JINDAL POWER

JPL/EMD/F-30/6.25 MTPA/2014/600

01/06/2014

The Regional Director,
Ministry of Environment & Forests (MoEF),
Regional Office, Western Region,
Kendriya Paryavaran Bhawan, Link Road No.3,
E-5, Ravishankar Nagar, Bhopal – 462 016 (M.P.)

Sub.:-**Submission of Half Yearly Environmental Clearance Compliance Report of Gare IV/2 and IV/3 Opencast and Underground Coal Mining Project of a combined production of 6.25 MTPA (OCP from 5.25 MTPA to 6.25 MTPA and 0.75 MTPA production in UGP) in an ML area of 964.65 ha and for establishment of a pit-head coal washery of 4.75 MTPA (800 TPH) within the Gare IV/2 and IV/3 ML of M/s Jindal Power Limited, Tamnar, Distt.- Raigarh (C.G.) for the period of September, 2013 to March ,2014.**

Ref.: - **Environmental Clearance No. J.11015/288/2007-IA.II (M) dated 12th June 2012.**

Dear Sir,

This has reference to the above cited subject. Enclosed please find herewith half yearly Environmental Clearance Compliance Report of Gare IV/2 and IV/3 Opencast and Underground Coal Mining Project of a combined production of 6.25 MTPA (OCP from 5.25 MTPA to 6.25 MTPA and 0.75 MTPA production in UGP) in an ML area of 964.65 ha and for establishment of a pit-head coal washery of 4.75 MTPA (800 TPH) within the Gare IV/2 and IV/3 ML of M/s Jindal Power Limited, Tamnar, Distt.- Raigarh (C.G.) for the period from **October, 2013 to March, 2014** both in hard and soft (through mail) copies.

Trust that you will find the above information in order.

Thanking you,

Yours faithfully,
For **JINDAL POWER LIMITED**

Ashok Kumar

A.K. Singh
Sr. Dy. General Manager- EMD

Encl. : As above.

Cc:

The Director, **Ministry of Environment & Forests,** **Paryavaran Bhawan, CGO Complex,** **New Delhi.**	**The Zonal Officer,** **Central Pollution Control Board,** **3rd Floor,Sahkar Bhawan, North** **T.T.Nagar, Bhopal-462 003 (M.P)**	**The Member Secretary,** **Chhattisgarh Environment Conservation Board,Commercial Complex, Housing Board Colony, Kabir Nagar,Raipur (C.G)**

Jindal Power Limited Corporate Identity No: U04010CT1995PLC006885
Registered Office Tamnar 496 107 District Raigarh, Chhattisgarh
T +91 7767 281701-08 / 302000 / 302004 F +91 7767 281991-93-95
Corporate Office Jindal Centre, 12 Bhikaiji Cama Place, New Delhi 110 066 W www.jindalpower.com

Compliance Report of Environmental Clearance for Gare IV/2 and IV/3 Opencast and Underground coal mining project of a combined production of 6.25 MTPA and establishment of pit-head Coal Washery of 4.75 MTPA (800TPH) issued vide letter No.J.11015/288/2007-IA.II (M) dated 12th June 2012.

S.No	Conditions	Compliance Status
A. Specific conditions :		
(i)	Maximum production by opencast mining shall not exceed 6.25 MTPA and that by underground mining shall not exceed 0.75 MTPA. The maximum combined production at any given time shall not exceed 6.25 MTPA from both opencast and underground mining.	Initially, entire production i.e. 6.25 MTPA will be from Opencast mine till underground mine is developed & attains production. However, the maximum combined production at any given time will not exceed 6.25 MTPA from both opencast and underground mining.
(ii)	The mining operations shall be opencast during the first 34 years and underground mining shall begin from the 3rd year and continue until the end of mine life.	Noted.
(iii)	Before starting underground mining, the void shall be properly backfilled, stabilised and reclamation undertaken. Sufficient parting shall be maintained between the bottom most OC seam and top most UG seam.	The void will be properly backfilled, stabilised and reclaimed before starting underground mining. There is more than 70 m parting thickness between the bottom most OC seam and top most UG seam.
(iv)	Diversion of Bendra Nala flowing through the ML area for a total length of 1230m shall be undertaken under the supervision of Hasdeo Kacher Water Resource Department (WRD), Bilaspur. The diversion channel of Bendra nala shall follow the natural gradient and join at the point of original exit at the ML boundary in its original course, so that the downstream users of Bendra Nala are not affected due to the proposed diversion. Monitoring of water quality of River Kelo and Bendra Nala upstream and downstream of the mine shall be monitored as per General Standards prescribed under EPA Rules, 1986 and data thereon uploaded regularly on the company website and also furnished as part of the Compliance Report to MOEF RO, Bhopal.	Permission has been obtained from Water Resource Dept. of the State Govt., MoEF, New Delhi and Chhattisgarh Environment Conservation Board, Raipur for diversion of Bendra Nala vide letters dated 4/4/2011,12/06/2012 & 28/01/2013. Bendra Nala will be diverted under the supervision of Hasdeo Kacher Water Resource Department (WRD), Bilaspur after approval of diversion plan. IIT, Kharagpur has been engaged for monitoring of water quality of River Kelo and Bendra Nala upstream and downstream of the mine. The data is being uploaded regularly on the company website. Water quality report for the month of January 2014 attached in ***Annexure* – I.**

(v)	Mining shall be carried out as per statute at a safe distance from River Kelo. The embankment of 5 Km length being constructed between River Kelo and the ML boundary shall be at least 6m higher than the HFL of River Kelo.	Mining is being carried out at a safe distance from River Kelo. Embankment of sufficient length and height will be constructed between River Kelo and the ML boundary.
(vi)	The proponent shall strengthen the embankment along the diverted stretch of the Bendra Nala and along River Kelo adjoining the boundary of the mine using large boulders in wire mesh along diverted Bendra nala and then along the eastern bank of Kelo river and grouting of weak portions of the embankment to protect the mine from flooding. The slope of the embankment towards the river shall at least 1:3 for stability and shall be stabilized with plantation using native species selected from the study area.	Will be complied.
(vii)	Top soil shall be stored in the earmarked area and used for green belt development and for plantation/reclamation within a year of its generation. Green belt development shall be completed within the first 3 years of mining operation.	Top soil is being temporally stacked in earmarked area and used for green belt development, plantation/reclamation, embankment etc. within a year of its generation. Green belt development around the mine periphery and overburden dumps is in progress.
(viii)	OB shall be stacked at earmarked external OB dumpsites of 48.40 ha within ML area. The maximum height of the external OB dump shall not exceed 60m. The ultimate slope of the dump shall not exceed 28^0. Monitoring and management of existing reclaimed dumpsites shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry of Environment & Forests and its Regional office located at Bhopal on yearly basis.	OB is being stacked at earmarked external OB dump site within mining lease and the height & slope is monitored so that it will not exceed. Existing reclaimed dumpsites are monitored and the same will be continued until the vegetation becomes self-sustaining. The compliance status is being submitted to the Ministry of Environment & Forests and its Regional office located at Bhopal on half-yearly basis.
(ix)	Catch drains and siltation ponds of appropriate size should be constructed to arrest silt and sediment flows from soil, OB and mineral dumps. The water so collected should be utilized for watering the mine area, roads, green belt development etc. The drains should be regularly de-silted and maintained properly.	Suitable catch drains & settling ponds have been constructed to arrest silt and sediment flows from soil and OB dumps. The collected water from the settling pond is being utilised for watering the mine area, haul roads, green belt development etc. The drains are regularly de-silted and maintained.

(x)	Garland drains (size, gradient and length) and sump capacity shall be designed keeping 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the mine site. Sump capacity shall also provide adequate retention period to allow proper settling of silt material.	Complied with.
(xi)	Dimension of the retaining wall at the toe of the dumps and OB benches within the mine to check run-off and siltation shall be based on the rainfall data.	Toe wall of appropriate dimension has been constructed around the OB dumps based on rainfall data. Additionally, plantation has also been carried out on OB dump & its slope.
(xii)	During underground mining, while extracting panels in the lower seam, all water bodies in the subsidence area shall be drained. Dewatering of the old goaves of the upper seam shall be continued as long as the lower seam is worked to prevent accumulation of large water bodies over working area. At the time of depillaring, protective bunds and garland drains shall be provided so that no water from the surface enters the subsidence area and the shaft.	Noted.
(xiii)	Sufficient coal pillars shall be left unextracted around the airshaft (within the subsidence influence area) to protect from any damage from subsidence, if any.	Sufficient coal pillars will be left un-extracted around the airshaft, though the predicted subsidence is negligible.
(xiv)	Solid barriers shall be left below habitation, agriculture land, roads falling within the blocks to avoid subsidence. No depillaring operation shall be carried out below the roads and habitation area found within the lease. In case of subsidence, the land shall be acquired and compensation provided as per policy/rules.	The underground mining will be done below the already worked opencast mine area. The effect of subsidence will be only in the backfilled opencast mine area and there will be no effect on the surroundings.
(xv)	Regular monitoring of subsidence movement on the surface over and around the working area and impact on natural drainage pattern, water bodies, vegetation, structure, roads, and surroundings shall be continued till movement ceases completely. In case of observation of any high rate of subsidence movement, appropriate effective corrective measures shall be taken to avoid loss of life and material.	The underground mining will be done below the already worked opencast mine area. The effect of subsidence will be only in the backfilled opencast mine area and there will be no effect on the surroundings. However, regular monitoring of subsidence movement on the surface over and around the working area and impact on natural drainage pattern, water bodies, vegetation, structure, roads, and surroundings will be undertaken. Beside this, NIT, Rourkela is awarded a study to

	Cracks shall be effectively plugged with ballast and clayey soil/suitable material.	monitor the slope stability and subsidence of the dump. Latest stability report enclosed as ***Annexure*-II.**
(xvi)	Crushers at the CHP shall be operated with high efficiency bag filters/water sprinkling system shall be provided to check fugitive emissions from crushing operations, conveyor system which shall be closed, haulage roads, transfer points, etc.	Crushers at the CHP, haulage roads, transfer points has been provided with water sprinkling arrangement and conveyor system is closed to check fugitive emissions. Two number of Bag Filters i.e. one bag filter at secondary crusher house and one bag filter at screen house, at CHP have been installed.
(xvii)	Drills shall be wet operated only.	Complied with.
(xviii)	Controlled blasting shall be practiced with use of delay detonators and only during daytime. The mitigative measures for control of ground vibrations and to arrest the fly rocks and boulders shall be implemented.	The controlled blasting is being carried out strictly in accordance with the blasting parameters fixed, pattern established and the precautions suggested by CMRI Dhanbad Engaged as scientific agency and permission under dgms regulation 170 (1B)(a) of CMR 1957.
(xix)	Coal (18,000 TPD) shall be transported from the mine by 7-km long piped conveyors only to the linked power plant located at the distance of 9 km.	Noted.
(xx)	The Washery unit shall be a zero-discharge facility and no wastewater shall be discharged from the washery into the drains/natural watercourses. No groundwater shall be used for washery operations. Recycled water shall be used for development and maintenance of green belt and in the plant operations.	The Coal Washery plant is designed based on zero-discharge concept. Effluent generated from coal washing process is being treated in Thickener and Multi Roll Belt Press filter. The treated wastewater is being reused in the plant operations. Hence zero discharge condition is being maintained all the time. The mine sump water is the source of water for washery operations.
(xxi)	The raw coal, washed coal and middling and coal wastes (rejects) shall be stacked properly at earmarked site(s) within sheds/stockyards fitted with wind breakers/shields. Adequate measures shall be taken to ensure that the stored minerals do not catch fire.	The raw coal from mine is directly fed to crushers and the washed coal is being stored in RCC bunkers for blending and being transported to TPP through pipe conveyor. The coal rejects is being stored in 2x500 Tonne capacity bunkers and is further stored at earmarked site.
(xxii)	The proponent shall maintain proper records of the ash content of raw (ROM) coal, clean coal, middling and coal rejects along with quantum of raw coal obtained and washed and dispatched every month and the same shall be uploaded on the company website every month.	Complied with.

(xxiii)	The entire quantity of clean coal shall be transported by conveyor only to the linked TPP located at a distance of 9km from the mine.	Complied with.
(xxiv)	All internal roads shall be concreted or black topped and the approach roads used for the project shall be blacked topped. Facilities for parking of trucks carrying raw coal from the linked coalmines shall be created within the Unit.	Complied with.
(xxv)	The roads (internal/approach/and roads used for the project) shall be regularly cleaned with mechanical sweepers and with water sprinklers. A 3-tier avenue plantation shall be developed along the major approach roads, internal roads and nearby roads used by the company.	The roads (internal/approach/and roads used for the project) will be regularly cleaned with mechanical sweepers and with water sprinklers. A 3-tier avenue plantation development along the major approach roads, internal roads and nearby roads is in progress.
(xxvi)	Green belt shall be developed along the areas such as the washery unit, crushing unit, and stockyards and at transfer points.	Green belt development along the areas such as the washery unit, crushing unit and at transfer points is in progress. Approx. 16,695 saplings have been planted so far.
(xxvii)	Hoppers of the coal crushing unit at the crushing shed and washery unit shall be fitted with high efficiency bag filters/Dust extractors and mist spray water sprinkling system shall be installed and operated effectively at all times of operation to check fugitive emissions from crushing operations, transfer points of belt conveyor systems which shall be closed and from transportation roads.	Existing water sprinkling system installed at hoppers, crushers, transfer points of belt conveyor systems and transportation roads is of sufficient capacity to check fugitive emissions.2 nos. of Bag Filters i.e. one bag filter at secondary crusher house and one bag filter at screen house, at CHP have been installed.
(xxviii)	The proponent shall ensure that coal rejects of 1.76 MTPA such as stones, shale and other wastes of an ash content of 77% or more only shall be dumped into the mine voids. Coal rejects with an ash content of 76% or less shall be fully utilized in TPP for power generation.	Being complied.
(xxix)	An estimated 3.905 Mm^3 (5.07 MTPA) of fly ash from the power plant to be accommodated in the mine, shall be dumped in the mine void in alternate layers of fly ash and OB in the ratio of 25%:75% as per DGMS approval, after the initial row of OB of not less than 15m thickness to prevent dump failures.	Fly ash is being back filled in mine voids as per DGMS permission and guidelines.
(xxx)	Continuous monitoring of long-term impacts of dumping of flyash (for life of	IIT-Kharagpur has been engaged for monitoring of long-term impacts of dumping of

	the mine) and leaching of heavy metals on soil and water quality of the study area shall be undertaken and the details of which shall be submitted to the Central Ground Water Board, SPCB and to the Regional Office of this Ministry at Bhopal as part of the compliance report. Permanent monitoring arrangements such as peizometers shall be established in and around the mine area covering the potential impact zone for contamination of heavy metals due to leachates from the flyash and in case of increasing levels of heavy metals detected in the groundwater, further dumping of flyash shall be stopped immediately. Independent Third-Party monitoring of the impacts of dumping of flyash shall also be undertaken and reported to the regulatory authorities and uploaded on the company website. In case disposal of flyash into the decoaled voids is not found to be an environmentally suitable option, the balance void shall be backfilled with only OB or converted into a water reservoir of a max. depth of 35m and shall be gently sloped and the upper benches of the reservoir shall be stabilised with plantation and the periphery of the reservoir fenced.	fly ash and leaching of heavy metals on soil and water quality of the study area. There is no sign of increasing levels of heavy metals in the soil/ground water. The reports for the month of January 2014 is submitted to CGWB, Raipur vide letter No. JPL/EMD/F-30/6.25 MTPA/2013/513dated 01/12/2013. The data is being uploaded on the company website. Peizometers have been established in and around the mine area.
(xxxi)	Regular monitoring of groundwater level and quality shall be carried out by establishing a network of existing wells and construction of new peizometers. The monitoring for quantity shall be done four times a year in pre-monsoon (May), monsoon (August), post-monsoon (November) and winter (January) seasons and for quality in May. Data thus collected shall be submitted to the Ministry of Environment & Forests and to the Central Pollution Control Board quarterly within one month of monitoring.	Established a network of existing wells and constructed piezometers for regular monitoring of ground water level and quality. The ground water quality is being monitored on quarterly basis. Data of monitoring of ground water level and quality are submitted to Ministry & its Regional Office, CGWB-Raipur and CECB regularly. The ground/surface water quality & ground water level reports for the month of October, 2013 and March, 2014 are enclosed as **Annexure-III(a) and Annexure-III(b)** respectively.
(xxxii)	As the entire mine water is proposed to be used for the mine-cum-washery operations, 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	Water stored in quarry sump, garland drains and settling ponds are recharging the ground water table. In buffer zone, pond deepening is regularly done to increase storage capacity and to recharge the ground water table. Plan for water conservation and recharge measures of ground water along with

	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 groundwater recharge measures for augmentation of groundwater resource in case monitoring of groundwater levels indicate decline of water table. Any additional water requirement for mining operation shall be met from rainwater use only. The project authorities shall meet water requirement of nearby village(s) in case the village wells go dry due to dewatering of mine. It shall be ensured that if the river/nala discharge of mine water takes place, it shall be treated to conform to prescribed standards before discharge.	budgetary provisions will be prepared and implemented in consultation with the Central/State Ground Water Board. There is no report of decline of water table and drying of village wells. However, to meet the water requirement of the nearby villages, the company has already provided 33 bore wells and 03 hand pumps. Mine seepage water is sufficient to meet the mine-cum-washery operations requirement.
(xxxiii)	ETP shall also be provided for treatment of effluents from workshop, CHP and an STP shall be provided in the colony and the treated effluents shall be used for green belt development. Outflow of rainfall, if any, from the mine shall meet prescribed norms and the water quality of such discharge shall be monitored at the exit points and records maintained thereof and also uploaded on the company website.	Oil & grease trap is provided to treat effluent from workshop and treated effluent is reused for green belt/plantation development and washing of vehicles. Effluent generated in the form of washed off coal particles from different transfer points, conveyors, roads etc. at CHP is collected through interconnecting drains connecting to sump. This fines/slurry finally collected in the settling tank is recovered and fed into the coal feeding system and supernatant water is reused for dust suppression & gardening purposes. The entire CHP is being operated on zero discharge principle. STP is provided at colony and the treated effluent is being used for green belt/plantation development, gardening purpose etc. Runoff is de-silted through a series of check dams and drains to meet prescribed norms.
(xxxiv)	An afforestation plan covering an area not less than 938 ha shall be implemented, which includes backfilled area (833 ha) and are originally covered by ext. OB dump (48.20 ha), along ML boundary, green belt, embankment (30 ha), along roads and infrastructure, undisturbed/vacant land by planting native species such as Sal, Tendu, Mahua, etc in consultation with the local	Being Complied. A total of 1.18 lakh plants have been planted in 20 hectare of reclaimed land in the OB dumps for the year 2013-14. The density of the trees is approx.2500 plants per ha.

	DFO/Agriculture Department/institution with the relevant discipline. The density of the trees shall be around 2500 plants per ha.	
(xxxv)	Backfilling shall start by the 3rd year of operations and completed by 34th year with cessation of opencast operations. Of the total excavated area of 866.25 ha, about 833 ha shall be backfilled and reclaimed with plantation/afforestation by planting native plant species in consultation with the local DFO/Agriculture Department. The density of the tress shall be around 2500 plants per ha. The balance 30m of void shall be left as a water body and the upper benches of the water body shall be gently sloped and stabilized and reclaimed with plantation.	Will be complied.
(xxxvi)	A programme for conservation of the wildlife particularly for the Indian Elephant reported in the study area and for other rare and endangered species/Schedule-I fauna and endangered flora and species of medicinal importance found in the study area shall be formulated and implemented in consultation with the Forest and Wildlife Departments in the State Government. Separate funds shall be earmarked for implementation of the various activities there under and the status thereof shall be regularly reported to this Ministry and the MoEF Regional Office, Bhopal and also uploaded on the company website. The project authorities shall participate in a Regional Action Plan of the State Government for conservation of flora and fauna found within the study area.	There are no rare and endangered species/Schedule-I fauna and flora in the study area. Our JSPL unit had already prepared conservation & Management Plan for flora & fauna in consultation with Forest and Wildlife Departments for their Gare IV/6 coal block. They have earmarked separate funds for implementation of the various activities there under and the status thereof is regularly reported to Ministry and the MoEF Regional Office, Bhopal. Gare IV/6 is just adjacent to our Gare IV/2 & IV/3 coal block and fall within our study area. As study area is overlapping, separate conservation & Management Plan for flora & fauna may not require. However, we will abide by the recommendation given in JSPL's conservation & Management Plan for flora & fauna.
(xxxvii)	Besides carrying out regular periodic health check up of their workers, 10% of the workers identified from workforce engaged in active mining operations shall be subjected to health check up for occupational diseases and hearing impairment, if any, through a recognised agency found in the district, and the results reported to this Ministry and to DGMS.	Phase wise periodical medical examination is being undertaken as per Mine rules. In addition to this all precautionary measures are being taken care of in compliance to health & safety norms. Regular Training Programs related to occupational health & safety is being organised.

(xxxviii)	For monitoring land use pattern and for post mining land use, a time series of landuse maps, based on satellite imagery (on a scale of 1: 5000) of the core zone and buffer zone, from the start of the project until end of mine life shall be prepared once in 3 years (for any one particular season which is consistent in the time series), and the report submitted to MOEF and its Regional office at Bhopal.	Land use land cover pattern monitoring was done based on satellite imagery for the years 2006 & 2010. The land use pattern monitoring of the core zone and buffer zone for the current year i.e. 2013 has been submitted to MoEF and its Regional office vide letter no. JPL/EMD/F-30/6.25MTPA/Feb-14/554 dated 25/02/2014.
(xxxix)	Cost for environmental protection measures shall be not less than Rs 1451.97 lakhs (capital) including Rs 837.81 lakhs for the washery and the annual recurring costs shall not be less than Rs. 442.09 lakhs.	Noted. Will be complied with.
(xxxx)	The activities under CSR shall continue for life of the mine (41 years) and a provision of Rs 5/T of coal or Rs 2.6 crores (whichever is higher) adjusted according to value of the rupee, shall be undertaken for the villages in the study area until end of mine life. Details of village-wise activities under CSR along with the activities and budgetary provision shall be uploaded on the company website and the status of its implementation along with expenditure thereon and also desired that a Third party audit of implementation of CSR shall be done periodically.	The implementation status along with expenditure for the year 2013-14 is enclosed as ***Annexure*-IV.** Third party audit of implementation of CSR will be done periodically. A detail of village-wise activities under CSR along with budgetary provision is being uploaded on the company website.
(xxxxi)	A Final Mine Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment & Forests five year before mine closure for approval. Habitat Restoration Plan of the mine area shall be carried out using a mix of native species found in the original ecosystem, which were conserved in-situ and ex-situ in an identified area within the lease for reintroduction in the mine during mine reclamation and at the post mining stage for habitat restoration.	Noted.
(xxxxii)	Corporate Environment Responsibility: a) The Company shall have a well laid down Environment Policy approved by the Board of Directors.	Complied.

	b) The Environment Policy shall prescribe for standard operating process/procedures to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions.	Complied.
	c) The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions shall be furnished.	Complied.
	d) To have proper checks and balances, the company shall have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large.	Complied.
S.No	**Conditions**	Compliance Status
B.General Conditions		
(i)	No change in mining technology and scope of working shall be made without prior approval of the Ministry of Environment and Forests.	Noted.
(ii)	No change in the calendar plan including excavation, quantum of mineral coal and waste shall be made.	Initially 6.25 MTPA coal production will be obtained from opencast till underground is developed.
(iii)	Four ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for monitoring PM_{10}, $PM_{2.5}$, SO_2 and NO_x. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, in PM10 and PM2.5 etc. shall be carried out at least once in a year.	A total of 8 Nos. ambient air quality monitoring (AAQM) stations have been established (4 in the core zone & 4 in buffer zone) for PM10, PM2.5, SO_2 and NO_X. Locations of the stations are based on the meteorological data, topographical features and environmentally sensitive targets in consultation with Chhattisgarh Environment Conservation Board. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, in PM10 and PM2.5 etc. will be carried out once in a year.
(iv)	Data on ambient air quality (PM_{10}, $PM_{2.5}$, SO_2 and NO_x and heavy metals such as Hg, As, Ni, Cr, etc) and other monitoring data shall be regularly submitted to the Ministry including its Regional Office at Bhopal and to the State Pollution Control Board and the Central Pollution Control	Ambient air quality data is submitting regularly to the Ministry including its Regional office, SPCB and CPCB once in 6 months. Ambient air quality report for the period from the period from October, 2013 to March, 2014 is enclosed as **Annexure- V.**

	Board once in six months. Random verification of samples through analysis from independent laboratories recognised under the EP Rules, 1986 shall be furnished as part of the compliance report.	
(v)	Fugitive dust emissions (PM10, PM2.5, and heavy metals such as Hg, Pb, Cr, As, etc) from all the sources shall be controlled regularly monitored and data recorded properly. Water spraying arrangement on haul roads, wagon loading, dump trucks (loading and unloading) points shall be provided and properly maintained.	Fugitive dust emissions will be monitored and data will be recorded properly. 10 Nos.of water tankers of 15-20KL capacity have been deployed to control fugitive dust emissions from haul roads and water spraying arrangement has been made at loading & unloading points.
(vi)	Adequate measures shall be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with ear plugs/muffs.	Delays, Relays, NONEL etc. are used for control of noise levels in the work environment. Ear muffs / earplugs have been provided to the workers engaged in blasting and drilling operations, operation of HEMM etc. Noise monitoring report for the period from the period from October, 2013 to March, 2014 is enclosed as **Annexure-VI.**
(vii)	Industrial wastewater (workshop and wastewater from the mine) shall be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19th May 1993 and 31st December 1993 or as amended from time to time before discharge. Oil and grease trap shall be installed before discharge of workshop effluents.	Oil & grease trap is provided to treat effluent from workshop. Siltation ponds and garland drains of appropriate size along the periphery of OB dump have been constructed to arrest any soil erosion. Runoff is de-silted through a series of check dams and drains.
(viii)	Vehicular emissions shall be kept under control and regularly monitored.	Will be complied with.
(ix)	Environmental laboratory shall be established with adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board.	An environmental laboratory has been established with adequate number and type (for air, noise, water etc.) of pollution monitoring and analysis equipment. The monitoring data generated from lab are being submitted to the Chhattisgarh Environment Conservation Board regularly.
(x)	Personnel working in dusty areas shall wear protective respiratory devices and they shall also be provided with adequate training and information on safety and health aspects. Occupational health surveillance programme of the workers shall be undertaken periodically to observe any contractions due to exposure to dust and to take corrective	Personnel working in the mining area are provided with nose masks, ear muffs/plugs, helmets, goggles, safety shoes, hand gloves etc. Periodical medical examination is being undertaken as per Mine rules. In addition to this, all precautionary measures are being taken in compliance to health & safety norms. Regular Training Programs related to occupational health & safety are being

	measures, if needed.	organised. Occupational health surveillance program is conducted periodically & corrective measures are taken accordingly.
(xi)	A separate environmental management cell with suitable qualified personnel shall be set up under the control of a Senior Executive, who will report directly to the Head of the company.	An Environment Management Department (EMD) is already established to carry out function relating to environmental management. The department is headed by Sr. DGM- EMD who report directly to the head of the company.
(xii)	The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to this Ministry and its Regional Office at Bhopal.	Will be complied with.
(xiii)	The Regional Office of this Ministry located at Bhopal shall monitor compliance of the stipulated conditions. The Project authorities shall extend full cooperation to the office(s) of the Regional Office by furnishing the requisite data/ information/monitoring reports.	Noted.
(xiv)	A copy of the will be marked to concerned Panchayat/ local NGO, if any, from whom any suggestion/representation has been received while processing the proposal.	A copy of the clearance letter has already been marked to concerned Libra & Gare Panchayats and local NGO vide letters dated 18/06/2012. The copies are already submitted to Regional Office of Ministry vide letter No.JPL/EMD/Gare IV/2 &IV/3/2012/356 dated 1/12/2012.
(xv)	State Pollution Control Board shall display a copy of the clearance letter at the Regional Office, District Industry Centre and Collector's Office/Tehsildar's Office for 30 days.	Not Applicable to JPL
(xvi)	The Project authorities shall advertise at least in two local newspapers widely circulated around the project, one of which shall be in the vernacular language of the locality concerned within seven days of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution control Board and may also be seen at the website of the ministry of Environment & Forests at http://envfor.nic.in. The compliance status shall also be uploaded by the	The information regarding grant of Environmental Clearance is already advertised in two local newspapers (Kelo Pravah in vernacular language and Nava Bharat in English) on 18.06.2012 & 17.06.2012 respectively. The copies of advertisements are already submitted to Regional Office of Ministry vide letter No.JPL/EMD/Gare IV/2 & IV/3/2012/356 dated 1/12/2012.The compliance status is being regularly uploaded on website of JPL. Data will be displayed at the entrance of the mine office.

	project authorities in their website and regularly updated at least once in six months so as to bring the same in the public domain. The data shall also be displayed at the entrance of the project premises and mines office and in corporate office.	
3.	The Ministry or any other competent authority may stipulate any further condition for environmental protection.	Noted.
4.	Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract the provisions of the Environment (Protection) Act, 1986.	Noted.
5.	The above conditions will be enforced inter- alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and Rules. The proponent shall ensure to undertake and provide for the costs incurred for taking up remedial measures in case of soil contamination, contamination of groundwater and surface water, and occupational and other diseases due to the mining operations.	There is no soil, ground/surface water contamination and occupational and other diseases due to the mining operations.

Annexure-I

DEPARTMENT OF MINING ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY- KHARAGPUR

ANALYSIS RESULTS

Report Number7/05-2014

Sample Location: Bendra Nallah Upstream
Sample Particulars: Surface Water
Date of Sampling: 12th January , 2014

Sl. No	Parameters	Unit	Result	Permissible limit of ef luent discharge for inland surface water as per GSR
1.	pH	-	7.2	5.5 to 9.0
2.	TSS	mg/l	42	100
3.	COD	mg/l	22.5	250
4.	BOD (3 days at 27°C)	mg/l	5.7	30
5.	Oil & Grease	mg/l	0.50	10
6.	Zinc (Zn)	mg/l	ND	5.0
7.	Copper (Cu)	mg/l	ND	3.0
8.	Manganese (Mn)	mg/l	ND	2.0
9.	Lead (Pb)	mg/l	ND	0.1
10	Iron (Fe)	mg/l	0.08	3.0
11.	Cadmium (Cd)	mg/l	ND	2.0
12.	Nickel (Ni)	mg/l	ND	3.0
13.	Arsenic (As)	mg/l	ND	0.2
14.	Mercury (Hg)	mg/l	ND	0.01

I.I.T-KGP

S. Chakraborty

एस चक्रवर्ती
Associate Professor
सहायक अधिवेशिकी विभाग
Deptt. of Mining Engineering
भा.प्रौ.सं. खड़गपुर/I.I.T. Kharagpur

B. Samanta

एस समन्ता
Associate Professor
सहायक अधिवेशिकी विभाग
Deptt. of Mining Engineering
भा.प्रौ.सं. खड़गपुर/I.I.T. Kharagpur

DEPARTMENT OF MINING ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY- KHARAGPUR

ANALYSIS RESULTS

Report Number8/05-2014

Sample Location: Bendra Nallah Downstream
Sample Particulars: Surface Water
Date of Sampling: 12th January, 2014

Sl. No	Parameters	Unit	Result	Permissible limit of ef luent discharge for inland surface water as per GSR
1.	pH	-	7.18	5.5 to 9.0
2.	TSS	mg/l	46	100
3.	COD	mg/l	26.0	250
4.	BOD (3 days at 27°C)	mg/l	5.9	30
5.	Oil & Grease	mg/l	0.50	10
6.	Zinc (Zn)	mg/l	ND	5.0
7.	Copper (Cu)	mg/l	ND	3.0
8.	Manganese (Mn)	mg/l	ND	2.0
9.	Lead (Pb)	mg/l	ND	0.1
10	Iron (Fe)	mg/l	0.08	3.0
11.	Cadmium (Cd)	mg/l	ND	2.0
12.	Nickel (Ni)	mg/l	ND	3.0
13.	Arsenic (As)	mg/l	ND	0.2
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सह आचार्य
Associate Professor
खनन अभियांत्रिकी विभाग
Deptt. of Mining Engineering
भा.प्रौ.सं. खड़गपुर/I.I.T. Kharagpur

सह आचार्य
Associate Professor
खनन अभियांत्रिकी विभाग
Deptt. of Mining Engineering
भा.प्रौ.सं. खड़गपुर/I.I.T. Kharagpur

I.I.T-KGP

DEPARTMENT OF MINING ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY- KHARAGPUR

ANALYSIS RESULTS

Report Number9/05-2014

Sample Location: Kelo River Upstream
Sample Particulars: Surface Water
Date of Sampling: 12th January , 2014

Sl. No	Parameters	Unit	Result	Permissible limit of ef luent discharge for inland surface water as per GSR
1.	pH	-	7.0	5.5 to 9.0
2.	TSS	mg/l	46	100
3.	COD	mg/l	23.1	250
4.	BOD (3 days at 27°C)	mg/l	5.1	30
5.	Oil & Grease	mg/l	0.50	10
6.	Zinc (Zn)	mg/l	ND	5.0
7.	Copper (Cu)	mg/l	ND	3.0
8.	Manganese (Mn)	mg/l	ND	2.0
9.	Lead (Pb)	mg/l	ND	0.1
10	Iron (Fe)	mg/l	0.12	3.0
11.	Cadmium (Cd)	mg/l	ND	2.0
12.	Nickel (Ni)	mg/l	ND	3.0
13.	Arsenic (As)	mg/l	ND	0.2
14.	Mercury (Hg)	mg/l	ND	0.01

I.I.T-KGP

Chakraborty

एसो.आचार्य
Associate Professor
खनन अभियांत्रिकी विभाग
Deptt. of Mining Engineering
भा.प्रौ.सं. खड़गपुर/I.I.T. Kharagpur

S. Samanta

एसो.आचार्य
Associate Professor
खनन अभियांत्रिकी विभाग
Deptt. of Mining Engineering
भा.प्रौ.सं. खड़गपुर/I.I.T. Kharagpur

DEPARTMENT OF MINING ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY- KHARAGPUR

ANALYSIS RESULTS

Report Number10/05-2014

Sample Location: Kelo River Downstream
Sample Particulars: Surface Water
Date of Sampling: 12th January , 2014

Sl. No	Parameters	Unit	Result	Permissible limit of ef luent discharge for inland surface water as per GSR
1.	pH	-	7.0	5.5 to 9.0
2.	TSS	mg/l	44	100
3.	COD	mg/l	23.8	250
4.	BOD (3 days at 27°C)	mg/l	5.2	30
5.	Oil & Grease	mg/l	0.50	10
6.	Zinc (Zn)	mg/l	ND	5.0
7.	Copper (Cu)	mg/l	ND	3.0
8.	Manganese (Mn)	mg/l	ND	2.0
9.	Lead (Pb)	mg/l	ND	0.1
10	Iron (Fe)	mg/l	0.10	3.0
11.	Cadmium (Cd)	mg/l	ND	2.0
12.	Nickel (Ni)	mg/l	ND	3.0
13.	Arsenic (As)	mg/l	ND	0.2
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I.I.T-KGP

Chakraborty

सह प्राध्यापक
Associate Professor
खनन अभियांत्रिकी विभाग
Deptt. of Mining Engineering
भा.प्रौ.सं. खड़गपुर/I.I.T. Kharagpur

S. Sarkar

सह प्राध्यापक
Associate Professor
खनन अभियांत्रिकी विभाग
Deptt. of Mining Engineering
भा.प्रौ.सं. खड़गपुर/I.I.T. Kharagpur

Annexure-II

FINAL REPORT

ON

FIELD MONITORING OF STABILITY OF DUMP WITH 25% FLY ASH AND 75% OVERBURDEN MATERIALS RELATED TO JPOCCM MINE, JPL

Dr Singam Jayanthu, Professor
DEPARTMENT OF MINING ENGINEERING
Mrs.Simantini Behera , Asst. Professor
DEPARTMENT OF CIVILENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY
ROURKELA-769008, ODISHA.
PABX: 0661-2465999, FAX: 0661-2462601
Website-www.nitrkl.ac.in. *Ph: 0661-2462611(Dept) 3611 (Res)-9938303259*

FEBRUARY , 2014

INVESTIGATION STATEMENT

The scientific work documented in this report titled **"Field monitoring of Stability of dump with 25% fly ash and 75% overburden materials related to JPOCCM mine, JPL"** was carried out by the National Institute of Technology –Rourkela at the request of Jindal Power Open Cast Coal Mine, Tamnar, Raigarh.

This report is classified as confidential and is meant for the internal use of the organization to which it is submitted. This report, in full or in part thereof, can neither be quoted nor published anywhere by anybody other than the investigators. It should not be communicated / circulated to other agencies other than the concerned government departments. National Institute of Technology - Rourkela reserves the right to publish the results of the present study.

Dr. SINGAM JAYANTHU
(Principal Investigator)

FIELD MONITORING OF STABILITY OF DUMP WITH 25% FLY ASH AND 75% OVERBURDEN MATERIALS RELATED TO JPOCCM MINE, JPL

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FIELD MONITORING OF STABILITY OF DUMP WITH 25% FLY ASH AND 75% OVERBURDEN MATERIALS RELATED TO JPOCCM MINE, JPL

1. INTRODUCTION

Jindal Power Open Cast Coal Mine is captive mine of Jindal's 1000 MW (4 x 250 MW) thermal power plant. The block is located between Longitudes - 83°29'40" to 83°32'32" (E) and Latitude - 22°09'15" to 22°05'44" (N) falling in the topo sheet number 64 N/12 (Survey of India). Administratively, the block is under TamnarTahsil of Raigarh District, Chhattisgarh. The block is well connected by Road. It is about 60 km from Raigarh town, which is district head quarter and nearest railway station on Mumbai - Howrah Main Line.

Management of Jindal power opencast coal Mine-Tamnar, Raigarh, proposed to conduct scientific studies for the assessment of overburden dump slope stability using fly ash. As part of the studies, NIT-Rourkela conducted field investigations, and laboratory studies were carried out at Geotechnical Laboratory of NIT-Rourkela. Based on the various physico-mechanical properties and the field studies, empirical models and numerical modeling studies were conducted for the stability of dump slope. Now, M/s JPL wanted to conduct scientific study on field Monitoring of Slope Stability in the fly ash dump area of the mine. The ground movement monitoring for understanding stability of dump slope in the mine site was carried out with the help of the Total Station, and final results of field monitoring during 2012 - 2013 are presented in this report.

2. GEOMINING CONDITION

In general, area of the coal block - Jindal Power Open Cast Coal Mine is almost flat with small undulations from surface. The lithological section comprises about 3-4 m unconsolidated loose soil/alluvium. Below the top soil there is weathered shale/sandstone up to 6–8 m depth. The weathered shale and sandstone are comparatively loose in nature and can be excavated without blasting. Below weathered zone (which varies from 3 – 10 m), the rock is hard, compact and massive in nature and can be excavated only after blasting. Thus the average depth of the excavation of these excavations, which can be removed, is about 16 m.

In the sub-block IV/2 & IV/3 only lower groups of Gondwana sediments have been deposited. Strata are gently dipping by 2 to 5° southwesterly. The general strike of the sediments is in NW-SE, and almost uniform throughout the block. Two normal faults of small magnitude have been deciphered based on the level difference of the floor of the seams, though the presence of some minor faults of less than 5 m throw cannot be overruled.

The MandRaigarh basin is a part of IB River - Mand - Korba master basin lying within the Mahanadigraben. The sub-block IV/2 & IV/3 of Gare-Pelma area is structurally undisturbed except one small fault (throw 0-15 m) trending NE-SW with westerly throws. The strike of the bed is NW-SE in general with dip varies from 2° to 6° southwesterly. The strata shows rolling dip. In the sub block IV/2 & IV/3 total 10 number of persistent coal seams have been established. They are seam X to I in descending order. Seam I is impersistent due to metamorphism in the central and eastern part of the block. The lithology of the seams is given in Table 1 and bore hole section at Figure 1.

Table 1: Lithology of the seams

Seam No /Parting	Thickness range(m)	Lithology
X&XA	2-3	Coal,Shaly coal & carbonaceous shale
Parting	38-52	Fine to coarse grain sandstone with shale and shaly coal band.
IX	4-4.5	Parting

Parting	4-6	Fine to medium sandstone with shale band
VIII	4-4.5	Coal,Shaly coal & carbonaceous shale band
Parting	6-9	Fine to medium sandstone with shale band
VII	5-5.5	Coal, Shaly coal & carbonaceous shale with grey shale band

Depth of mine working is about 36 m with six benches of 6 m height. Ultimate depth of the mine would be about 120 m from RL of 271 to 151 m. Back hoe in combination of dumper with 6 m bench height is adopted for excavation in the mine. It is also proposed to have 6 m height benches at the time of formation of ultimate pit slope. Mine plan and typical cross section of the mine is presented in Fig 1a, and 1 b, respectively. The overburden dump was formed with admixture of Fly ash and OB material as internal dump as back filling and the present practice is limited to 90 m height with 3 decks of 30 m each. These dumps are covered with top soil for further plantation and stabilization. The details of the joints observed in various coal seams are presented in Table 2. Bore hole section is shown in Figure 1c. The plan of the mine area is shown in Figure 1 and the section along 7-7' is shown in Figure 2

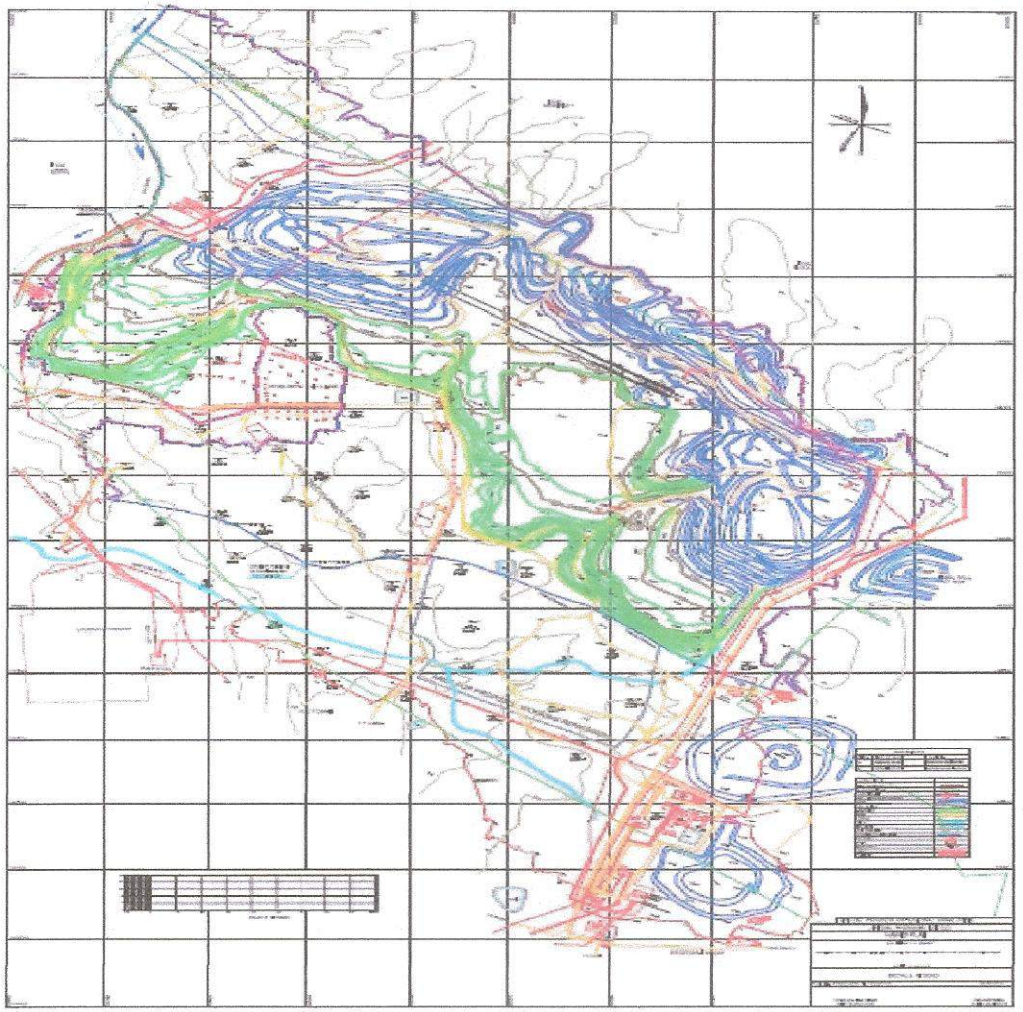

Fig. 1a: Plan of the Jindal Opencast Coal Mine, Dongamauha, Raigarh

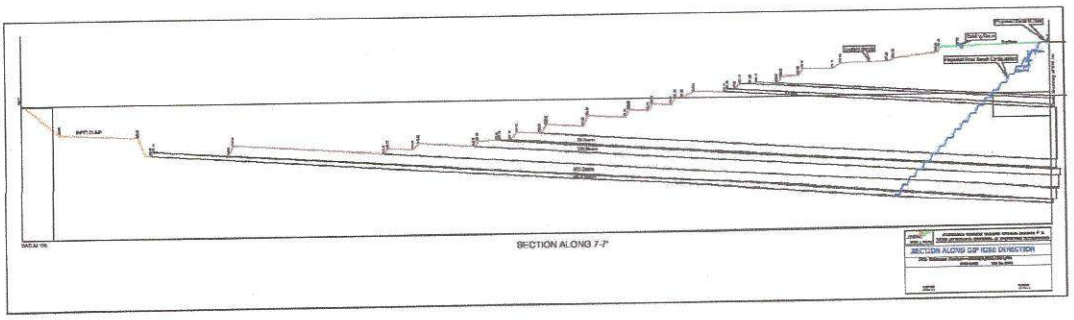

Fig. 1b: Typical cross section A-A of the mine

Table 2: The details of the joints observed in various Coal seams at JPL Mine

Seam	Particulars
Seam VII:	1. Spacing of joint - 90 cm. 2. Joint direction 220-310 ^{0}. 3. Dip of joint 70 ^{0}.
Parting:	1. It is marked by vertical joints every 1m of dip 5-9 2. The maximum joint spacing here is 23cm.
Seam VIII:	1. Joint Spacing – 89 cm 2. Joint dip – 93^0. 3. Strike 135 ^{0} SE 4. Dip of seam is 5-9 ^{0}.
Parting:	1. Dip amount 5^0. 2. Joint direction 210- 260^0 3. Joint dip amount – 70^0.
IX Seam:	1. Strike 170^0. 2. Joint Orientation – 85^0. 3. Joint dip - 162^0.
IX A Seam:	1. Joint Spacing – 4 m approx. 2. Bench slope angle – around 70^0. 3. Every 1 meter has 7 joints 4. One dip side joint (4 joints /meter) 5. One strike side joint (5 - 7 joints / meter)

Ultimate depth of the mine would be about 120 m from RL of 271 to 151 m. Back hoe in combination of dumper with 6 m bench height is adopted for excavation in the mine. It is also proposed to have 6 m height benches at the time of formation of ultimate pit slope.

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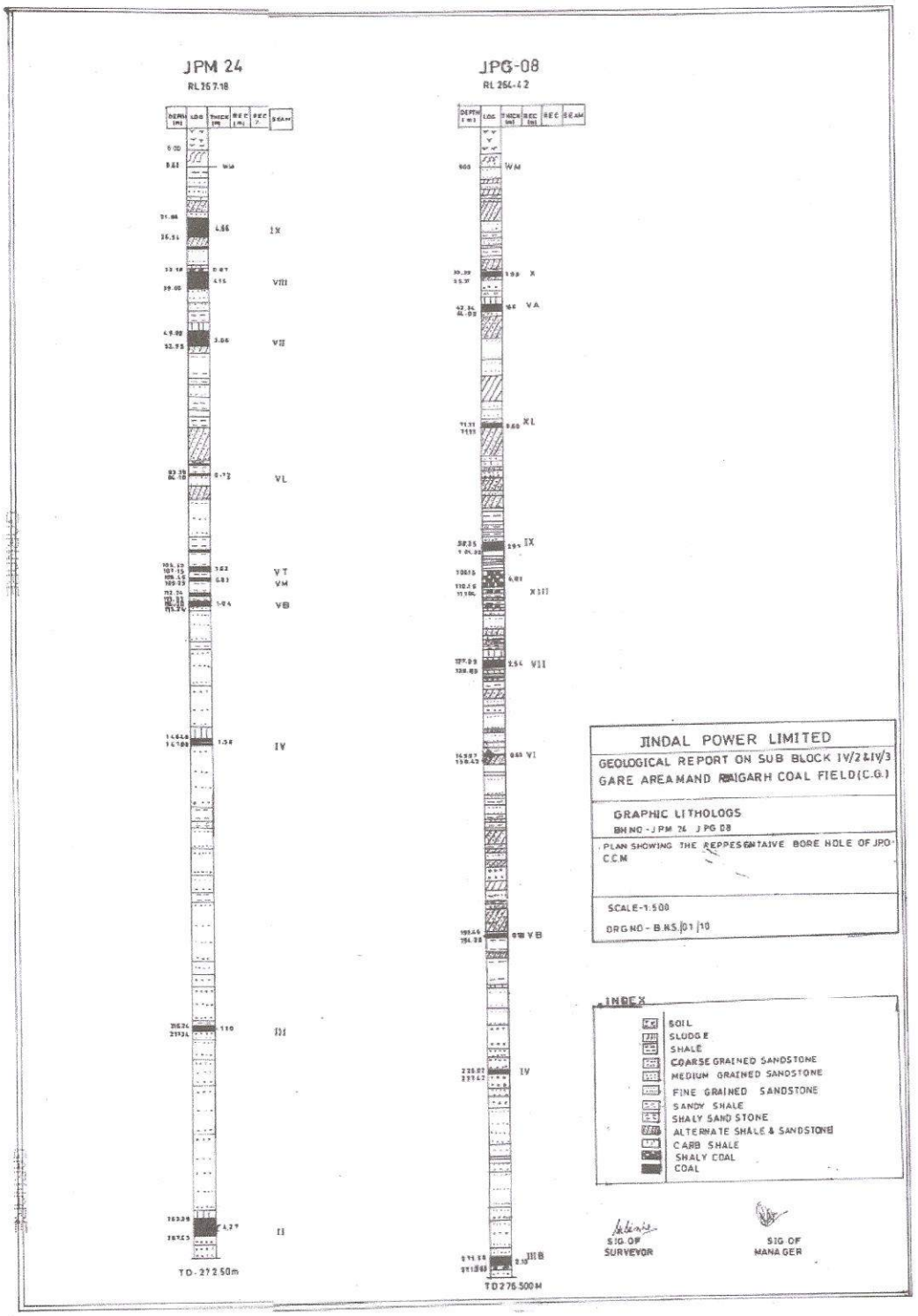

Fig. 1c: Bore hole section at Jindal Opencast Mine, Tamnar

Bench parameters being followed at present are s follows:

Bench height	= 6 m
Numbers of working benches	= 6
Width of the bench	= 20 m
Gradient of the ramp	= 1 in 16

3. PHYSICO-MECHANICAL PROPERTIES

Physio-mechanical properties (Uniaxial Compressive Strength and Density), of the Bore hole # 32 and 44 are presented in the Table 3. Strata overlying seam IX consists of Alternative bands of fine grained sandstone and shale with compressive strength of about 14 MPa. Density of the coal in the seams IX, VIII, VII are in the range of 1.340-1.43, I.41 -1.63, and 1.57-1.67 g/cc respectively. Shear Strength Parameters; Cohesion, C t/m^2, and Angle of internal friction Φ are in the range of 0.2 to 0.7 and 35 to 38 degrees, respectively.

Table 3: Physio-mechanical properties of various strata in Bore hole No- 32 and 44

Zone		Depth(M)		Litho Type	Density gm/cc	Uniaxial Compressive Strength (MPa)
		From	To			
Bore Hole No.-44						
	11	9.0	17.76	FG.SST TO SST		14.03
	22	17.76	29.73	ALT. BANDS OF SH. & SST		27.21
	33	29.73	43.35	ALT. BANDS OF SH. & SST		36.75
SEAM IX	44	43.35	49.70	COAL	1.43	38.29
PARTING	55	49.70	50.87	FG.SST TO MG. SST		20.51
SEAMVIII	66	50.87	56.68	COAL	1.63	34.3
PARTING	77	56.68	61.97	ALT. BANDS OF SH. & SST		30.31
SEAMVII	88	61.97	73.60	COAL	1.67	42.22
	99	73.60	80.75	SHALE/FG. TO CG. SST		33.92
Bore Hole No.-32						
	11	9.00	23.42	ALT. BANDS OF SH. & SST		21.63
	22	23.42	30.94	SHALE/SANDY SHALE		38.64
	33	30.94	40.84	ALT. BANDS OF SH. & SST		36.26
	44	40.84	49.32	ALT. BANDS OF SH. & SST		26.01
SEAM IX	55	49.32	53.37	COAL	1.34	24.35
PARTING	66	53.37	55.16	FG.SST.		32.27
SEAM IXA	77	55.16	57.17	COAL	1.41	28.41

SEAM VIII	88	57.17	67.05	SH./CARB.SH./ SH.COAL		37.97
PARTING	99	67.05	74.42	FG.SST TO MG. SST		31.36
	110	74.42	78.45	ALT. BANDS OF SH. & SST		25.67
SAEM VII	111	78.45	84.43	COAL(SEAM VII)	1.57	41.62
	112	84.43	88.00	FG.SST TO MG. SST		18.39

4. METHODOLOGY FOR DUMPING OF FLY ASH

It was proposed earlier to have internal overburden dumps of maximum height of 30 m in each individual deck with four decks up to 120 m overall dump height. Presently overburden dump height is about 72 m with a maximum deck height up to 25 m in this mine. These dumps and slopes are observed to be stable at present. Stability analyses for the proposed dumps were undertaken using various techniques for the maximum dump height of 120 m, which is the ultimate depth of the mine. Ground Water level conditions are below the 13 m from the surface and benches are generally dry. Jindal Power Limited, Tamnar has already have captive thermal power plants of 1000 MW and generating fly ash, a solid coal combustion residue form due to the burning of coal, of nearly 16000 tons per day. Therefore, quantity of fly ash generated requires large area for its dumping. In last two decade it was realized that fly ash is no more a waste. Its utilization has increased by several folds, and particularly in mining industries.

Fly ash is being used at JPL along with overburden material for backfilling in the mine as per the DGMS guide line. The following methodology was adopted for the dumping process:

Section of the dumping of fly ash at Jindal Power Open Cast Coal Mine, Tamnar is shown in Figure 1d. Initially a row of overburden was dumped forming an embankment with a width of greater than 15 m and height up to 5 m all around the proposed area for fly ash dump. A number of such areas were formed in a layer wherein the fly ash was dumped so that each dump of fly ash was separated by another overburden dump of 15 m wide in order to control the airborne quality of the fly ash. Fly ash was dumped within this area surrounded by overburden in alternate layers of height not exceeding 5 m in each layer. Therefore, each layer of overburden was followed by a layer of mixture of fly ash and overburden (fly ash 25%) and so on up to the height of 30 m .

The side of the overburden dump is benched and the angle of slope is about 28°. Dump is compacted; width of the dump is about 40 m and the overall slope is about 21° from the horizontal. The toe of the dump is protected by putting the compact rocks (Overburden material) in order to restrict the possibility of any failure in future. Fig 2a to 2d illustrates dumping of fly ash through truck in the dump, sprinkling of water in the dump area, dozing of flay ash and OB material at the dump site, top soil on the dump area respectively. Fig 3 shows Plantation over Top soil on the dump area.

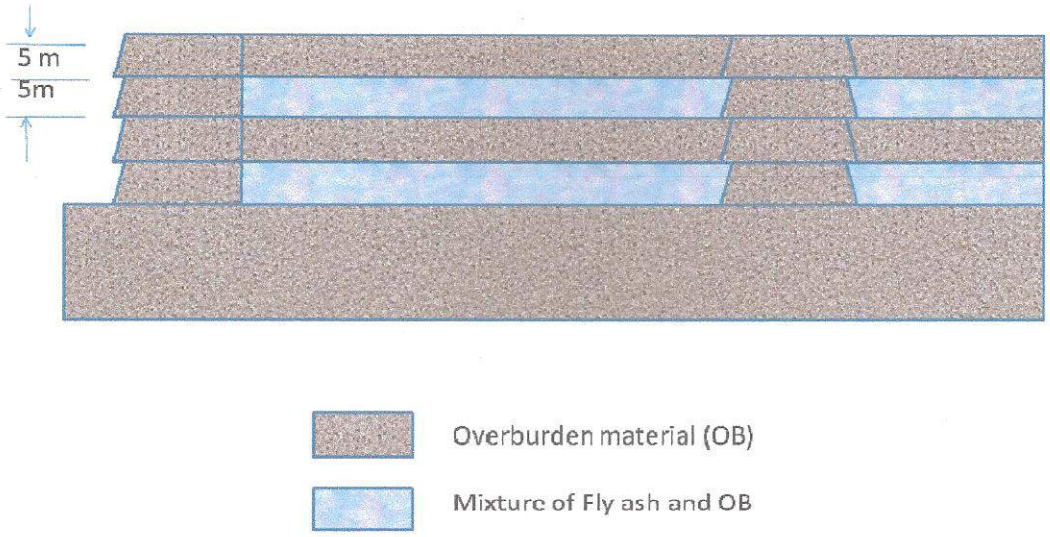

Fig.1d: Section of the dump

Fig. 2a: Dumping of fly ash through truck in the dump

Fig. 2b: Sprinkling of water in the dump area

Fig. 2c: Dozing of flay ash and OB material at the dump site

Fig. 2d: Top soil on the dump area

Fig. 3: Plantation over Top soil on the dump area

4. EXPERIMENTAL INVESTIGATION

Various samples of overburden, soil and fly ash from the dump site were supplied by the Jindal Power Limited for finding out various geotechnical properties through the laboratory study. Different geotechnical tests were conducted for the overburden and the fly ash samples collected from the site. Laboratory geotechnical investigation was carried out for determination of grain size distribution, specific gravity, compaction characteristics (optimum moisture content and maximum dry density), and shear strength characteristics following Bureau of Indian standard (BIS) methods. The parameters like density, and shear parameters cohesion (*C*) and angle of internal friction (_) (angle of repose) are determined for both overburden and fly ash to analyze stability of dumped slope. Fig 4 shows the process of collection of field sample for testing of PhysicomechanicalProperties of dump material

Fig. 4: Collection of field sample for testing of Physico mechanical Properties of dump material

The typical grain size distribution of the overburden and fly ash is shown in Figure 5. The particle size of the overburden ranges between gravel, sand and silt. However, the grain size distribution of fly ash and most of the fly ash corresponds to the silt size. The specific gravity of the fly ash found to be very low (average value of 2.15) in comparison to specific gravity of over burden as 2.79. This low specific gravity of fly ash reduces the total weight of the dumped slope and may help in increasing the stability of the dumped slope.

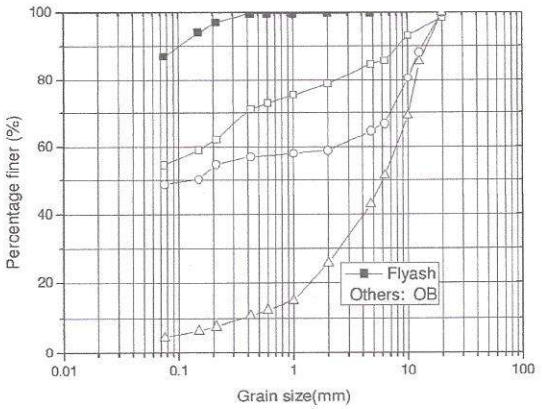

Fig. 5: Grain size distribution of typical overburden (OB) and fly ash

From the results of the laboratory compaction characteristics of the fly ash, it was observed that the optimum moisture content (OMC) was found to be 22.9% and maximum dry density (MDD) as 1.27 gm/cc. The MDD of the overburden is 1.87 gm/cc and OMC is 11.4%. The compaction characteristic of overburden with 25% fly ash is shown in Figure 6. It was observed that the OMC is 12.85% and MDD found to 1.74 gm/cc for the mixture. This reduction in MDD is due to low MDD of fly ash. One-way this also helps in reducing the self weight (driving force) of the slope.

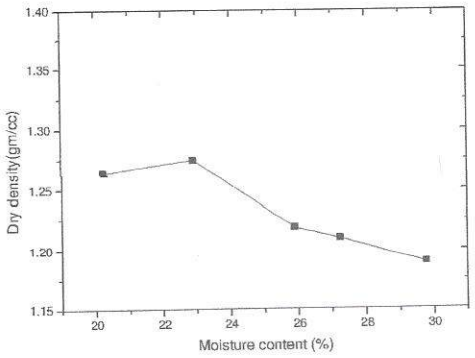

Fig. 6: Compaction characteristics of mixture of overburden and fly ash (25%)

The shear strength characteristics of mixture of fly ash with overburden are shown in Figures 7. The shear parameters of the overburden and fly ash are also shown in Table 4. These properties are used for the stability analysis of dumped slope as described below.

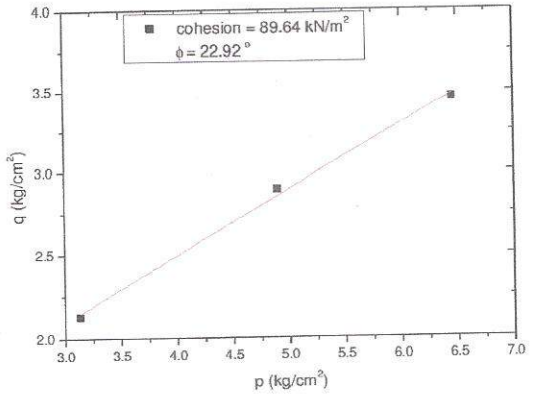

Fig. 7: Triaxial test results for overburden and 25% fly ash

Table 4: Shear parameters for the overburden, soil and mixture of fly ash and OB

Sample type	Cohesion (kN/m^2)	Angle of internal friction(Φ), Degree
Overburden	41.8	28.5
Fly ash + OB	89.6	22.9
Soil	78.2	20.5

5. SLOPE STABILITY ANALYSIS

The stability of dumped slope is analyzed by PLAXIS software, Version 9 using the above geotechnical parameters. PLAXIS is a finite element program for geotechnical applications in which Mohr- Coulomb models are used to simulate the behavior of dump material. Its implementation consists of three stages, known as input stage, calculation stage and post processing (curves) stage. Input stage contains model design, assigning the material parameters, boundary conditions, loading and meshing. In the present analysis 15-node triangular element is considered for meshing which contains 12 stress points. In PLAXIS, stresses and strains are calculated at individual Gaussian integration points rather than at nodes. In the

calculation stage, analysis type is chosen such as Plastic, dynamic, consolidation and phi-c reduction. The assigned loads are activated in this stage and analyzed. In the post processing stage, curves are plotted between various calculated parameters such as load Vs displacement. In PLAXIS *Phi-c reduction* method is used to compute factor of safety (FOS) for dump slope stability. The total multiplier Σ*Msf is* used to define the value of the dump material strength parameters at a given stage in the analysis.

$$\sum \text{Msf} = \frac{tan\Phi}{tan\Phi_r} = \frac{c}{c_r}$$

The safety factor is then defined as the value of $\sum M_{sf}$ at failure, provided that at failure more or less constant value is obtained for a number of successive load steps. Different trials were made with overburden and mixture of overburden and fly ash with overall slope angle of 27^0.

The trial -1 was made with the overburden and mixture of over burden with 25% fly ash. The Factor of Safety obtained was 1.75, and as it is much higher than 1.2, this overburden does satisfy the minimum requirement and can be used along with the fly ash. The trial-2 was made for the dump prepared by alternate layer of overburden and mixture of overburden and 25% fly ash along with the incorporation of top soil of nearly 2 meter thickness at the top of the dump for the reclamation purpose. The results on variation of shear stress in the dump slope as per PLAXIS (Brinkgreve, and. Swolfs, 2011) analysis are shown in Figure 8.

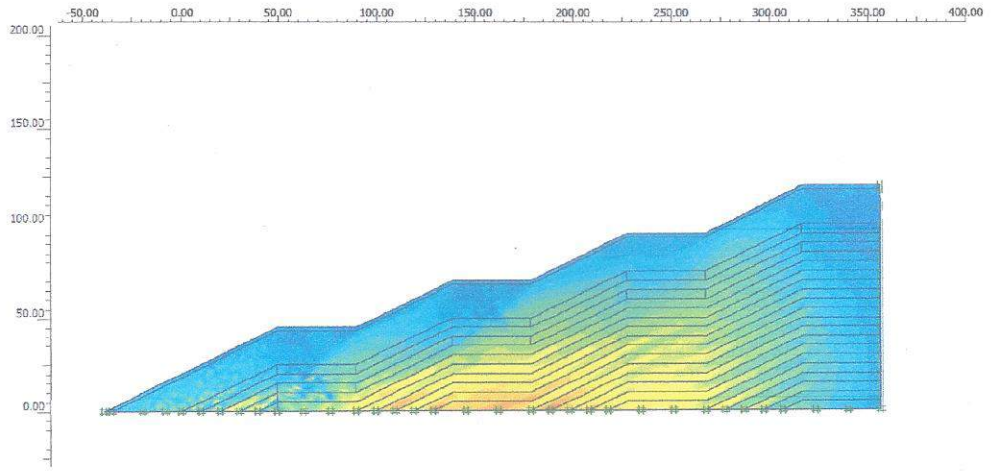

Fig. 8: Variation of shear stress in the dump slope as per PLAXIS analysis for Trial 2

The Factor of Safety obtained was 1.78, and as it is more than 1.2. This indicates that at the end the dump after dozing of top soil, the dump satisfies the minimum requirement and can be used. However, top soil should be protected against rainfall by taking measures like plantation, geosynthetics, or jute/coir reinforcement. The compaction control may be periodically checked for proper compaction of overburden and fly ash mixture.

Slope stability of the overburden dump after mixing of fly ash, it was observed that on the application of 25% fly ash mixture safety factor has increased to 1.78, which was only 1.32 with 8% fly ash mixture with overburden. This increase may be attributed to the increase in cohesion of the mixture due to self-cementing properties of fly ash generated from the combustion of sub-bituminous coal. In presence of water, the fly ash will harden and get strength over time.

Generally, Stability of the slopes is evaluated from empirical, analytical and numerical techniques. In homogenous, isotropic ground conditions, the factor of safety can be determined for predefined failure modes using limit equilibrium method. Some design charts are available, which are useful to analyze only

simple types of predetermined failures, but not for determining the slope angle which depends on the rock mass stability, particularly the unfavorable joints. If the factor of safety for the slope under analysis was above 1.2, then it was considered stable, and if it was less than 1.2, then the slope was considered to be potential hazardous horizon. Over design of slopes are not only uneconomic but also generate more waste. In view of conservation of the deposit it is necessary to design the slopes utilizing the geotechnical considerations.

The limit equilibrium analysis for slope stability estimates the factor of safety against shear failure along a predetermined surface. Factor of safety is the ratio of stabilizing forces and destabilizing forces existing on the failure surface under study. Various methods including numerical modeling, kinematic analysis etc were used by different investigators for understanding the stability of slopes in opencast mines (Jayanthu et a, 2002, 2011) The shear strength is mobilized to resist the shearing stress caused by the gravitational forces. Analysis was also conducted using two more software's FLAC-SLOPE (2005) and OASYS (2013). Fig 9, and Fig 10 presents stability analysis with Bench angle of 32 degrees and 28 degree, respectively for the alternate layers of OB and admixture of OB + Fly ash with safety factor exceeding 2 supporting the stability of dump using Bishops method in OASYS software. Fig 11, and Fig 12 presents stability analysis with Bench angle of 32 degrees and 28 degree, respectively for the alternate layers of OB and admixture of OB + Fly ash with safety factor of 2.15, and 1.96, respectively supporting the stability of dump using Bishops method in FLAC-SLOPE software.

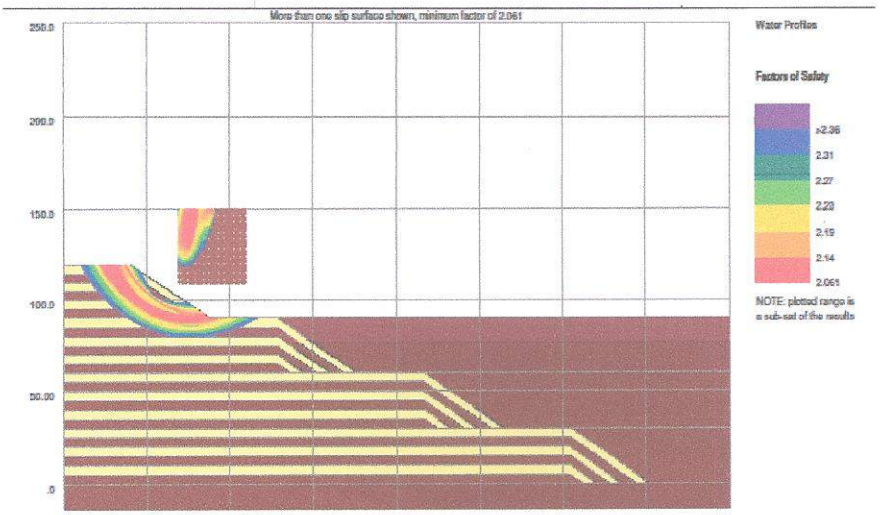

Fig. 9: Slope stability analysis (Alternate layers of OB and OB+flyash) with Bench angle 32 degrees, using OASYS software

Based on the laboratory investigation and slope stability analysis, following recommendations were made: It is observed that dumps with alternative layer of overburden and admixture of overburden mixed with fly ash (only 25%) are found to be stable with safety factor more than 1.2 for the following geometry of the dump:

- Total height of the dump: 120 m
- Number of decks: 4
- Height of individual deck: 30 m
- Slope of each deck: 32°

Beside the dump form with alternate layer of overburden and mixture of fly ash and overburden after dozing the top soil of nearly 2 m thick at the top, the slope also found stable with safety factor 1.78 for the above geometry. For the long term stability of the slope following suggestions are made:

- Top soil should be protected against rainfall by taking measures like plantation, geosynthetics, or jute/coir reinforcement.
- The compaction control should be periodically checked for proper compaction of overburden and fly ash mixture.
- As it was observed rainfall intensity is high during monsoon/cyclone, so gully drains may be provided along the slope at regular intervals.
- Toe walls and peripherals drains may be required after observation of the dump slope during heavy rainfall.

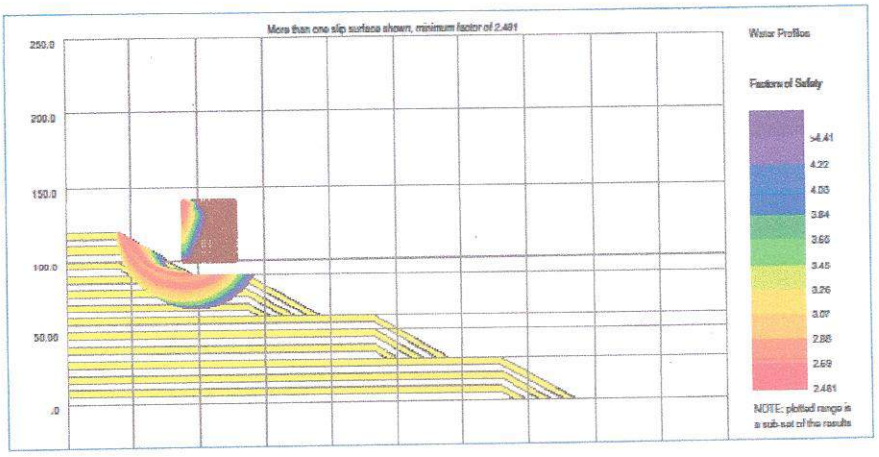

Fig. 10: Slope stability analysis (Alternate layers of OB and OB + fly ash) with Bench angle 28 degrees, using OASYS software

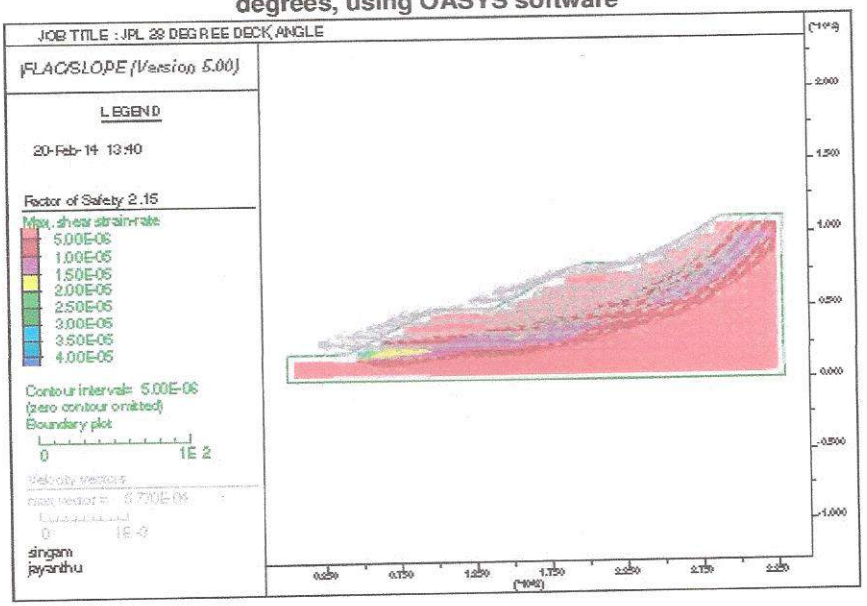

Fig. 11: Slope stability analysis with Bench angle 28 degrees, using FLAC-SLOPE software

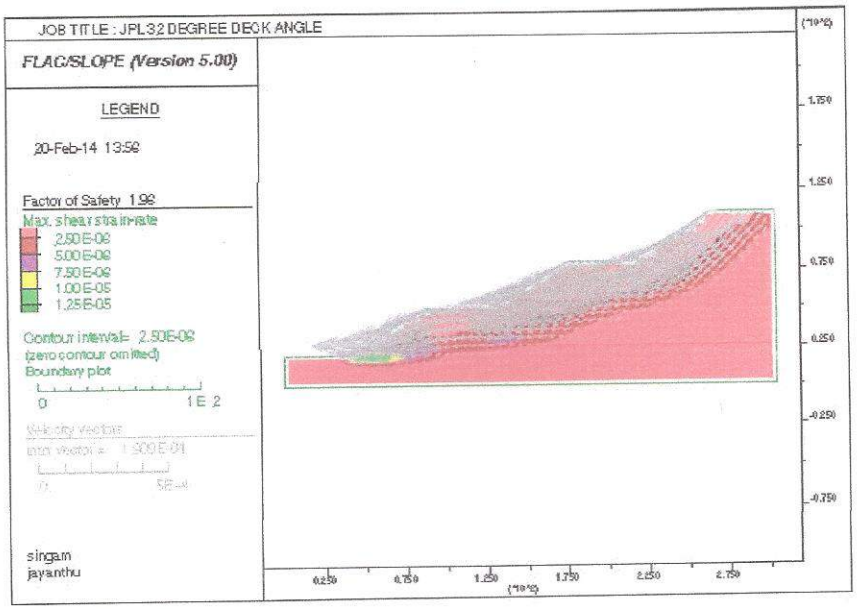

Fig. 12: Slope stability analysis with Bench angle 32 degrees, using FLAC SLOPE software

6. SLOPE STABILITY MONITORING

As per the DGMS permission for fly ash filling in opencast working along with overburden, height of dump was limited to 30 m. The height of dump at study site was about 25 m. Stability of Dump slopes was monitored with total station and monitoring stations fixed at an interval of 20 to 30 m on the dumps at a distance of about 5 m from the crest of the dump slope (Fig 13). 47 monitoring stations were installed with1.0 m long pipes and masonry pillars; 23 stations in the Pit 1 and 24 stations in Pit 2 (Fig 14, 15). Final stage dump consist of 2 m top soil above the layers of OB and OB mixed fly ash material. Fig 16 shows GPS survey for monitoring the location of the stations.

Fig. 13: Monitoring stations at an interval of 30 m on the dumps at a distance of About 5 m from the crest of the dump slope

Fig. 14: Monitoring stations were installed with 1.0 m long pipes and masonry pillars

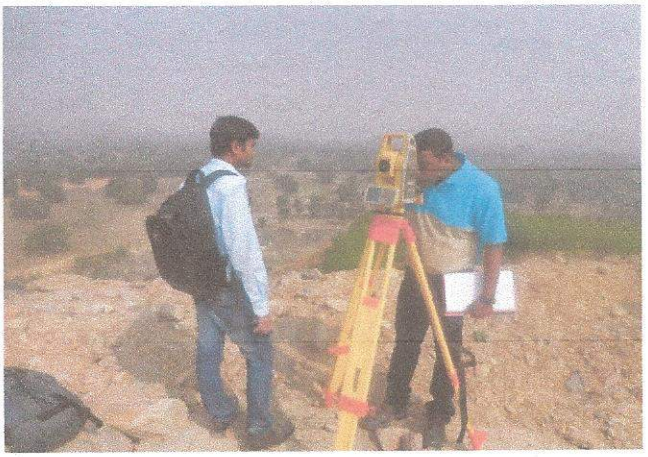

Fig. 15: Total station for measuring Reduced Levels of monitoring stations

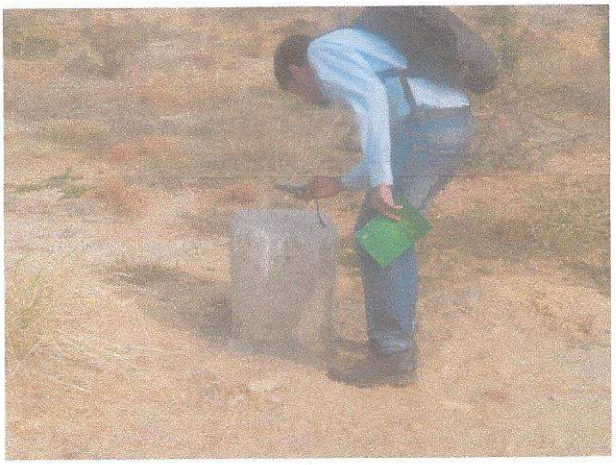

Fig .16: GPS survey for monitoring the location of the stations

Table 5 and Table 6 indicate the Reduced Levels of monitoring stations during Nov'12 to the end of Nov '13 in Pit 1, and Pit 2, respectively. Up to the end of March'13. maximum Vertical deformation of -0.018 m was noticed in Pit 1, while the Vertical deformation was limited to -0.01 m in Pit 2. Negative deformation may be considered as settlement of the material over time. Deformation pattern indicates that more than 50% of the stations showed no further displacement. Monitoring station KJS2 was disturbed due to movement of the machinery. Few stations showed downward as well as upward vertical displacement from Nov.2012 to the end of March 2013. The irregular deformation pattern may be due to differential settlement and consolidation of the material near the monitoring stations.

Upto the end of March'13, incremental downward vertical displacement of about 30% of the monitoring stations indicates gradual settlement of the material, which may settle further in due course of time. It does not show any accelerating trends in deformation which is one of the indicators of slope failure. It necessitates further study of these stations till total settlement. As the dump was formed a year back, it may be inferred that settlement of the dump material at some places may take more than a year. Thus further monitoring of reduced levels of the stations may be continued till all the stations show complete settlement. Except at station KJS2 in Pit 2, all the stations showed no perceptible variation indicating stability of the dump material.

Up to the month of June'13, except at station KJS2 in Pit 2, all the stations showed no perceptible variation indicating stability of the dump material..About 65%, and 74% of the monitoring stations in Pit 1, and Pit 2, respectively showed no perceptible deformation of the dump material near the stations during March'13 to June'13. About 30% and 26% of the monitoring stations in Pit 1, and Pit 2, respectively showed deformation within 2 mm of the dump material near the stations during March'13 to June'13. This indicates that dump material takes about seven to eight months for settlement after formation of the dump.

Up to August '13, KJS 4 station shows maximum vertical displacement of 0.021 m. Maximum number of stations show gradual settling of the stations. In pit-1 , AS1,AS2,AS8,AS12,AS15,AS18,AS19,AS21 (34.78%) stations show no change in the slope over time by zero settlement from the beginning of the survey, nov12 to Aug'13. 4 stations , AS6,AS7,AS10,AS22 showed initial settlement between nov12 to june13,but later in the quarter June'13 to August'13 their zero displacement reading may be due to its settlement. The rest 11 stations show different pattern of settlement,AS4,AS5,AS17,AS23 show settlement in the first five to six months, then zero settlement in the next quarter and a negligible settlement of 2 mm to 3 mm . Stations AS 3, AS13 settlement pattern shows a very slow settlement after 8 months. 4 stations AS9, AS14, AS16, and AS20 did not show any settlement in the first five months whereas showed a very negligible settlement in the next 3 months and again zero settlement from June to August. The study of the next quarter may reveal its characteristics pattern of settlement.

Up to the end of Nov'13, in pit-2, about 50%, 11 stations did not show from the beginning of the survey from Nov'12 to till date. Table 7 indicates the status of vertical displacement of monitoring stations during Nov'12 to the end of Nov'13 in Pit 1 and Pit 2. Out of the stations showing zero displacement, 4 stations KJS11, KJS12, KJS19, KJS23 showed displacement in the first 6 months and afterwards no settlement till now indicating its gradual settlement afterwards 3 stations KJS8, KJS16, KJS21 showed intermediate displacement in the slope. 2 stations KJS24, KJS4 showed settlement of slopes in each previous quarter. Fig 17, and Fig 18 represents variation of RL of Monitoring stations over the dump material in Pit 1, and Pit 2, respectively up to November' 13. Fig 19, and Fig 20 shows displacement of Monitoring stations over the dump material in Pit 1, and Pit 2, respectively from November'12 to November' 13. Fig 21 and Fig 22 illustrates status of vertical displacement of dump at the monitoring stations in Pit-1, and Pit 2, respectively during August'13 to Nov' 13. Few stations such as KJS4 in Pit 1, AS6, AS7, S10 in Pit 2 appears to be disturbed the moving machinery, and hence deformation of about 20 mm was noticed. Otherwise, displacement pattern of all the stations confirmed the stability of dump and possibility of undertaking further process of laying top soil and plantation in near future.

Table 5: Level of monitoring stations installed at the dump site with fly-ash and OB material on Pit 1 up to November '13

Sl. No.	Pillar No.	R.L. On 16.11.13	Vertical Deformation – m Nov '12- March'13 –	Vertical Deformation – m March'13 – June'13	Vertical Deformation – m June'13 - Aug'13	Vertical Deformation – m Aug'13 - Nov.13	Vertical Deformation – m Nov.12 - Nov.13
1	AS1	332.433	0	0	0	0	0
2	AS2	333.528	0	0	0	0	0
3	AS3	334.311	0	0	-0.002	0	-0.002
4	AS4	334.744	-0.001	0	-0.002	-0.001	-0.004
5	AS5	334.84	-0.005	0	-0.003	0	-0.008
6	AS6	335.064	-0.018	-0.001	0	0	-0.019
7	AS7	335.036	-0.015	-0.002	0	0	-0.017
8	AS8	335.01	0	0	0	0	0
9	AS9	334.197	-0.015	-0.002	-0.003	-0.001	-0.021
10	AS10	334.805	-0.016	-0.001	0	-0.001	-0.018
11	AS11	334.854	0	0.001	0	0	0.001
12	AS12	334.608	0	0	0	0	0
13	AS13	333.94	0	0	-0.002	-0.001	-0.003
14	AS14	332.562	0	-0.001	0	0	-0.001
15	AS15	332.458	0	0	0	0	0
16	AS16	333.417	0	-0.001	0	0	-0.001
17	AS17	334.07	-0.001	0	-0.002	0	-0.003
18	AS18	334.478	0	0	0	0	0
19	AS19	334.708	0	0	0	0	0
20	AS20	334.711	0	-0.002	0	0	-0.002
21	AS21	334.823	0	0	0	0	0
22	AS22	335.031	-0.002	0	0	0	-0.002
23	AS23	335.194	-0.003	0	-0.001	0	-0.004

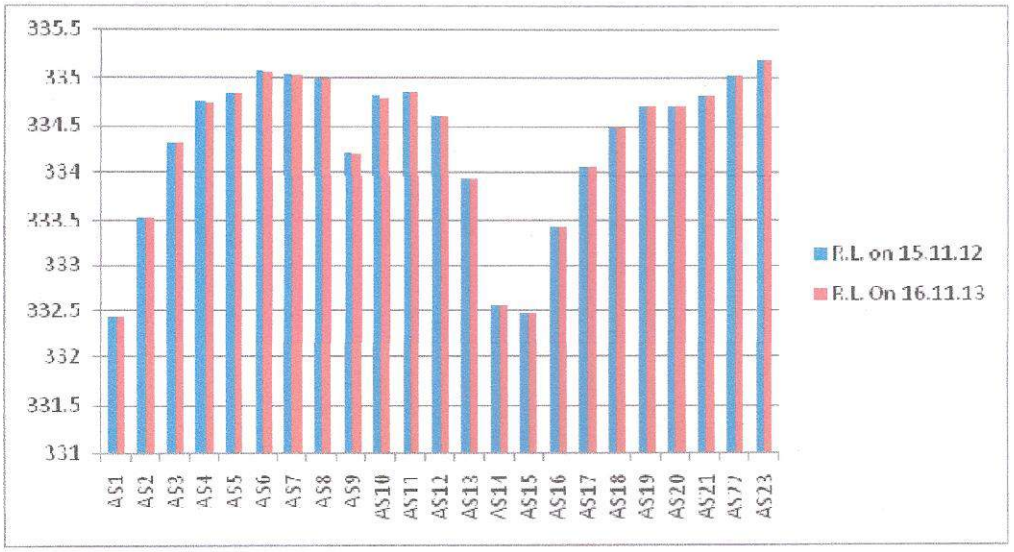

Fig .17: Variation of RL of Monitoring stations over the dump material in Pit 1 up to November' 13

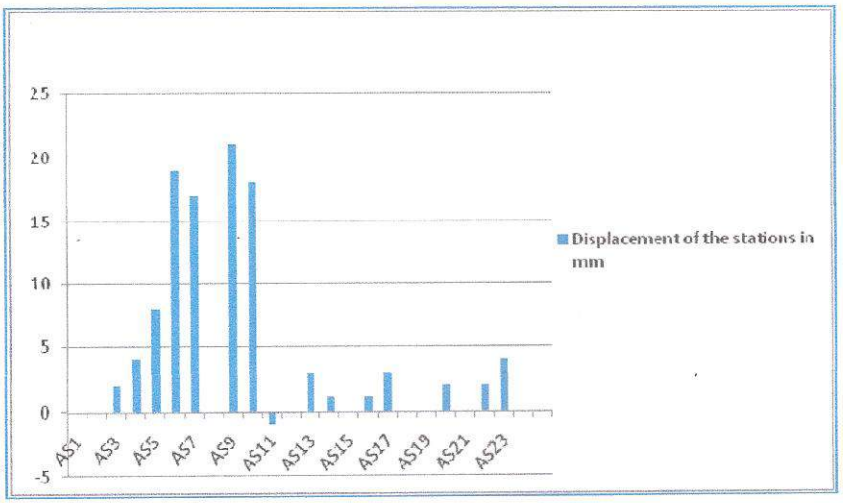

Fig. 18: Displacement of Monitoring stations over the dump material in Pit 1 from November'12 to November' 13

Table 6: Level of monitoring stations installed at the dump site with fly-ash and OB material on Pit 2 up to November' 13

Sl. No.	Pillar No.	R.L. on 12.06.13	Vertical Deformation – m Nov '12- March'13 –	Vertical Deformation – m March'13 – June'13	Vertical Deformation – m Nov'12, June'13	Vertical Deformation – m Aug'13 - Nov.13	Vertical Deformation – m Nov.12 - Nov.13
1	KJS1	313.948	0	0	0	0	0
2	KJS2	313.69	Disturbed due to movement of machinery				

3	KJS3	314.158	0	0	0	0	0
4	KJS4	313.907	-0.02	-0.001	-0.021	0	-0.021
5	KJS5	314.713	0	0	0	0	0
6	KJS6	314.393	0	0	0	0	0
7	KJS7	314.998	0	0	0	0	0
8	KJS8	315.072	0	-0.001	-0.001	0	-0.001
9	KJS9	315.123	0	0	0	0	-0.002
10	KJS10	315.263	0	0	0	0	0
11	KJS11	315.058	-0.01	0	-0.01	0	-0.01
12	KJS12	314.748	-0.005	0	-0.005	0	-0.005
13	KJS13	314.188	0	0	0	0	0
14	KJS14	313.822	0	-0.001	-0.001	-0.001	-0.003
15	KJS15	313.833	0	0	0	0	0
16	KJS16	314.001	0	-0.002	-0.002	0	-0.002
17	KJS17	314.253	0	0	0	0	0
18	KJS18	315.473	0	0	0	0	0
19	KJS19	314.692	-0.001	0	-0.001	0	-0.001
20	KJS20	314.283	0	0	0	0	0
21	KJS21	314.412	0	-0.001	-0.001	0	-0.001
22	KJS22	314.543	0	0	0	-0.001	-0.003
23	KJS23	314.801	-0.002	0	-0.002	0	-0.002
24	KJS24	315.347	-0.005	-0.001	-0.006	0	-0.006

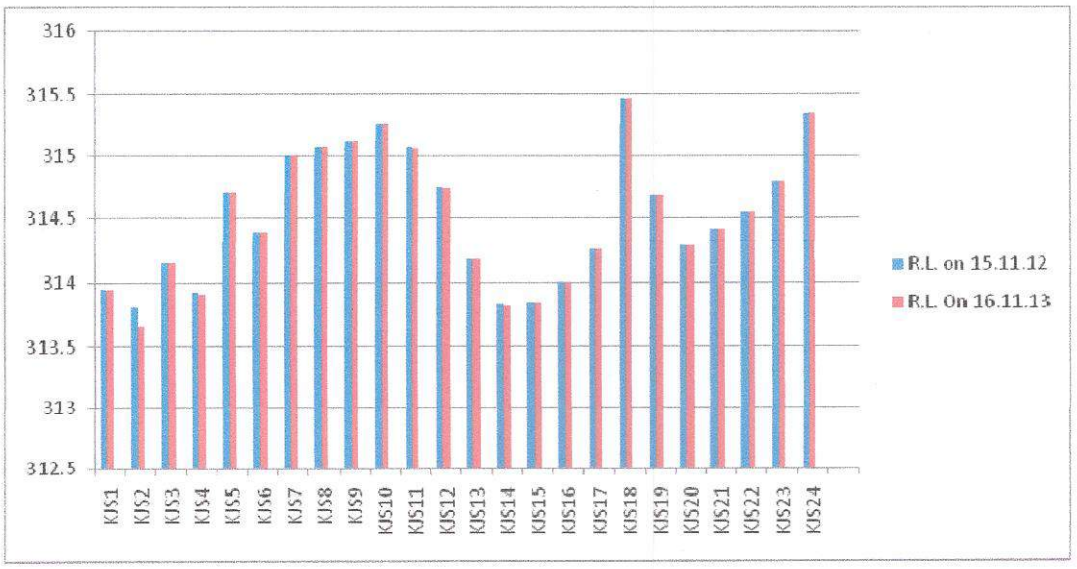

Fig 19: Variation of RL of Monitoring stations over the dump Material in Pit 2 up to November'13

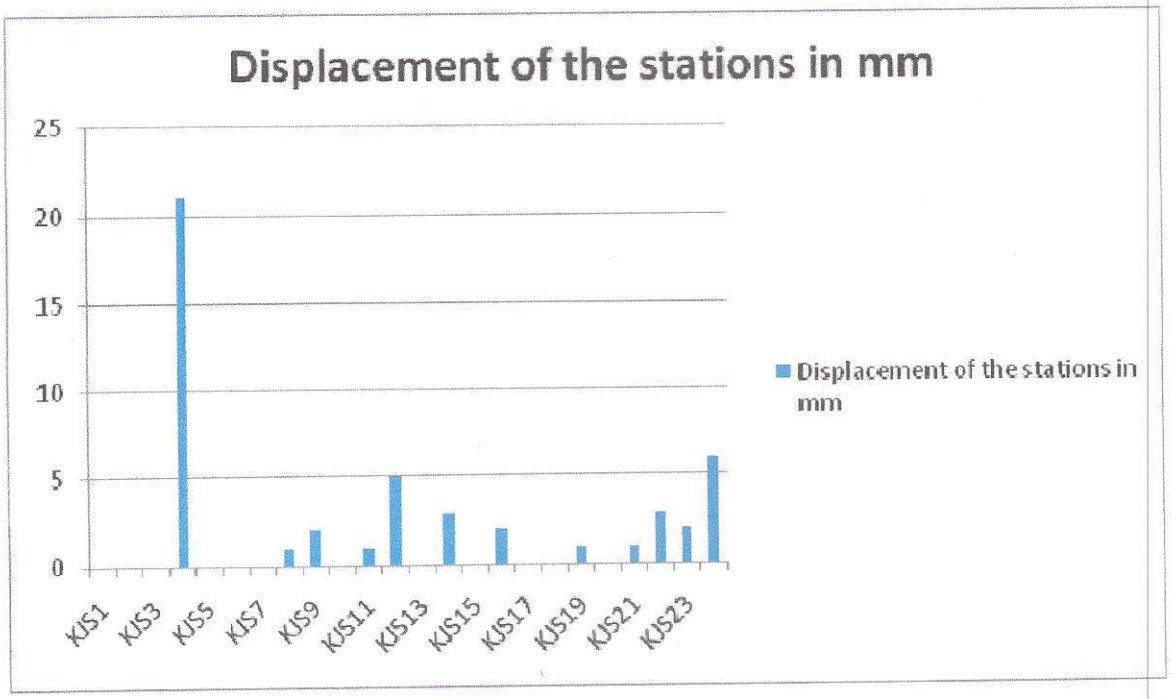

Fig .20: Displacement of Monitoring stations over the dump material in Pit 2 from November 12 to November' 13

Table 7: Status of vertical displacement of dump at the monitoring stations during August'13 to November' 13

	Total no of stations	Zero displacement	%	Gradual displacement	%
PIT-1	23	AS1, AS2, AS3, AS5, AS6, AS7, AS8, AS11, AS12, AS14, AS15, AS16, AS17, AS18, AS19, AS20, AS21, AS22, AS23	82.60	AS4,AS9,AS10,AS13	17.40
PIT-2	23	KJS1, KJS2, KJS3, KJS4, KJS5, KJS6, KJS7, KJS8, KJS9, KJS10, KJS11, KJS12, KJS13, KJS15, KJS16, KJS17, KJS18, KJS19, KJS20, KJS21, KJS23	91.30	KJS14,KJS22	8.70

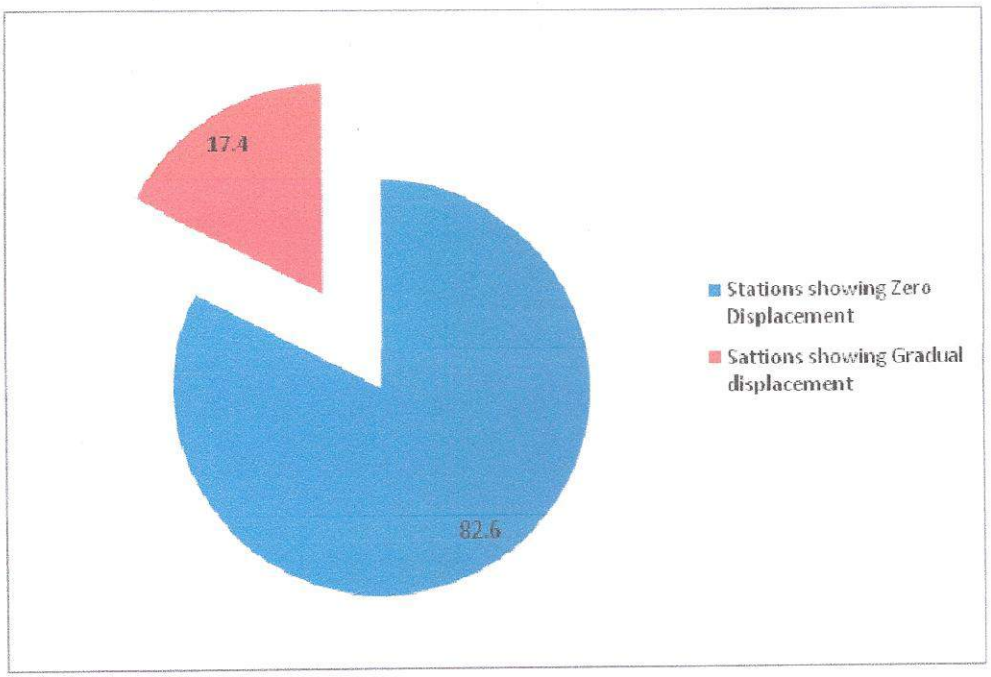

Fig. 21: Status of vertical displacement of dump at the monitoring stations in Pit-1 during August'13 to November' 13

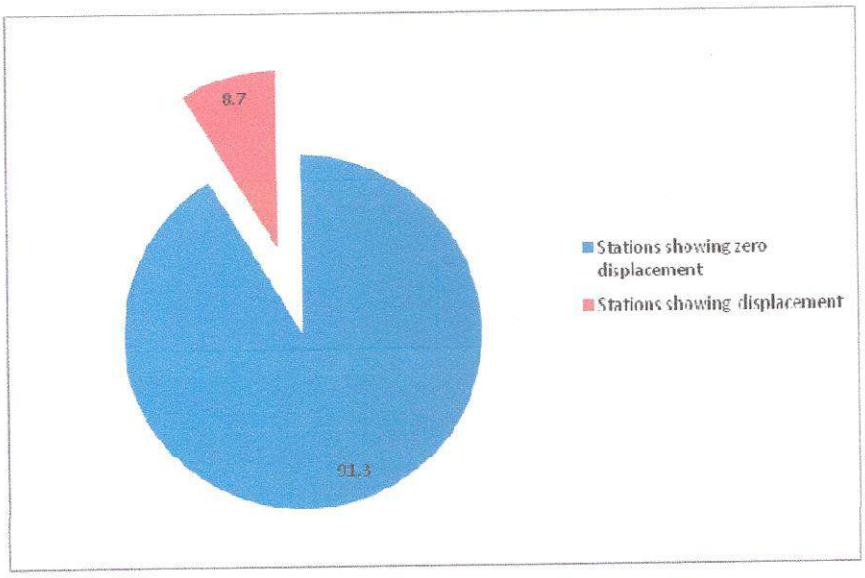

Fig. 22: Status of vertical displacement of dump at the monitoring stations in Pit-1 during August'13 to November' 13

7. CONCLUSIONS AND RECOMMENDATIONS

Displacement pattern of the monitoring stations using Total station during November 2012 to November 2013 indicated no significant displacement in the Overburden dumps with fly ash ensuring stability of the dump. Based on the above monitoring results, it is recommended to undertake further process of laying top soil and plantation, subsequently.

8. ACKNOWLEDGEMENT

Thanks are due to the officers of Jindal Power Limited, Tamnar, Raigarh for providing necessary financial and logistic support for carrying out this work, and also to the National Institute of Technology, Rourkela for allowing to do this scientific study. Mr Tapan Nayak, Final Year B.Tech student, Mr Karthik G, PhD Research Scholar of Mining Engineering department helped in analysis and preparation of the final report.

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NATIONAL INSTITUTE OF TECHNOLOGY
ROURKELA-769008, ODISHA.

PABX: 0661-2465999, FAX: 0661-2462601
Website-www.nitrkl.ac.in *.Ph: 0661-2462611 (Dept) 3611 (Res)*

Jindal Power Limited, Tamnar

Annexure- III (a)

GROUND AND SURFACE WATER QUALITY MONITORING REPORT FROM OCTOBER 2013 TO MARCH, 2014

S.No	Parameters	Location/Month													Permissible Limit as per IS 10500
		NOVEMBER, 2014							JANUARY 2014						
		Kosampali Village	Libra Village	Kelo River US	Kelo River DS	Piezo meter-1 (Pit Office)	Piezometer-2 (Urjanagar Colony)	Piezometer-3 (CHP)	Kosampali Village	Libra Village	Kelo River US	Kelo River DS	Piezometer-1 (Pit Office)	Piezometer-2 (Urjanagar Colony)	Piezometer-3 (CHP)	
1	pH	7.0	7.0	7.1	7.1	7.2	7.2	7.0	6.9	7.0	7.2	7.2	7.1	7.0	7.1	6.5-8.5
2	Turbidity (NTU)	2.8	2.2	5.0	4.8	2.0	1.8	2.1	2.0	1.6	2.6	2.8	1.2	1.4	1.6	10.0
3	Total Dissolved Solids (mg/l)	318	340	268	274	298	314	310	308	320	288	280	284	322	326	2000
4	Total Hardness (as $CaCO_3$) (mg/l)	140	122	98	94	120	96	106	146	128	94	94	112	104	114	600
5	Alkalinity (mg/l)	44	52	56	58	48	40	52	48	56	60	64	44	50	56	600
6	Sulphate (as SO_4) (mg/l)	6.8	8.6	16	16	8.2	9.8	9.0	6.2	8.0	20	24	7.6	9.6	9.2	400
7	Nitrate (as NO_3) (mg/l)	3.0	3.6	4.2	4.4	3.8	2.2	3.0	3.4	3.2	4.0	4.0	4.0	2.8	3.6	100
8	Chlorides (as Cl) (mg/l)	36	32	40	38	32	38	34	40	36	40	34	38	42	36	1000
9	Fluoride (as F) (mg/l)	0.14	0.24	0.30	0.30	0.22	0.24	0.26	0.20	0.22	0.24	0.25	0.20	0.28	0.22	1.5
10	Iron (as Fe) (mg/l)	0.20	0.20	0.30	0.34	0.22	0.16	0.20	0.22	0.24	0.20	0.18	0.22	0.20	0.32	1.0
11	Calcium (as Ca) (mg/l)	34	38	44	46	40	38	36	38	42	48	46	48	32	40	200
12	Copper (as Cu) (mg/l)	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	1.5
13	Zinc (as Zn) (mg/l)	0.38	0.56	0.66	0.64	0.54	0.52	0.62	0.46	0.50	0.72	0.74	0.68	0.66	0.75	15

Note: -US: Up Stream , DS: Down Stream

Annexure-III(a)

Jindal Power Limited, Tamnar

MINE SUMP WATER QUALITY REPORT FOR THE PERIOD OF OCTOBER 2013 TO MARCH, 2014

Parameters	Unit	OCT-13	NOV-13	DEC-13	JAN-14	FEB-14	MARCH-14	Limit
pH	-	7.5	7.2	7.6	7.5	7.5	7.9	**5.5-9.0**
TSS	mg/l	46	42	30	42	32	36	**100**
COD	mg/l	30.5	31.2	33.2	28.6	36.2	38.4	**250**
BOD (3 days at 27 ^{0}C)	mg/l	6.8	7.1	6.2	6.5	7.1	7.4	**30**
Oil & Grease	mg/l	2.0	1.5	1.0	1.0	1.5	2.0	**10**

Note: Sump water is being utilized for development of plantation and dust suppression purpose at mine haul road, dump area, CHP etc.

Annexure- III (b)

WATER LEVEL MONITORING REPORT FROM OCTOBER 2013 TO MARCH, 2014

S. No	Location of Well / Piezometer	Distance (KM) w.r.t Coal Mine excavation area	Water Level (MBGL) November 2013	Water Level (MBGL) January 2014
1	Kosampali Village	0.5	4	4.6
2	Libra Village	1.5	2.3	3.2
3	Dongamahua Village	1.0	4.1	4.9
4	Kondkel Village	5.0	3.8	6.6
5	Piezometer-1 (Old Pit Office)	0.5	7.5	9.2
6	Piezometer-2 (CHP)	1.5	6.1	6.9
7	Piezometer-3 (Urja Nagar Colony (Tehlirampur village)	2.5	5	6.3

Note: MBGL: Meter Below Ground Level

Annexure- IV

Jindal Power Limited (JPL) Tamnar

Achievement Report 2013-14 (Mines Area)

Area of Intervention	Description of Activities	Village/panchayat	Achievement	Budget Utilised
1. Health	Emergency Ambulance services	All adopted village	105 patients benefitted by the 2X7 emergency ambulance service of CSR.	313500
	Vatsalaya Project	All adoopted village	• Reduced IMR and MMR through Vatsalya reach out Program in all 07 adopted village with the support of 05 Village Health Volunteers (VHVs) • VHVs facilitated 65 institutional deliveries and 481 child vaccination, conducted 127 community meetings, 127 adolescent girls meetings, 57 panchayat meetings, 712 school meetings	473670
	Health Awareness program for school & community (Malaria, Filariya, Sick-cell anemia, TV, epilepsy, drug-de-addiction)	All adoopted village	To spread awareness among community on Malaria, Filaria, anemia, sickle cell, cancer, drug-di-addiction, population stabilization, breast feeding, child care, antenatal and post natal care, safe drinking water and sanitation health awareness program were organized at villages as well as schools. The message was spread through lecture, role play, street play and cultural folk dance. 10 awareness programs were organized in which more than 2000 people benefitted.	188322
	Construction of Toilet and sanitation facilities	Dongamuha	Completed	1569600
	Construction of Rein for Cemented Concrete Water Tank (10000 Ltr.)		Completed	111321
	Supply of drinking water through tankers during Summer/Drought and on incidences of Fire in the villages	All adoopted village	As per the need the drinking water was supplied in the villages	414166
	Road safty awareness program	All adoopted village	10 road safety awareness programs for villagers and truckers were organized in the mines area sensitizing approximately 5000 people.	135122
	Sub total			**3205701**
2. Infrastructure Development	Construction of Cemented Ghats/Changing rooms	Tehlirampur	Cemeneted Ghat in the pond of Tehlirampur constructed	445778
	Bunding of Kelo River	Kosampali, Libra	Completed	32975
	Road Repairing of Kelo river	Kosampali, Libra	Completed	9804
	Road Repairing Primary School Kosampali	Kosampali, Libra	Completed	29378
	Four lane Construction from CHP Libra to Salihabahata	Libra	Road is being constructed	12856290
	Dhourabhata repairing and wall painting	Dhourabhata	Repaired	12302
	Sub total			**13386527**
3. Education	Upgrading School Infrastructure and basic amenities	All adoopted village	50 sets of bench with desk and 10 ceiling fans were provided to Govt. schools .	401950
	Coaching classes for Board Entry students	Libra	Additional Coaching Classes for the Board appearing students was conducted in 01 Govt Higher Secondary School benefitting 50 students.	51618
	Spoken English Classes at School	Libra	Ongoing 4 months comprehensive course of spoken english conducted by EEEI (Effective English Educational Institute). Benefitting 65 nos of students of 10th standard. Study materials were provided.	99000
	TLM (Wall Painting)	All adoopted village		151051
	Computer Centre at School	Libra	Computer centre was opened in village Libra	255353
	Running of OP Jindal School	Tehlirampur	Support was provided to run OP Jindal School, Urjanagar	11820000
	Sub total			**12778972**
4. Livelihood	Swalamban Project	All adoopted village	Organized training on bamboo craft, Bangle making for women SHG members. Constructed 02 polutry sheds. 33 women graduated on the basic sewing course at "AKRITI" in collaboration with "USHA International".	1095000
	Formation/Revival and capacity building of SHG	All adoopted village	Monthly meetings with the SHGs were conducted throughout the years and trainings were conducted to capacitate the women	121000
	Cluster/Federation Formation/Development			122311
	Sub total			**1338311**
5. Policy and Other program	Social Welfare	All adoopted village		510000
	Other Activities	All adoopted village		1147619
	Sub total			**1657619**
Grand total				**32,367,130**

Jindal Power Limited, Tamnar

Annexure- V

AMBIENT AIR QUALITY MONITORING FOR THE MONTH OF OCTOBER, 2014

Note: All Units in µg/m³ except CO (in mg/m³)

Date	Location-1 Near Mines Switch Yard					Location-2 Near KJS camp (Kosampali)					Location-3 Coal Handling Plant					Location-4 Dongamouha Village				
	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³
01.10.2013	30.8	15.4	7.2	15.6	0.39	32.8	16.4	6.4	14.2	0.41	34.8	17.6	7.2	15.8	0.38	28.9	14.7	6.8	15.3	0.40
04.10.2013	32.7	16.3	7.4	15.9	0.41	34.8	17.5	6.9	14.9	0.38	33.7	17.9	7.4	16.2	0.37	30.8	15.4	7.0	15.9	0.42
08.10.2013	33.8	17.5	7.3	16.2	0.37	30.2	15.1	7.0	15.3	0.35	35.8	17.3	7.3	15.8	0.40	27.6	13.8	6.7	14.8	0.38
11.10.2013	28.6	14.3	6.7	14.8	0.35	27.6	14.2	6.8	14.7	0.39	32.4	16.8	7.0	16.1	0.36	25.8	13.2	6.5	13.7	0.43
15.10.2013	36.7	18.3	7.2	16.3	0.42	35.8	18.3	7.3	15.9	0.42	39.5	20.1	7.6	16.8	0.41	35.6	17.3	7.0	15.3	0.39
18.10.2013	40.3	20.1	7.6	17.2	0.36	36.5	18.4	7.5	16.2	0.33	38.5	19.5	7.8	17.2	0.35	34.6	17.3	7.2	16.3	0.41
22.10.2013	38.9	19.6	8.1	18.5	0.43	40.6	20.3	8.3	17.6	0.41	42.6	21.3	8.4	18.5	0.44	37.6	18.2	7.8	16.8	0.45
25.10.2013	37.6	18.8	7.5	16.8	0.34	35.9	17.6	7.6	16.8	0.37	40.6	20.3	7.9	17.3	0.33	32.6	16.3	6.6	15.4	0.37
29.10.2013	42.9	21.8	8.3	17.6	0.38	38.8	19.4	8.1	18.2	0.43	44.6	22.3	8.5	18.9	0.42	38.5	19.6	7.5	17.2	0.45
Date	Location-5 Gare Village					Location-6 Libra Village					Location-7 Punj Lloyd Colony					Location-8 Urjanagar Colony				
	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³
01.10.2013	26.8	13.4	6.3	13.5	0.38	28.6	14.3	6.8	14.2	0.40	28.5	14.3	6.3	14.8	0.42	30.5	15.2	6.4	14.2	0.38
04.10.2013	30.7	15.6	6.5	14.5	0.36	32.5	16.2	6.7	15.3	0.43	32.8	16.4	6.7	12.7	0.40	25.3	12.1	7.4	11.8	0.37
08.10.2013	32.8	16.4	7.1	15.4	0.40	30.9	15.8	6.9	13.9	0.39	34.5	17.9	5.9	13.4	0.39	25.6	13.3	5.3	14.8	0.36
11.10.2013	26.9	13.6	6.8	14.3	0.35	33.6	17.2	7.2	14.9	0.38	27.6	14.6	5.7	12.2	0.41	36.4	16.7	6.6	14.2	0.40
15.10.2013	36.8	18.4	7.3	16.3	0.39	34.9	17.5	7.1	15.4	0.37	38.5	19.2	6.6	16.4	0.42	26.2	13.1	6.3	15.7	0.41
18.10.2013	34.8	17.4	7.2	15.8	0.41	36.8	18.4	7.4	16.4	0.42	38.4	19.2	6.9	15.8	0.40	44.2	22.0	8.1	18.6	0.50
22.10.2013	33.7	17.3	7.0	14.8	0.37	35.6	18.0	7.6	15.8	0.36	34.6	17.3	7.7	14.9	0.38	38.6	19.2	7.6	17.1	0.39
25.10.2013	28.6	14.3	6.8	13.9	0.34	30.8	15.4	6.7	14.8	0.35	32.9	16.3	6.2	14.8	0.42	30.6	15.3	7.4	15.8	0.34
29.10.2013	38.6	19.3	7.5	15.9	0.42	36.8	18.4	7.2	16.2	0.42	37.4	18.9	7.2	18.3	0.43	44.8	22.5	7.6	16.8	041
Permissible Limit (24 hrs Average): (Standard Prescribed in NAAQS -2009)						PM-10 : 100 µg/m³, PM-2.5 : 60 µg/m³, SO_2 : 80 µg/m³, NO_x: 80 µg/m³, CO : 2.0 mg/m³														

Jindal Power Limited, Tamnar

AMBIENT AIR QUALITY MONITORING FOR THE MONTH OF NOVEMBER, 2014

Note: All Units in µg/m³ except CO (in mg/m³)

Date	Location-1 Near Mines Switch Yard					Location-2 Near KJS camp (Kosampali)					Location-3 Coal Handling Plant					Location-4 Dongamouha Village				
	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³
01.11.2013	42.6	21.3	7.5	19.5	0.52	45.3	22.8	7.2	18.9	0.45	48.6	24.3	8.2	20.5	0.41	40.4	20.2	7.6	20.3	0.49
05.11.2013	45.8	22.4	7.8	20.6	0.48	42.8	21.4	7.6	19.2	0.46	46.7	23.3	7.8	19.8	0.46	38.8	19.4	7.2	19.3	0.47
08.11.2013	48.6	24.3	8.1	21.8	0.50	43.4	22.5	7.9	20.3	0.49	50.6	25.3	8.1	21.2	0.42	41.8	21.2	8.0	20.8	0.44
12.11.2013	52.6	26.2	8.3	22.3	0.45	46.5	23.5	8.2	21.4	0.46	45.6	23.2	8.3	21.8	0.43	44.8	22.4	8.2	21.1	0.48
15.11.2013	44.6	22.3	7.9	19.3	0.42	48.6	24.3	8.3	22.3	0.52	47.6	24.2	7.9	20.7	0.46	42.8	21.4	7.8	18.5	0.50
19.11.2013	50.3	25.1	8.2	22.9	0.47	51.8	26.1	8.6	23.2	0.50	49.8	24.8	8.5	21.6	0.48	45.2	22.9	7.9	20.7	0.52
22.11.2013	46.8	23.3	7.9	21.2	0.49	47.6	23.9	7.9	20.8	0.48	52.6	26.3	8.6	23.5	0.49	43.5	22.6	8.0	21.3	0.48
26.11.2013	47.5	23.1	8.0	22.3	0.46	53.5	27.1	8.4	21.6	0.47	44.8	22.4	8.2	20.8	0.44	40.8	20.4	7.6	20.4	0.46
29.11.2013	49.6	24.8	8.4	23.2	0.44	49.2	25.1	8.0	22.3	0.49	51.3	26.0	8.4	22.5	0.45	46.8	23.4	7.9	21.3	0.45

Date	Location-5 Gare Village					Location-6 Libra Village					Location-7 Punj Lloyd Colony					Location-8 Urjanagar Colony				
	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³
01.11.2013	40.6	20.3	7.3	18.6	0.42	43.6	21.8	7.6	19.4	0.40	35.2	16.2	7.8	19.1	0.40	44.8	22.4	8.8	20.6	0.61
05.11.2013	43.5	21.7	7.5	19.3	0.45	45.6	23.5	7.8	20.3	0.43	45.6	22.8	6.9	20.2	0.43	42.8	21.4	7.5	17.8	0.42
08.11.2013	45.3	22.6	7.8	20.3	0.43	46.2	23.1	8.0	19.8	0.45	40.8	20.7	8.5	20.6	0.39	42.2	21.1	8.1	21.3	0.50
12.11.2013	42.8	21.4	7.6	18.6	0.44	44.4	22.2	7.5	19.7	0.47	48.3	24.1	6.9	22.2	0.46	44.8	22.4	7.6	18.7	0.43
15.11.2013	46.8	23.4	8.0	20.8	0.46	48.6	24.3	8.2	21.2	0.48	51.6	25.8	8.8	22.9	0.49	46.4	23.2	8.1	21.8	0.39
19.11.2013	44.8	22.4	7.9	19.5	0.47	47.6	23.8	8.3	20.8	0.46	47.7	23.5	9.2	23.3	0.36	45.2	23.1	8.8	22.3	0.40
22.11.2013	48.6	24.3	8.2	21.8	0.48	45.2	22.3	7.9	19.2	0.45	47.3	23.8	8.6	20.7	0.48	46.6	23.3	8.0	20.4	0.45
26.11.2013	45.8	22.6	7.8	20.2	0.41	42.9	21.6	7.5	20.3	0.49	44.6	22.3	8.0	20.8	0.43	52.4	26.2	8.6	22.8	0.45
29.11.2013	50.6	25.3	8.3	21.8	0.46	48.2	24.1	8.1	21.3	0.47	42.8	21.4	7.3	19.4	0.55	48.4	24.2	8.2	20.3	0.47

Permissible Limit (24 hrs Average):
(Standard Prescribed in NAAQS -2009)

PM-10 : 100 µg/m³, PM-2.5 : 60 µg/m³, SO_2 : 80 µg/m³, NO_x : 80 µg/m³, CO : 2.0 mg/m³

Jindal Power Limited, Tamnar

AMBIENT AIR QUALITY MONITORING FOR THE MONTH OF DECEMBER, 2014

Note: All Units in µg/m³ except CO (in mg/m³)

Date	Location-1 Near Mines Switch Yard					Location-2 Near KJS camp (Kosampali)					Location-3 Coal Handling Plant					Location-4 Dongamouha Village				
	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³
03.12.2013	52.6	26.2	8.3	21.6	0.48	48.9	24.5	8.9	21.8	0.47	50.6	25.4	9.2	22.1	0.51	46.8	23.4	8.1	21.3	0.54
06.12.2013	50.3	25.3	8.6	20.8	0.46	50.8	25.4	9.2	22.2	0.51	48.7	24.6	8.9	21.5	0.49	44.5	22.4	8.6	20.6	0.48
10.12.2013	48.6	24.3	8.9	21.2	0.45	52.6	26.4	9.4	23.2	0.49	55.6	27.8	9.5	23.4	0.48	48.6	24.3	8.8	21.9	0.51
13.12.2013	54.5	27.6	9.2	22.5	0.51	50.2	25.1	9.2	22.1	0.45	52.2	26.3	9.3	22.8	0.52	47.6	23.8	9.1	22.3	0.52
17.12.2013	46.8	23.5	8.9	22.1	0.52	48.6	24.4	8.5	21.3	0.48	49.8	25.1	9.1	21.8	0.50	50.5	25.3	9.3	23.1	0.49
20.12.2013	55.6	27.8	9.5	23.5	0.47	54.2	27.1	9.5	23.2	0.52	50.2	25.3	9.4	22.4	0.53	47.8	24.1	9.2	22.7	0.50
24.12.2013	49.8	24.7	8.9	21.6	0.53	50.2	25.1	9.3	22.4	0.51	47.8	24.2	9.2	21.3	0.49	52.6	26.3	9.5	23.5	0.46
27.12.2013	53.2	26.8	9.3	22.6	0.48	46.5	23.2	8.7	20.6	0.46	48.5	25.1	8.8	18.9	0.44	56.2	27.6	8.9	21.3	0.47
31.12.2013	55.3	27.9	8.8	20.9	0.44	54.3	27.1	8.4	19.7	0.43	56.5	28.0	9.1	19.8	0.47	54.1	26.8	8.4	19.8	0.41

Date	Location-5 Gare Village					Location-6 Libra Village					Location-7 Punj Lloyd Colony					Location-8 Urjanagar Colony				
	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³
03.12.2013	48.6	24.5	8.3	21.5	0.54	47.6	23.8	8.2	20.9	0.45	46.2	23.1	7.4	19.3	0.35	49.7	24.8	8.6	20.5	0.41
06.12.2013	46.8	23.4	8.4	21.3	0.51	50.5	25.3	8.6	21.6	0.48	38.6	19.3	7.1	17.2	0.38	50.4	25.2	7.7	21.8	0.50
10.12.2013	44.5	22.4	8.1	20.8	0.48	46.8	23.2	8.5	22.1	0.46	48.8	24.4	7.4	22.6	0.46	44.8	22.0	7.3	20.3	0.42
13.12.2013	42.8	21.2	7.8	21.2	0.42	43.8	22.1	8.1	21.4	0.41	46.6	23.3	8.3	23.4	0.41	40.6	20.1	7.5	20.9	0.39
17.12.2013	41.8	21.0	8.0	21.8	0.49	46.5	23.4	8.3	22.1	0.44	40.9	20.5	7.4	20.8	0.43	52.8	26.4	8.5	22.4	0.35
20.12.2013	48.6	24.3	8.4	22.3	0.47	50.3	25.2	8.6	22.7	0.48	50.2	25.1	8.5	22.7	0.42	52.4	26.2	8.6	23.2	0.46
24.12.2013	50.4	25.2	8.6	23.2	0.51	48.9	24.8	8.8	23.4	0.52	49.2	24.8	8.3	21.7	0.44	44.4	22.2	7.8	22.1	0.38
27.12.2013	45.6	22.8	9.1	22.8	0.46	44.8	22.3	8.2	21.4	0.45	50.2	25.1	7.8	22.8	0.45	47.4	23.7	8.54	23.5	0.44
31.12.2013	53.6	27.2	9.3	23.5	0.47	52.8	26.4	8.9	23.1	0.42	48.4	24.2	9.6	24.8	0.46	50.6	25.3	9.2	25.4	0.36

Permissible Limit (24 hrs Average): (Standard Prescribed in NAAQS -2009)	PM-10 : 100 µg/m³, PM-2.5 : 60 µg/m³, SO_2 : 80 µg/m³, NO_x: 80 µg/m³, CO : 2.0 mg/m³

Jindal Power Limited, Tamnar

AMBIENT AIR QUALITY MONITORING FOR THE MONTH OF JANUARY, 2014

Note: All Units in μg/m³ except CO (in mg/m³)

Date	Location-1 Near Mines Switch Yard					Location-2 Near KJS camp (Kosampali)					Location-3 Coal Handling Plant					Location-4 Dongamouha Village				
	PM-10 μg/m³	PM-2.5 μg/m³	SO_2 μg/m³	NO_x μg/m³	CO mg/m³	PM-10 μg/m³	PM-2.5 μg/m³	SO_2 μg/m³	NO_x μg/m³	CO mg/m³	PM-10 μg/m³	PM-2.5 μg/m³	SO_2 μg/m³	NO_x μg/m³	CO mg/m³	PM-10 μg/m³	PM-2.5 μg/m³	SO_2 μg/m³	NO_x μg/m³	CO mg/m³
03.01.2014	52.3	26.1	8.9	21.5	0.46	48.9	24.3	8.7	20.6	0.52	50.8	24.9	9.2	22.3	0.47	46.5	23.0	8.6	20.3	0.55
07.01.2014	54.6	27.3	9.3	22.1	0.49	50.6	25.3	9.1	21.1	0.48	55.5	27.8	9.4	22.9	0.46	48.2	24.3	8.9	21.2	0.52
10.01.2014	50.4	25.2	9.0	21.7	0.52	55.2	26.5	9.3	22.4	0.54	52.4	26.3	9.1	22.2	0.55	50.2	25.2	9.2	21.9	0.48
14.01.2014	48.8	24.2	8.6	20.8	0.45	52.4	25.7	9.4	23.1	0.47	49.6	24.8	9.3	21.7	0.54	46.8	23.1	8.7	20.6	0.47
17.01.2014	46.3	23.1	9.1	21.3	0.51	48.9	24.8	9.3	22.4	0.46	50.2	25.1	9.5	23.2	0.52	47.2	23.5	8.8	21.3	0.49
21.01.2014	49.2	24.8	9.3	22.3	0.48	51.6	26.1	9.5	23.3	0.51	53.8	27.2	9.7	23.6	0.48	55.6	27.4	9.2	22.6	0.50
24.01.2014	51.7	26.3	9.6	23.2	0.50	53.5	26.5	9.6	23.8	0.53	56.5	28.3	9.9	24.2	0.47	50.8	25.3	9.6	23.3	0.46
28.01.2014	56.1	27.9	9.9	24.5	0.47	51.6	25.8	9.4	23.1	0.49	52.7	26.3	9.6	23.9	0.43	48.9	24.2	9.4	22.8	0.45
31.01.2014	53.5	26.4	9.4	23.6	0.53	56.2	28.1	9.8	24.3	0.50	48.6	24.2	9.8	21.9	0.45	52.2	26.1	9.5	24.2	0.44

Date	Location-5 Gare Village					Location-6 Libra Village					Location-7 Punj Lloyd Colony					Location-8 Urjanagar Colony				
	PM-10 μg/m³	PM-2.5 μg/m³	SO_2 μg/m³	NO_x μg/m³	CO mg/m³	PM-10 μg/m³	PM-2.5 μg/m³	SO_2 μg/m³	NO_x μg/m³	CO mg/m³	PM-10 μg/m³	PM-2.5 μg/m³	SO_2 μg/m³	NO_x μg/m³	CO mg/m³	PM-10 μg/m³	PM-2.5 μg/m³	SO_2 μg/m³	NO_x μg/m³	CO mg/m³
03.01.2014	50.2	25.1	9.2	21.6	0.48	52.6	26.3	9.3	22.1	0.49	44.8	22.4	8.2	20.4	0.46	48.6	24.9	8.0	22.1	0.47
07.01.2014	48.2	24.0	8.7	20.3	0.42	46.2	23.1	8.6	21.6	0.51	42.6	21.3	7.8	18.9	0.44	46.7	23.3	8.3	21.4	0.40
10.01.2014	52.4	26.1	8.3	21.2	0.46	48.3	24.1	9.1	22.3	0.47	50.4	25.2	9.5	22.6	0.43	46.2	23.1	9.2	20.8	0.48
14.01.2014	49.6	24.2	9.2	22.3	0.45	47.6	23.4	9.3	21.8	0.46	45.9	23.0	8.8	20.2	0.42	50.2	25.1	9.3	21.5	0.44
17.01.2014	44.8	22.4	8.3	20.8	0.43	42.8	21.4	8.6	20.1	0.42	46.8	23.2	8.2	21.2	0.45	48.6	24.3	9.0	20.8	0.42
21.01.2014	49.2	25.1	8.9	21.5	0.47	50.5	24.8	9.2	22.4	0.48	47.4	23.8	8.7	21.2	0.44	50.6	25.2	9.4	22.7	0.46
24.01.2014	54.3	27.2	9.4	22.6	0.52	56.8	28.3	9.6	23.5	0.51	48.4	24.2	8.5	21.2	0.46	50.8	25.4	9.0	22.2	0.45
28.01.2014	51.4	26.1	9.3	21.8	0.50	52.2	26.1	8.9	21.9	0.44	47.8	23.4	9.3	22.7	0.49	44.6	22.3	9.6	21.3	0.41
31.01.2014	50.8	25.4	9.6	22.8	0.49	54.2	27.1	9.4	23.2	0.53	48.8	24.2	9.2	21.9	0.48	52.6	25.7	10.8	22.9	0.45
Permissible Limit (24 hrs Average): (Standard Prescribed in NAAQS -2009)	PM-10 : 100 μg/m³, PM-2.5 : 60 μg/m³, SO_2 : 80μg/m³, NO_x: 80 μg/m³, CO : 2.0 mg/m³																			

Jindal Power Limited, Tamnar

AMBIENT AIR QUALITY MONITORING FOR THE MONTH OF FEBRUARY, 2014

Note: All Units in µg/m³ except CO (in mg/m³)

Date	Location-1 Near Mines Switch Yard					Location-2 Near KJS camp (Kosampali)					Location-3 Coal Handling Plant					Location-4 Dongamouha Village				
	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³
04.02.2014	54.6	27.1	8.6	21.6	0.52	50.2	25.2	8.3	20.7	0.48	52.6	26.2	8.9	21.2	0.44	49.8	24.3	8.0	21.3	0.42
07.02.2014	56.2	28.0	8.9	23.5	0.53	51.8	26.2	8.9	21.6	0.50	53.8	26.4	9.2	22.4	0.42	50.6	25.3	8.6	22.1	0.52
11.02.2014	52.6	26.3	9.2	22.8	0.47	53.5	26.3	9.2	22.1	0.49	57.6	28.3	9.5	23.4	0.46	52.8	26.4	9.1	23.1	0.49
14.02.2014	50.9	26.2	9.4	23.2	0.53	55.8	28.3	9.6	23.5	0.52	51.6	25.8	9.3	22.9	0.55	54.2	27.1	9.3	23.7	0.53
18.02.2014	40.3	19.4	8.2	21.6	0.54	38.4	18.6	7.8	20.3	0.45	42.2	20.1	8.2	20.2	0.48	36.4	17.2	8.4	21.1	0.45
21.02.2014	53.6	26.1	9.1	23.2	0.48	56.5	28.2	9.3	23.2	0.55	50.2	25.1	8.6	22.6	0.54	51.6	25.7	8.6	22.6	0.52
25.02.2014	51.8	26.3	9.4	22.6	0.46	52.8	26.3	9.6	24.5	0.46	48.9	24.5	9.2	23.1	0.47	53.6	26.5	9.2	23.3	0.48
28.02.2014	35.9	17.2	7.8	20.6	0.45	32.4	16.1	7.5	21.6	0.44	30.4	15.2	7.5	20.4	0.51	28.8	14.2	7.4	21.4	0.47

Date	Location-5 Gare Village					Location-6 Libra Village					Location-7 Punj Lloyd Colony					Location-8 Urjanagar Colony				
	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	PM-10 µg/m³	PM-2.5 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³
04.02.2014	52.2	26.0	7.8	20.6	0.48	50.4	25.2	8.3	21.3	0.47	42.7	21.4	8.1	19.6	0.51	45.5	22.8	9.0	20.1	0.44
07.02.2014	50.7	25.1	7.2	21.3	0.47	48.6	24.3	7.8	20.5	0.45	45.4	22.8	8.5	21.2	0.42	55.3	28.2	8.9	24.3	0.39
11.02.2014	54.8	27.2	7.9	22.3	0.45	56.8	28.2	8.2	22.5	0.49	46.4	23.3	7.8	20.2	0.45	58.4	29.2	9.2	22.6	0.46
14.02.2014	58.6	29.3	8.5	23.2	0.42	53.2	26.8	8.6	23.8	0.52	43.8	21.5	7.4	20.1	0.56	57.8	28.3	9.4	23.9	0.52
18.02.2014	40.2	18.6	6.9	18.5	0.52	42.1	19.2	7.6	20.1	0.48	38.5	19.4	6.6	17.3	0.61	47.2	22.5	8.9	21.2	0.59
21.02.2014	52.8	26.3	8.2	23.6	0.46	54.2	26.1	8.5	23.2	0.45	49.5	24.6	8.8	22.3	0.52	52.6	25.7	9.2	24.3	0.46
25.02.2014	56.2	28.0	8.8	24.2	0.53	52.9	26.5	8.9	24.2	0.43	47.4	22.6	8.2	23.1	0.53	41.7	20.4	7.9	21.2	0.36
28.02.2014	43.2	21.2	7.4	21.2	0.52	39.8	18.6	7.3	20.8	0.51	20.2	10.1	7.4	18.6	0.47	21.6	12.6	7.5	16.5	0.42

Permissible Limit (24 hrs Average): (Standard Prescribed in NAAQS -2009)	PM-10 : 100 µg/m³, PM-2.5 : 60 µg/m³, SO_2 : 80 µg/m³, NO_x : 80 µg/m³, CO : 2.0 mg/m³

Jindal Power Limited, Tamnar

AMBIENT AIR QUALITY MONITORING FOR THE MONTH OF MARCH, 2014

Note: All Units in µg/m^3 except CO (in mg/m^3)

Date	Location-1 Near Mines Switch Yard					Location-2 Near KJS camp (Kosampali)					Location-3 Coal Handling Plant					Location-4 Dongamouha Village				
	PM-10 µg/m^3	PM-2.5 µg/m^3	SO_2 µg/m^3	NO_x µg/m^3	CO mg/m^3	PM-10 µg/m^3	PM-2.5 µg/m^3	SO_2 µg/m^3	NO_x µg/m^3	CO mg/m^3	PM-10 µg/m^3	PM-2.5 µg/m^3	SO_2 µg/m^3	NO_x µg/m^3	CO mg/m^3	PM-10 µg/m^3	PM-2.5 µg/m^3	SO_2 µg/m^3	NO_x µg/m^3	CO mg/m^3
04.03.2014	42.2	20.1	8.2	20.3	0.52	38.4	17.9	7.9	19.5	0.52	40.5	19.5	7.9	20.3	0.51	36.8	17.2	7.3	18.6	0.51
07.03.2014	48.6	24.2	8.5	21.2	0.48	52.6	26.3	8.2	20.6	0.48	54.6	27.3	8.3	21.4	0.52	50.3	25.2	8.2	21.2	0.49
11.03.2014	52.7	26.1	8.9	22.3	0.46	56.8	28.3	8.6	21.6	0.51	58.4	29.2	8.6	22.3	0.48	54.2	27.3	8.4	22.3	0.47
14.03.2014	59.6	29.6	9.1	23.2	0.49	63.4	32.2	9.2	22.5	0.49	61.2	31.2	9.2	23.6	0.54	57.3	28.6	9.1	23.2	0.48
18.03.2014	62.4	31.2	9.3	24.5	0.51	60.4	30.2	8.8	21.8	0.46	64.8	32.4	9.5	24.2	0.49	61.5	30.7	9.3	23.9	0.45
21.03.2014	64.5	32.2	9.5	23.7	0.48	66.2	33.1	9.3	23.4	0.45	62.5	31.2	9.3	23.7	0.50	58.6	29.3	8.9	22.5	0.43
25.03.2014	60.9	30.4	9.1	22.8	0.47	64.8	32.3	9.5	24.2	0.50	63.2	32.2	9.4	24.3	0.48	61.2	30.5	9.2	23.1	0.46
28.03.2014	65.8	33.2	9.6	24.3	0.54	62.2	31.2	9.0	23.6	0.47	66.5	33.2	9.7	25.3	0.46	63.5	31.8	9.4	24.2	0.52
Date	Location-5 Gare Village					Location-6 Libra Village					Location-7 Punj Lloyd Colony					Location-8 Urjanagar Colony				
	PM-10 µg/m^3	PM-2.5 µg/m^3	SO_2 µg/m^3	NO_x µg/m^3	CO mg/m^3	PM-10 µg/m^3	PM-2.5 µg/m^3	SO_2 µg/m^3	NO_x µg/m^3	CO mg/m^3	PM-10 µg/m^3	PM-2.5 µg/m^3	SO_2 µg/m^3	NO_x µg/m^3	CO mg/m^3	PM-10 µg/m^3	PM-2.5 µg/m^3	SO_2 µg/m^3	NO_x µg/m^3	CO mg/m^3
04.03.2014	35.8	16.3	7.6	18.8	0.52	32.8	15.4	7.3	19.2	0.44	39.0	17.4	8.3	18.3	0.57	40.1	18.2	8.8	21.8	0.36
07.03.2014	45.6	22.6	8.2	20.3	0.48	43.6	21.3	7.8	20.2	0.46	42.4	21.0	8.6	20.5	0.46	49.8	25.1	9.4	22.7	0.44
11.03.2014	52.7	26.3	8.4	21.4	0.50	54.2	27.2	8.2	21.5	0.48	50.8	25.2	8.2	24.4	0.55	59.4	30.2	9.6	24.8	0.52
14.03.2014	60.4	30.2	8.6	22.5	0.47	56.4	28.3	8.5	22.1	0.46	59.6	29.2	9.2	22.4	0.49	50.8	25.4	9.0	23.3	0.44
18.03.2014	65.3	32.8	8.9	23.2	0.42	58.2	29.0	9.0	22.8	0.43	51.8	28.2	8.3	21.4	0.46	42.6	21.3	7.7	19.9	0.50
21.03.2014	62.2	31.2	9.1	23.6	0.46	60.3	30.1	9.2	23.2	0.42	50.3	22.6	9.3	21.6	0.45	53.8	24.4	9.0	22.8	0.49
25.03.2014	60.6	30.3	9.3	24.1	0.51	54.2	27.2	8.9	22.7	0.49	58.4	29.3	8.9	25.3	0.52	64.6	32.4	9.8	26.2	0.48
28.03.2014	58.4	29.3	9.5	23.8	0.45	60.7	30.4	9.3	24.2	0.51	55.2	27.6	8.8	23.3	0.49	62.4	31.2	9.6	25.6	0.50
Permissible Limit (24 hrs Average): (Standard Prescribed in NAAQS -2009)						PM-10 : 100 µg/m^3, PM-2.5 : 60 µg/m^3, SO_2 : 80 µg/m^3, NO_x: 80 µg/m^3, CO : 2.0 mg/m^3														

Jindal Power Limited, Tamnar

Annexure- VI

NOISE LEVEL MONITORING DATA FOR THE PERIOD OF OCTOBER 2013 TO MARCH, 2014

Unit-dB (A)

S. No	Monitoring Location	OCT-13	NOV-13	DEC-13	JAN-14	FEB-14	MARCH-14
1	Near Coal Excavation Area	78.5	79.8	80.5	68.1	65.5	72.6
2	Near Mine Screen Hopper	80.5	79.2	79.7	73.4	69.6	70.4
3	Near Coal Crushing Plant	80.8	80.2	79.4	82.3	75.3	76.8
4	Near dumper unloading hopper	78.6	77.8	78.6	78.4	77.8	68.9
5	Ground Floor at Coal Washery	78.2	75.8	76.8	79.9	77.9	75.4

Note: Limit for Work Environment is 85 dB (A).