plant, Angul	3 brick plants inside and 42 nos of outside brick plants.	In opernational state.	Supply to Asbestos Units	It is continuing.	No low land inside the plant is available.	No more land filling.	Stone quarry in Paranga and Talataila areas of Angul.	Dry form through covered vechicles by road.	Suspended for the time being.	Ash disposed off in lean slurry & HCSD form in to the ash pond.	It is a continuing process.	Mine void in Bharatpur OCP of MCL has been alloted.	The project is under implementation stage.
2	Talcher Thermal Power Station Ltd. (NTPC), Angul	3 brick plants inside and 18 nos of outside brick plants.	In opernational state.	Supply to Asbestos Unit.	Continuing	No land filling	No activity	No quarry has been alloted.	Not applicable	No activity	In lean slurry form to contigency pond.	25 % of ash meant for disposal in lean slurry form is disposed off in contigency pond.	Lean slurry form to the mine void of South Balanda coal mine of MCL through pipe line.	75 % of ash meant for disposal in lean slurry form is disposed off in the mine void.

Sl. No.	Name of the Power Plant	Scope & Present mode of disposal of ash												
		Brick Manufacturing		Supply to Cement / Asbestos Units		Low land filling		Abandoned Quarry filling			Ash Pond / Ash Mound Disposal		Coal Mine Void Filling	
		Scope	Present Status	Scope	Present Status	Scope	Present Status	Scope	Form of disposal	Present Status	Mode	Present Status	Mode	Present Status
3	TSTPS, (NTPC), Deepsikha, Kaniha, Angul	5 brick plants inside and 25 nos of outside brick plants.	In opernational state.	Supply to Asbestos unit	Conti-nuing	Marginal Scope	No low land filling at present	No quarry has been alloted.	Not applicable	No activity	Lean slurry disposal through pipe line into the ash pond.	It is a continuing process.	Quarry no. 8 of Jagannath coal mine of MCL has been alloted.	In the process of obtaining necessary clearances. No dumping has started.
4	Nava Bharat Ventures Ltd. Dhenkanal	1 Brick unit inside the plant.	In opernational state.	Supppl y to Cement units.	Conti-nuing	There is scope.	At present no land filling is in practice.	Stone quarry at Bodalo in Dhenkanal.	Dry form through covered vechicles by road.	In operation	Ash mound at Nimidha	Temporarily suspended for the time being.	Dry transportation through covered vechicles and disposed into the void of South Balanda coal mine of MCL.	In active stage.

Sl. No.	Name of the Power Plant	Scope & Present mode of disposal of ash												
		Brick Manufacturing		Supply to Cement / Asbestos Units		Low land filling		Abandoned Quarry filling			Ash Pond / Ash Mound Disposal		Coal Mine Void Filling	
		Scope	Present Status	Scope	Present Status	Scope	Present Status	Scope	Form of disposal	Present Status	Mode	Present Status	Mode	Present Status
5	GMR Kamalang Energy Ltd, Dhenkanal	No brick plant inside. But 21 nos of outside brick units.	Practice is followed.	No	Nil	Little area inside is left out for filling.	No activities at present.	No quarry has been alloted.		No activity	Ash disposed off in HCSD form inside the plant premises.	It is a continuing process.	No coal mine void has been alloted.	No activity
6	Bhushan Energy Ltd., Dhenkanal	3 nos of Brick units inside Plant.	In opernational state.	No	Nil	Back filling of Project area.	Marginaly utilized.	Stone quarry in Karanda Village in Dhenkanal.	Dry form through covered vechicles by road.	In operation.	Ash mound at Sibapur.	Suspended and no more dumping.	Dry transportation through bulkers and disposed into the void of quarry no. 4 of agannath OCP of MCL in slury form.	In active stage. Major mode of disposal.