

JPL/EMD/F-33 (3)/4x600MW/2022/179
28/11/2022



The Regional Director (S),
Ministry of Environment and Forests,
Regional office (WCZ)
Ground Floor, East Wing
New Secretariat Building
Civil Line, Nagpur - 440001 (Maharashtra)

Sub.: Submission of Half Yearly Environmental Clearance Compliance Reports for expansion of 4x250 MW TPP by addition of 2x600MW (Units-1&2) and 2x600MW (Units-3&4) Coal based TPP of M/s Jindal Power Limited, Tamnar, Distt.- Raigarh (C.G.) for the period of April, 2022 to September, 2022.

- Ref.: -1. Environmental Clearance issued vide letter No.J.13012/117/2008-IA.II (T) dated 18/03/2011.
2. Environmental Clearance issued vide letter No.J.13012/117/2008-IA.II (T) dated 04/11/2011.
3. MoEF Office Memorandum No. J-11013/41/2006-IA.II (I) dated 06/04/2011.
4. Amendment in Environmental Clearance issued vide letter No.J.13012/117/2008-IA.II (T) dated 10/01/2014.
5. Amendment in Environmental Clearance issued vide letter No.J.13012/117/2008-IA.II (T) dated 27/03/2015.
6. Amendment in Environmental Clearance issued vide letter No.J.13012/117/2008-IA.II (T) dated 26/04/2017.
7. Amendment in Environmental Clearance issued vide letter No.J.13012/117/2008-IA.II (T) dated 28/08/2020.

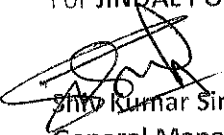
Dear Sir,

This has reference to the above cited subject. Enclosed please find herewith Half Yearly Environmental Clearance Compliance Reports along with compliance of additional conditions for expansion of 4x250 MW TPP by addition of 2x600MW (Units-1&2) and 2x600MW (Units-3&4) Coal based TPP of M/s Jindal Power Limited, Tamnar, Distt.- Raigarh (C.G.) for the period of April, 2022 to September, 2022 in soft copy (through e-mail).

Trust that you will find the above information in order.

Thanking you,

Yours faithfully,
For JINDAL POWER LIMITED


Shri Kumar Singh
General Manager -EMD

Encl. : As above.

Cc:

Integrated Regional Office (IRO)
Aranya Bhawan, North Block, Sector-19
Naya Raipur, Atal Nagar
Chhattisgarh-492002

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,
Paryavas Bhavan, North Block Sec.19
Atal Nagar, Raipur (CG) -490099

Jindal Power Limited

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Jindal Power Limited, Tamnar

Compliance Report of Environmental Clearance and additional conditions for Expansion of 4x250MW by addition of 2x600 MW (Units-1 & 2) Coal Based Thermal Power Plant, Tamnar vide letters No.J.13012/117/2008-IA.II (T) dated 18/03/2011 & amendment vide letter No.J.13012/117/2008-IA.II (T) dated 04/11/2011, 10/01/2014, 27.03.2015, 22.12.2016, 26.04.2017 and 28.8.2020.

Sl. No	Conditions	Compliance Status
(i)	Environmental clearance shall be applicable for 2x600 MW. However at a later stage when firm coal linkage for third and fourth unit of 600 MW are also available, the project proponent may request the Ministry for inclusion of these units of 600 MW each, for which the Ministry shall consider appropriately.	Ministry has granted Environmental Clearance for 2x600 MW (Units-3&4) vide Letter No.J-13012/117/2008-IA.II(T) dated 04/11/2011.
(ii)	(As amended vide MoEF letter No. J-13012/117/2008-IA. II (T) dt. 4/11/2011) Prior permission/clearance from the Ministry of Coal shall be obtained before undertaking construction activity for the expansion project.	Permission has been obtained from Ministry of Coal vide letter dated 01/11/2011.
(iii)	Vision document specifying prospective plan for the site shall be formulated and submitted to the Ministry within six months.	Vision document has been submitted to the Ministry & its Regional Office-Bhopal vide letter No. JPL/EMD/2x600MW/2011/194 dated 10/09/2011.
(iv)	Provision for installation of FGD shall be provided for future use.	Space provision has been provided for installation of FGD in future use.
(v)	High Efficiency Electrostatic Precipitators (ESPs) shall be installed to ensure that particulate emission does not exceed 50 mg/Nm ³ . Adequate dust extraction system such as cyclones/ bag filters and water spray system in dusty areas such as in coal handling and ash handling points, transfer areas and other vulnerable dusty areas shall be provided.	The ESP's are designed to achieve particulate emission below 50 mg/Nm ³ . Adequate dust extraction system and dust suppression system in coal handling and ash handling points, transfer areas and other vulnerable dusty areas have been provided.
(vi)	Sulphur and ash contents in the coal to be used in the project shall not exceed 0.5 % and 34 % respectively at any given time. In case of variation of coal quality at any point of time fresh reference shall be made to MoEF for suitable amendments to environmental clearance condition wherever necessary.	The condition has been updated by MoEF&CC vide its notification no. S.O. 1561 (E) dated 21.05.2020. As per the said notification, MoEF&CC has permitted use of coal by TPPs without stipulations as regards to ash content or distance. The MoEF&CC vide this notification has stipulated that the existing ECs stand modified so as to make the above condition operative.
(vii)	Stack of 275 m height shall be installed and provided with continuous online monitoring equipments for SO _x , NO _x and Particulate Matter. Exit velocity of flue gases shall not be less than 22 m/sec. Mercury emissions from stack may also monitored on periodic basis.	Twin flue stacks of 275 meters height with continuous online monitoring instrument for SO _x , NO _x and Particulate Matter have been provided at Unit-1, Unit-2 & Unit-3 & Unit-4. COD for Unit-1 is on 14.03.2014, COD for Unit-2 is on 31.03.2014, COD for Unit-3 is on 15.01.2015 & COD for Unit-4 is on 12.12.2016 and flue gas exit velocity of 22 m/sec is being

		maintained and report for the period of April 2022 to September 2022 is enclosed as Annexure-I . Mercury emissions from stack is being monitored periodically.
(viii)	Existing de-generated water bodies (if any) in the study area shall be regenerated at the project proponent's expenses in consultation with the state Govt.	Revival/regeneration of 65 nos. of water bodies by de-silting /deepening in the study area has already been done under CSR activities in consultation with District administration.
(ix)	Detailed hydro-geological study shall be conducted (including sustainability of water source study) shall be carried out by an institute of repute and report submitted to the Regional Office (RO) of the ministry. Further hydro-geological study shall be reviewed annually from an institute/ organization of repute to assess impact of surface water and ground regime (especially around ash dyke). In case and deterioration is observed specific mitigation measures shall be undertaken and reports/ data of water quality monitored regularly and maintained shall be submitted to the RO of the Ministry.	National Institute of Hydrology (NIH), Roorkee has carried out detailed Hydro-geological study. The report was submitted to MoEF & its Regional Office vide letter No. JPL/EMD/4x600MW/2011/228 dated 14/12/2011. IIT(ISM) Dhanbad through annual Environmental audit reviews ground water and surface water monitoring reports to assess if any deterioration has occurred. Water quality monitoring reports are regularly submitted to RO. Water quality monitoring reports for the period April, 2022 to August, 2022 are attached as Annexure -7(a) & (b)
(x)	Source of water for meeting the requirement during lean season shall be specified and submitted to the Regional Office of the Ministry within three months.	Source of water for meeting the requirement during lean season was already specified and submitted to the Regional Office of the Ministry vide letter No. JPL/EMD/2x600MW/JULY-11/15 dated 04/07/2011.
(xi)	No ground water shall be extracted for use in operation of the power plant even in lean season.	No ground water was extracted for use in power plant operation.
(xii)	No water bodies (including natural drainage system) in the area shall be disturbed due to activities associated with the setting up / operation of the power plant.	There are no water bodies within the project site.
(xiii)	Minimum required environmental flow suggested by the Competent Authority of the State Govt. shall be maintained in the Channel/ Rivers (as applicable) even in lean season.	Will be complied, whenever stipulated.
(xiv)	COC of 5.0 shall be adopted. The treated effluents conforming to the prescribed standards only shall be re-circulated and reused within the plant. There shall be no discharge outside the plant boundary except during monsoon. Arrangements shall be made that effluents and storm water do not get mixed. A sewage treatment plant shall be provided (as applicable) and the treated sewage shall be used for raising greenbelt/plantation.	Cooling water system with COC of 5.0 is being adopted. Separate storm water drains are provided, hence there is no chance of mixing of effluents with storm water. The project has been designed with zero discharge concept. As stipulated, treated sewage is being used completely for raising greenbelt/plantation purpose.
(xv)	Additional soil for levelling of the proposed site shall be generated within the sites (to the extent possible) so that natural drainage system of the	Topography of the site is more or less flat. Therefore leveling works are not required.

	area is protected and improved.	
(xvi)	Utilisation of 100% Fly Ash generated shall be made from 4 th year of operation. Status of implementation shall be reported to the Regional Office of the Ministry from time to time.	Noted, Implementation status report is being submitted time to time.
(xvii)	Fly ash shall be collected in dry form and storage facility (silos) shall be provided. Unutilized fly ash shall be disposed off in the ash pond in the form of slurry form. Mercury and other heavy metals (As, Hg, Cr, Pb etc.) will be monitored in the bottom ash as also in the effluents emanating from the existing ash pond. No ash shall be disposed off in low lying area.	We have incorporated total ash utilization as integral part of the project. We have installed dry fly ash extraction system with 4 nos of silos of adequate capacity 2300 Tonnes each so that ash generated during the power generation is collected in dry form. Unutilized fly ash is being disposed off in the ash dyke in the form of slurry. Mercury & other heavy metals (As, Hg, Cr, Pb etc.) is being monitored in the bottom ash and in the effluents emanating from the existing ash pond.
(xviii)	Ash pond shall be lined with HDP/LDPE lining or any other suitable impermeable media such that no leachate takes place at any point of time. Adequate safety measures shall also be implemented to protect the ash dyke from getting breached.	Noted, HDP/LDPE lining will be carried out in the proposed Ash dyke.
(xix)	Disposal of Bottom Ash in abandoned mines (if proposed to be undertaken) shall be carried out only after obtaining permission from DGMS and it shall be ensured that the bottom and sides of the mined out areas are adequately lined with clay before Bottom Ash is filled up. The project proponent shall inform the State Pollution Control Board well in advance before undertaking the activity.	Noted, Permission from DGMS will be obtained for disposal of Bottom Ash in abundant mines.
(xx)	Green Belt consisting of 3 tiers of plantations of native species around plant and at least 100 m width shall be raised. Wherever 100 m width is not feasible adequate Green Belt shall be raised and detail justification shall be submitted to the Ministry. Tree density shall not less than 2500 per ha with survival rate not less than 85 %.	Action plan for green belt development and details regarding the feasibility of green belt development was submitted to Ministry & its Regional office vide letter Nos.JPL/EMD/2x600MW/JULY-11/156 & No.JPL/EMD/4x600MW/2012/359 dated 04/07/2011 & 01/12/2012. Wide Green belt consisting of three tiers of plantation of broad leaf local species of 100 meter width all along the periphery of the plant is being developed/ strengthened on continuous basis. Plantation details for the year 2022-23 (till Sep-22) is enclosed as Annexure -II .
(xxi)	The project proponent shall also adequately contribute in the development of the neighbouring villages. Special package with implementation schedule for providing fluoride free potable drinking water supply in the nearby villages and schools shall be undertaken in a time bound manner.	JPL under its CSR activities has undertaken several community development programmes for fulfillment of the basic needs of the neighboring villagers. Further as per Govt. PHE department survey, all the neighboring villages of project area are free from fluoride contaminated water, hence there is no need to supply fluoride free potable drinking water in the villages and schools.

(xxii)	Further an amount of atleast 0.4% of the cost of the project (for 2x600 MW) shall be earmarked as one time capital cost for CSR programme as committed by the project proponent. Subsequently a recurring expenditure 1/5 th of the above per annum shall be earmarked till the operation of plant as recurring expenditure for CSR activities. Details of the activities to be undertaken shall be submitted within six month along with road map for implementation.	The CSR activities progress report for the financial year, 2022-23 (April-2022 to Sept-2022) is enclosed as Annexure-III.
(xxiii)	While identifying CSR activities it shall be ensured that need based assessment for the nearby villages within study area shall be conducted to study economic measures with action plan which can help in upliftment of poor section of society. Income generating projects consistent with the traditional skills of the people shall be undertaken. Development of fodder farm, fruit bearing orchards, vocational training etc. can form a part of such programme. Company shall provide separate budget for community development activities and income generating programmes. Vocational training programme for possible self-employment and jobs shall be imparted to identified villagers free of cost.	The CSR plan for the year 2022-23 has been prepared and subsequently the work plans have been rolled out in the field. The activities are being implemented under the following thematic heads: 1. Health & Nutrition 2. Drinking water & Sanitation 3. Community Education 4. Enterprenorship Development & women empowerment 5. Environment 6. Agriculture Development 7. Sports, Art and Culture 8. Social Inclusion 9. Rural Infrastructure Development The detail of the need based activities in nearby villages for the period of FY-2022-23 (April to Sept- 2022) is enclosed as Annexure-IV.
(xxiv)	It shall be ensured that in-built monitoring mechanism for the schemes identified is in place and annual social audit shall be got done from the nearest government institute of repute in the region. The project proponent shall also submit the status of implementation of the scheme from time to time.	To ensure the schemes operating well, the organization has its own in-built monitoring cell. The Impact study through Community Satisfaction Index is being carried out by NABCONS (NABARD Consultation Pvt. Ltd.). The final report has been received.
(xxv)	For the tribal families affected directly or indirectly (if any) by the proposed project, specific schemes for up-liftment of their sustainable livelihood shall be prepared with time bound implementation and in-built monitoring programme. The status of implementation shall be submitted to the Regional Office of the Ministry from time to time.	Schemes for the tribal families are being implemented. The status of activities is enclosed as Annexure-V.
(xxvi)	(As amended vide MoEF letter No. J-13012/117/2008-IA. II (T) dt. 10/01/2014) Information on all new activities like proposed settling up of a Coal Handling Plant, a Coal Gasification Plant, Coal stock yard etc. including the proposed pipe coal conveyer from Prasada to M/s JPL, at Tamnar shall be brought to the notice of the people both through EIA/EMP studies and at the time of the Public hearing for the proposed	Permission for the installation of coal crusher with in the plant and transportation of coal by road for period of three years was granted by MoEF on 10.01.2014. Subsequently, JPL was granted amendment in EC by MoEF&CC on 26.04.2017 permitting coal transportation by road & coal crushing facility within plant site for further 30 months.

	Steel Plant of M/s JSPL in an explicit, comprehensive and understandable fashion. However as an interim arrangement as the above may take some time, the coal handling plant may be setup at the thermal power site for crushing coal obtained from SECL and MCL mines located between 20-50 Kms distances. The coal crusher at the plant site is permitted as an interim measure and would be dismantled after the lapse of interim period of three years. The transportation of coal from these mines by road may be undertaken for a limited period of three years from the date of issue of this letter, by which time the pipe conveyer shall be put in place for coal transportation".	MoEF&CC vide letter dated 28.08.2020 permitted use of coal crusher facility already installed within the plant premises and also extended the permission for coal transportation by road till 20.05.2020. Coal transportation by road from 21.05.2020 onwards is governed Ministry's Gazette Notification vide S.O. 1561 (E) dated 21 st May, 2020.
	Additional Specific Conditions (As EC amended vide MoEF letter No. J-13012/117/2008-IA. II (T) dt. 10/01/2014)	
(xxvii)	Power generated from Unit-1&2 (2x600 MW) domestic coal linkage, shall be sold / supplied on tariff based bidding or through competitive bidding route on long term Power Purchase Agreement with State distribution companies (DISCOMS).	Noted, Power is being supplied from unit-1 & 2 of 600 mw through long term PPA to KSEB, TNEB, CSEB.
xxviii)	Avenue plantation along the route (both sides of the road) of coal transportation from SECL and MCL mines over distances varying from 20 to 50 kms shall be raised by the project proponent at its own cost. The status of implementation shall be submitted to the Regional Office of the Ministry.	Avenue plantation along the route (both sides of the road) of coal transportation from SECL and MCL mines is being done on continuous basis.
xxix)	It shall be ensured that only mechanized covered trucks are used for coal transportation	Noted for compliance.
xxx)	A long term study of radio activity and heavy metals contents on coal to be used shall be carried out through a reputed institute. Thereafter mechanism for an in-built continuous monitoring for radio activity and heavy metals in coal and fly ash (including bottom ash) shall be put in place.	The radioactivity in coal was analysed by BARC for determination of Radioactivity in Coal and fly ash. Study of heavy metals contents in coal and fly ash from a reputed institute/organization is carried out regularly. Study report is already submitted to MoEF&CC.
xxxi)	Recommendation made by CEA in its report for setting up of crusher and dumper hopper as given under shall be strictly implemented: • The dust extraction / collection and suppression facilities to be installed at the coal crushing site.	Water sprinkling systems have been installed at crushers area, transfer points etc to control fugitive dust emissions. Dust extraction system equipped with 02 bag filters have already been installed.
xxxii)	The existing water reservoir and water allocation for the existing 1000 MW plant shall be utilized for an interim period not exceeding three years by which time the system shall be put in place for self sustenance of the expansion units.	JPL has obtained amendment in EC from MoEF&CC on 26.04.2017 for use existing water reservoir of 1000 MW power plant.
xxxiii)	The existing ash dyke shall be utilized for the expansion for an interim period not exceeding	JPL has obtained amendment in EC from MoEF&CC on 28.10.2021 for using the

	three years subject to ash dyke having necessary capacity to handle additional ash on account of the expansion units. A new ash dyke shall be constructed within three years to meet the requirement of substantial quantity of ash that would be generated by the expansion plant.	existing ash dyke of 4x250 MW for disposal of unutilized ash of 4x600 MW till December, 2022.
	Additional Specific Conditions (As EC amended vide MoEF letter No. J-13012/117/2008-IA. II (T) dt. 27/03/2015)	
(xxxiv)	The coal transportation by road shall be through mechanically covered trucks only.	Noted for compliance
(xxxv)	Avenue plantation of 2/3 rows all along the coal transportation route (both side of the road shall be carried out by the project proponent at its own expenses and in consultation with the state Government Authorities. The status of the implementation shall be submitted to the Regional Office of the Ministry.	Avenue plantation along the route (both sides of the road) of coal transportation from SECL and MCL mines is being done on continuous basis.
(xxxvi)	Periodic maintenance of the road for coal transportation shall be done by the project proponent at its own expenses and shall also facilitate the traffic control on the road in consultation with the state Government Authorities.	Complied with
(xxxvii)	Harnessing solar power within the premises of the plant particularly at available roof tops shall be undertaken and status of implementation shall be submitted periodically to the Regional Office of the Ministry.	1 MW roof top solar systems has been installed for solar power generation & 50 nos solar street lights has been installed at residential colony. The details of solar system power generation from April 2022 to September 2022 is enclosed as Annexure-VIII .
(xxv)	Fugitive emission shall be controlled to prevent impact on agricultural or non-agricultural land.	All the steps are being taken to avoid the fugitive dust generation and its suppression
xxvi)	Fly ash shall not be used for agriculture purpose. No mine void filling will be undertaken as an option for ash utilization without adequate lining of mine with suitable media such that no leachate shall take place at any point of time. In case, the option of mine void filling is to be adopted, prior detailed study of soil characteristics of the mine area shall be undertaken from an institute of repute and adequate clay lining shall be ascertained by the State Pollution Control Board and implementation done in close co-ordination with the State Pollution Control Board.	IIT-Kharagpur has been engaged for monitoring of long-term impacts of dumping of fly ash and leaching of heavy metals on soil and water of study area. There is no sign of increasing level of heavy metals in the soil/ground water.
xxvii)	Green belt shall also be developed around the Ash Pond over and above the Green Belt around the plant boundary.	Noted, Green belt will be developed around the proposed new Ash dyke.
xxviii)	The project proponent shall formulate a well laid corporate environment policy and identify and designate responsible officers at all levels of its hierarchy for ensuring adherence to the policy and compliance with the condition stipulated in this clearance letter and other applicable	Complied. Policy is already in place and is being complied with.

	environment laws and regulations.	
	General Conditions as EC vide MoEF letter No. J-13012/117/2008-IA. II (T) dt. 18/03/2011	
	General Conditions	Compliance Status
(i)	A well designed rainwater harvesting shall be put in place before commissioning of the plant. Central Groundwater Authority/ Board shall be consulted for finalization of appropriate rainwater harvesting technology/design within a period of three months from the date of this clearance and details shall be furnished.	A detailed scheme for rainwater harvesting to recharge the ground water aquifer has been prepared in consultation with Central Ground Water Board-New Delhi & Central Ground Water Board-Raipur by engaging National Institute of Hydrology, Roorkee and copy of the same has already been submitted to the Ministry of Environment and Forests, Government of India, Head Office and Regional Office, Bhopal, Chhattisgarh Environment Conservation Board vide Letter No. JPL/EMD/4x600MW/2011/228 dated 26/12/2011. The scheme has been approved by Central Ground Water Board, Raipur vide Letter No. 30-11/Compliance/CGWA/NCCR/TS/075 dated 28/10/2013. The drawing of RWH system has been finalized and the same implementation. A rain water harvesting pond capacity of 35,000 m3 has been made for rainwater harvesting and to recharge the ground water table.
(ii)	Adequate safety measures shall be provided in the plant area to check/minimize spontaneous fires in coal yard, especially during summer season. Copy of these measures with full details along with location plant layout shall be submitted to the Ministry as well as to the Regional Office of the Ministry.	Drawing & documents has been finalized and the same was submitted to the Ministry as well as to the Regional Office of the Ministry vide letter No. JPL/EMD/4x600MW/2013/497 dated 24.10.2013. As per scheme, adequate safety measures like hydrant points and water monitor points, etc are installed in and around the coal yard and project area.
(iii)	Storage facilities for auxiliary liquid fuel such as LDO and/ HFO/LSHS shall be made in the plant area in consultation with Department of Explosives, Nagpur. Sulphur content in the liquid fuel will not exceed 0.5%. Disaster Management Plan shall be prepared to meet any eventuality in case of an accident taking place due to storage of oil.	Petroleum & Explosives Safety Organisation (PESO), Nagpur has granted license for storage of 1200 KL LDO within the plant area vide letter dated 29/10/2012. Disaster Management Plan, risk assessment & emergency response plan has already incorporated in the Final EIA report.
(iv)	Regular monitoring of ground water level shall be carried out by establishing a network of existing wells and constructing new piezometers. Monitoring around the ash pond area shall be carried out particularly for heavy metals (Hg,Cr,As,Pb) and records maintained and submitted to the Regional Office of this Ministry. The data so obtained should be compared with the baseline data so as to ensure that the ground water quality is not adversely affected due to the project.	A network of existing wells is being established and piezometers are constructed for ground water level and quality monitoring. Piezometers will be installed around the ash dyke for monitoring the ground water as stipulated.
(v)	Monitoring surface water quantity and quality	Complied.

	shall also be regularly conducted and records maintained. The monitored data shall be submitted to the Ministry regularly. Further, monitoring points shall be located between the plant and drainage in the direction of flow of ground water and records maintained. Monitoring for heavy metals in ground water shall be undertaken.	The monitoring data are attached as Annexure-VI (a) & VI (b) .
(vi)	First Aid and sanitation arrangements shall be made for the drivers and other contract workers during construction phase.	Complied.
(vii)	Noise levels emanating from turbines shall be so controlled such that the noise in the work zone shall be limited to 75 dBA. For people working in the high noise area, requisite personal protective equipment like earplugs/ear muffs etc. shall be provided. Workers engaged in noisy areas such as turbine area, air compressors etc shall be periodically examined to maintain audiometric record and for treatment for any hearing loss including shifting to non noisy/less noisy areas.	Noise level is being maintained within the prescribed limit. Earplugs & Earmuffs have been provided to the employees working in the high noise areas.
(viii)	Regular monitoring of ambient air ground level concentration of SO ₂ , NO _x , PM _{2.5} & PM ₁₀ and Hg shall be carried out in the impact zone and records maintained. If at any stage these levels are found to exceed the prescribed limits, necessary control measures shall be provided immediately. The location of the monitoring stations and frequency of monitoring shall be decided in consultation with SPCB. Periodic reports shall be submitted to the Regional Office of this Ministry. The data shall also be put on the website of the company.	The location of the Ambient Air Quality Monitoring (AAQM) Stations and frequency of monitoring has already been decided in consultation with CECB-Raipur. SO ₂ , NO _x , PM _{2.5} & PM ₁₀ in Ambient Air are being monitored in and around the power plant and records are being maintained. The reports for the period from April 2022 to September 2022 are enclosed as Annexure- VII(a) to VII(f) .
(ix)	Provision shall be made for the housing of construction labour (as applicable) within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.	Complied.
(x)	The project proponent shall advertise in at least two local newspapers widely circulated in the region around the project, one of which shall be in the vernacular language of the locality concerned within seven days from the date of this clearance letter, informing that the project has been accorded environmental clearance and copies of clearance letter are available with the State Pollution Control Board/Committee and may also be seen at Website of the Ministry of Environment and Forests at http://envfor.nic.in .	Information regarding grant of Environmental Clearance has already been advertised in two local newspapers (Kelo Pravah in vernacular language and Nav Bharat in English) on 23/03/2011 & 24/03/11 respectively. The copies of advertisements were already submitted to Regional Office of Ministry vide letter No.JPL/EMD/2X600MW/MAY-11/137 dated 24/05/2011.
(xi)	A copy of the clearance letter shall be sent by the	A copy of the clearance letter has already

	proponent to concerned Panchayat, Zila Parishad / Municipal Corporation, urban local Body and the Local NGO, if any, from whom suggestions/representations, if any, received while processing the proposal. The clearance letter shall also be put on the website of the Company by the proponent.	been sent to concerned District panchayats and NGO vide letter dated 07/04/2011. The clearance letter has already been uploaded on website of JPL.
(xii)	An Environmental Cell shall be created at the project site itself and shall be headed by an officer of appropriate seniority and qualification. It shall be ensured that the head of the Cell shall directly report to the head of the organization.	Well equipped Environmental Cell at JPL, headed by Senior Executive directly reporting to the head of the project is already in place.
(xiii)	The proponent shall upload the status of compliance of the stipulated environmental clearance conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MOEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely; SPM, RSPM (PM _{2.5} & PM ₁₀), SO ₂ , NO _x (ambient levels as well as stack emissions) shall be displayed at a convenient location near the main gate of the company in the public domain.	Compliance of the stipulated environmental clearance conditions is being regularly uploaded on website of JPL. Compliance report is being submitted to the Regional Office of MoEF, Zonal Office of CPCB, Bhopal and the CECB, Raipur.
(xiv)	The environment statement for each financial year ending 31 st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of environmental clearance conditions and shall also be sent to the respective Regional Offices of the Ministry by e-mail.	The environmental statement for the financial year 2021-22 has been submitted to State Pollution Control Board (CECB, Raipur) on 24 September 2022. Status of compliance of environmental clearance conditions is being regularly uploaded on website of JPL.
(xv)	The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental safeguards to the Ministry of Environment and Forests, its Regional Office, Central Pollution Control Board and State Pollution Control Board. The project proponent shall upload the status of compliance of the environment of the environmental clearance conditions on their website and update the same periodically and simultaneously send the same by e-mail to the Regional Office, Ministry of Environment and Forests.	Compliance report is being submitted to the Regional Office of MoEF, Zonal Office of CPCB, Bhopal and CECB, Raipur. The same was sent by e-mail to the Regional Office of MoEF. Status of compliance of environmental clearance condition is being regularly uploaded on website of JPL.
(xvi)	Regional Office of the Ministry of Environment & Forests will monitor the implementation of the stipulated conditions. A complete set of documents including Environmental Impact Assessment Report and Environment Management Plan along with the additional	A complete set of documents including EIA Report and EMP along with the additional information to the Regional Office will be provided for use Regional office of MoEF, during monitoring. Compliance status is being regularly uploaded on website of JPL. The

	information submitted from time to time shall be forwarded to the Regional Office for their use during monitoring. Project proponent will up-load the compliance status in their website and update the same from time to time at least six monthly basis. Criteria pollutants levels including NO _x (from stack & ambient air) shall be displayed at the main gate of the power plant.	data including NO _x is being displayed at the main gate of power plant.
(xvii)	Separate funds shall be allocated for implementation of environmental protection measures along with item-wise break-up. These cost shall be included as part of the project cost. The funds earmarked for the environment protection measures shall not be diverted for other purposes and year-wise expenditure should be reported to the Ministry.	Separate fund has been allocated for implementation of environmental protection measures and cost is included as part of the project cost. The fund earmarked for the environment protection measures with item-wise break-up was submitted to Regional Office of Ministry vide letter No.JPL/EMD/2X600MW/MAY-11/137 dated 24/05/2011. The fund earmarked for the environment protection measures will not be diverted for other purposes.
(xviii)	The project authorities shall inform the Regional Office as well as the Ministry regarding the date of financial closure and final approval of the project by the concerned authorities and the dates of start of land development work and commissioning of plant.	Grant of Permission to establish by CECB, Raipur and date of start of development work has already been informed to Regional Office as well as the Ministry vide letter No.JPL/EMD/4x600MW/2011/231 dated 27/12/2011. The COD (commercial operation declaration) of Unit-1, 2, 3 & 4 are 14.03.2014, 31.03.2014, 15.01.2015 & 12.12.2016 respectively.
(xix)	Full cooperation shall be extended to the Scientists/Officers from the Ministry / Regional Office of the Ministry at Bangalore / CPCB/ SPCB who would be monitoring the compliance of environmental status.	Noted.
7	The Ministry of Environment and Forests reserves the right to revoke the clearance if conditions stipulated are not implemented to the satisfaction of the Ministry. The Ministry may also impose additional environmental conditions or modify the existing ones, if necessary.	Noted.
8	The environmental clearance accorded shall be valid for a period of 5 years to start operations by the power plant.	Noted.
9	Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.	Noted.
10	In case of any deviation or alteration in the project proposed including coal transportation system from those submitted to this Ministry for clearance, a fresh reference should be made to the Ministry to assess the adequacy of the	Noted.

	condition(s) imposed and to add additional environmental protection measures required, if any.	
11	The above stipulations would be enforced among others under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and rules there under, Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 and its amendments, the Public Liability Insurance Act, 1991 and its amendments.	Noted.
	Additional Conditions (As EC amended vide MoEF letter No. J-13012/117/2008-IA. II (T) dt. 26/04/2017)	
i	Use of existing ash dyke is permitted for two more years.	JPL has obtained amendment in EC from MoEF&CC on 28.10.2021 for using the existing ash dyke of 4x250 MW for disposal of unutilized ash of 4x600 MW till December, 2022.
ii	Transport coal by road and installation of crushing facility located within the plant premises for thirty months for all the units.	JPL has obtained amendment in EC from MoEF&CC on 28.08.2020 for coal transportation by road till 20.05.2020 and from 21.5.2020 onward is governed by Ministry's Gazette Notification vide S.o. 1561 (E) dated 21st May, 2020. MOEF&CC has also permitted for coal crusher facility within plant premises.
iii	Use of existing water reservoir for expansion of 4X250 MW TPS is permitted.	Noted.
iv	Change in coal source from imported to domestic coal for Units 3 & 4 is allowed. Coal source from Kulda OCP-MCL (Road: 42 km, CCPC: 7 km), Gare Pelma-IV/ 1, IV/ -2 & IV/ -3-SECL (CCPC: 7 km), Baroud Mines-SECL (Road: 40 km) and Chhal Mine-SECL (Road: 49 km) mines is permitted. Total quantity of coal to be transported through road/CCPC shall not exceed 4.81 MTPA for Unit-3&4 (2x600 MW).	Noted.
v	Details of coal characteristics, source & location of coal mine, traffic study shall be submitted to the Ministry after getting allocation of coal through forward e-auction or any other scheme notified by M/s Coal India Limited.	Coal is being sourced from the above mentioned mines in condition (iv). However, the Company will submit details as & when source of coal is changed.
vi	Coal transportation shall be preferably by rail or pipe/belt conveyor after thirty months only.	JPL has obtained amendment in EC from MoEF&CC on 28.08.2020 for coal transportation by road till 20.05.2020 and from 21.5.2020 onward is governed by Ministry's Gazette Notification vide S.o. 1561 (E) dated 21st May, 2020.
vii	Any variance in coal characteristics/source/mode of transport, it shall be brought along with environment and traffic impact assessment study to the Ministry for assessing the adequacy of the conditions already stipulated or to incorporate	Noted.

	any additional condition as may be necessary in the interest of environment protection.	
viii	Change in location of ash dyke from Rodapalli to near Dolesara village is allowed.	Noted.
ix	Plantation along CCPC shall be carried out. Fruit bearing, neem and local indigenous species shall be planted.	Noted.
x	MoEFCC Notification S.O. 3305(E) dated 7.12.2015 shall be implemented with respect to specific water consumption, zero liquid discharge and revised emission standards, as applicable.	Noted.
xi	MoEF&CC Notification G.S.R 02(E) dated 2.1.2014 regarding use of raw or blended or beneficiated or washed coal with ash content not exceeding 34% shall be complied with, as applicable.	Not applicable as the Notification G.S.R 02 (E) has been superseded by the MoEF&CC's notification dated 21.05.2020 wherein the Ministry has permitted use of coal by TPPs without stipulations as regards to ash content or distance.
xii	MoEF&CC Notifications on flyash utilization S.O. 763(E) dated 14.09.1999, S.O. 979(E) dated 27.08.2003, S.O. 2804(E) dated 3.11.2009, S.O. 254(E) dated 25.01.2016 and subsequent amendments shall be complied with.	Noted.
xiii	As proposed, ash pond shall be lined with HDPE liner.	Noted, HDP/LDPE lining will be carried out in the proposed Ash dyke.
xiv	Third party evaluation/ Environment Audit shall be conducted annually for reviewing the compliance conditions stipulated in the clearances along with the baseline data/ studies carried out and the audit report shall be submitted to Ministry's Regional office.	ISM Dhanbad is conducting annual Environmental Audit for reviewing the compliance conditions stipulated in the clearances.
xv	Compliance of EC/amendment conditions, Environment (Protection) Act, 1986, Rules and MoEF&CC Notifications issued time to time shall be achieved by an Environment Officer to be nominated by the Project Head of the Company who shall be responsible for implementation and necessary compliance timely.	GM (Env) is responsible for implementation of EC conditions, EPA rules and MoEF&CC notifications. He is directly reporting to Project head.
Additional Conditions (As EC amended vide MoEF letter No. J-13012/117/2008-IA. II (T) dt. 28/08/2020)		
i	The coal transportation from 21.5.2020 onward is governed by Ministry's Gazette Notification vide S.o. 1561 (E) dated 21st May, 2020.	Noted
ii	The details of quantities of ash generation, utilization to various purposes such as brick manufacturing, construction, soil condition & cement manufacturing and disposal shall be provide for six months (April- September & October- March) in the six monthly compliance report.	The fly ash generation and utilization report for the period of April, 2022 to September, 2022 is attached as Annexure-IX .
iii	As per the Ministry's fly ash amendment Notification vide S.O. 254 (E) dated 25.01.2016, the company shall upload the details of stock of each type of ash generated/available from all the	Complied with.

	units (4X250 MW and 4X600 MW) on their website and shall update the stock position regularly.	
iv	As per the Ministry's fly ash amendment Notification vide S.O. 254 (E) dated 25.01.2016 , the fly ash shall be supplied to various utilising units. The cost of transportation of ash for road construction projects or for manufacturing of ash based products or use as soil conditioner in agriculture activity within a radius of hundred km from thermal power station shall be borne by the company and the cost of transportation beyond the radius of hundred km and up to three hundred km shall be shared equally between the user and the company.	Noted
v	For achieving compliance of fly ash notification, a map and details of ash utilising units within 100 km radius and 100-300 km along with quantity of ash required for each unit shall be prepared and submitted to the Ministry within 3 months.	The details of ash utilising units within 100 km radius and 100-300 km along with quantity of ash required has been submitted to Ministry vide letter no JPL/EMD/F-33/4X600MW TPP/ OCT-20/377 dated 16.11.2020.
vi	A public notice in major daily newspapers shall be published in both vernacular and English that the fly ash/bottom ash will be supplied free of cost for ash utilising units located within 100 km radius and the cost of transportation will be shared equally between user and company for ash utilising units located in the radius of 100-300 km , in compliance to the fly ash amendment notification dated 25.01.2016. A copy of newspaper advertisement shall be submitted to Regional office.	A public notice has been issued in two major newspapers (Hitavada in English and Naveen Kadam in vernacular language) on 04/11/2020 & 11/11/2020 respectively. The copy of advertisements is attached as Annexure-X.
vii	While commissioning the proposed project, the compliance of applicable revised emission norms vide Notification dated 07.12.2015 , shall be achieved along with specific water consumption as per the notification issued vide dated 28.6.2018. The FGD system, NOX control measures such as SCR/SCNR/De-Nox burners shall be installed to achieve the revised emission norms.	Noted.
viii	Coal crusher inside the plant premises is permitted which is to be set up with bag filters /dust suppression to control air pollution generated due to coal crushing, coal transfer, etc. Air quality monitoring is to be done in and around the crusher house once a month to assess the pollution causing in the vicinity	Already commissioned with requisite pollution control measures, as stipulated
ix	The progress and readiness of railway line being constructed by M/s Chhattisgarh East Railway Limited from Gharghoda till Bhalumuda shall be submitted along with compliance report.	The railway station of Bhalumuda has been commissioned on March 2022.
x	The physical and financial progress of private siding by the company and take off line from	Feasibility study for the above project has been submitted. DPR is in progress and after

	Bhalumunda station shall be submitted. A copy of detailed Project Report (DPR) approved by South East Central Railway (SECR) is also to be submitted.	completion of DPR, it will be submitted to South East Central Railway (SECR) for approval.
xi	Traffic Marshals at kudumkera village, Baroud Village, Samaruma village and Jhingolpara village along the route of Kulda/Basundhara mines and chhal/Barodh mines shall be developed at the cost of project proponent to streamline the traffic as the total traffic is exceeding the design volume	Complied with
xii	Water sprinkling on the road shall be done during transportation along the routes.	Complied with
xiii	Avenue plantation shall be carried out in consultation with Social Forestry Department of the State Govt. along the proposed routes.	Avenue plantation along the route (both sides of the road) of coal transportation from SECL and MCL mines is being done on continuous basis.
	Additional Conditions (As EC amended vide MoEF letter No. J-13012/117/2008-IA. II (T) dt. 28/10/2021)	
i.	PP shall strictly adhere to the guidelines as per MO number 22-13/2019-AI.III dated 28 th August 2019 & CPCB guidelines for filling of ash in the low lying area & accordingly proper study to be conducted regarding the impact on various parameters such as ground water, leachate, stability & as per above guidelines along with statutory permission & submit to Ministry's regional Office.	Ground water leachate study report , Annual Fly ash audit report and statutory permission for filling of ash in the low lying area is attached as Annexure X A , XB, XC
ii.	100% ash utilization shall be carried out considering the fly ash as a resource and not a waste.	The fly ash generation and utilization report for the period of April, 2022 to September, 2022 is attached as Annexure-IX .
iii.	Extension of permission to use ash pond for disposal of unutilized ash generated from 4X600 MW Coal based Thermal Power Plant is strictly subject to 100% utilization of ash.	Noted.

	Bhalumunda station shall be submitted. A copy of detailed Project Report (DPR) approved by South East Central Railway (SECR) is also to be submitted.	completion of DPR, it will be submitted to South East Central Railway (SECR) for approval.
xi	Traffic Marshals at kudumkera village, Baroud Village, Samaruma village and Jhingolpara village along the route of Kulda/Basundhara mines and chhal/Barodh mines shall be developed at the cost of project proponent to streamline the traffic as the total traffic is exceeding the design volume	Complied with
xii	Water sprinkling on the road shall be done during transportation along the routes.	Complied with
xiii	Avenue plantation shall be carried out in consultation with Social Forestry Department of the State Govt. along the proposed routes.	Avenue plantation along the route (both sides of the road) of coal transportation from SECL and MCL mines is being done on continuous basis.
	Additional Conditions (As EC amended vide MoEF letter No. J-13012/117/2008-IA. II (T) dt. 28/10/2021)	
i.	PP shall strictly adhere to the guidelines as per MO number 22-13/2019-AI.IIIdated 28 th August 2019 & CPCB guidelines for filling of ash in the low lying area & accordingly proper study to be conducted regarding the impact on various parameters such as ground water, leachate, stability & as per above guidelines along with statutory permission & submit to Ministry's regional Office.	Noted.
ii.	100% ash utilization shall be carried out considering the fly ash as a resource and not a waste.	The fly ash generation and utilization report for the period of April, 2022 to September, 2022 is attached as Annexure-IX .
iii.	Extension of permission to use ash pond for disposal of unutilized ash generated from 4X600 MW Coal based Thermal Power Plant is strictly subject to 100% utilization of ash.	Noted.

Jindal Power Limited, Tamnar

Compliance Report of Environmental Clearance for Expansion of 4x250 MW by addition of 2x600 MW (Units-3& 4) Coal Based Thermal Power Plant, Tamnar issued vide letter No.J.13012/117/2008-IA.II (T) dated 04/11/2011 and amendment vide letter No.J.13012/117/2008-IA.II (T) dated 26/04/2017.

Sl. No	Conditions	Compliance Status
(i)	The company shall comply with all the conditions stipulated in environmental clearance of even no. dated 18.03.2011 except the specific condition no.i	All the conditions stipulated in environmental clearance of even no. dated 18/03/2011 has been complied.
(ii)	Prior permission/clearance from the Ministry of Coal shall be obtained before undertaking construction activity for the expansion project.	Permission has been obtained from Ministry of Coal vide letter dated 01/11/2011 and construction is in progress.
(iii)	In case source of fuel supply is to be changed at a later stage for the proposed 2x600 MW (Units 3 and 4) now proposed to be run on imported coal from M/s JSPL Mozambique Minerals LDA, the project proponent shall intimate the Ministry well in advance along with necessary requisite documents for its concurrence for allowing the change.	JPL has obtained amendment in EC from MoEF&CC on 26.04.2017 for change of coal source from imported to domestic coal for Units 3 & 4.
Additional conditions as per MoEF Office Memorandum F.No.22-13/2019-IA.III dated 28/08/2019		
i	The guidelines prepared by CPCB for disposal of fly ash for reclamation of low lying areas and in stowing / backfilling of abandoned mines/quarries shall be followed during disposal of ash in abandoned or working mines, as annexed.	Noted
ii	There should at least be clearance of 500 m of safe distance be maintained from River and water body in case of ash disposal in abandoned mines to prevent embankment failures and flyash flowing into the nearby water body.	Noted
iii	The top layer of the fly ash disposal area in the abandoned mines shall be kept moist during disposal.	Noted
iv	Top layer of the disposed area should have 70 cm overburden or gravels/stones and then 30 cm sweet soil cover. Subsequently, the vegetation shall be raised on the soil cover.	Noted
v	Bioaccumulation and bio-magnification tests shall be conducted on surrounding flora and fauna (tree leaves, vegetation, crop yields and cattle population) during shall be pre-monsoon	Noted

	and post monsoon to find out any trace metals escaped through groundwater or runoff.	
vi	Surface runoff and supernatant water in any case shall not be let into the surrounding areas. It shall be collected by providing adequate drain around the mine. The supernatant water along with surface runoff shall be treated and re-used for mixing ash and plant operations.	Noted
vii	To the extent possible, only decanted water from mine, make up water from treated effluents such as cooling tower blow down and treated sewage water shall be used for making ash slurry.	Noted
viii	Fly ash to be used as soil conditioner in agriculture needs and to be applied in controlled manner to limit excessive application so as to prevent soil degradation. The optimize proportion of ash to be applied which is to be certified by the state Agricultural Universities /Colleges based on the soil testing.	Noted
ix	Approval from DGMS shall be obtained before disposing the ash in mine voids.	Noted
x	Technology for conversion of fly ash into coarse granules for stowing in the underground mines to be explored	Noted
xi	All the power plants should install different silos for dry collection of fly ash.	Complied
xii	Records pertaining to details of month-wise quantity of fly ash disposed and water consumption along with nature/source of water shall be maintained and submitted to Ministry Regional office annually	Records pertaining to details of month-wise quantity of fly ash disposed and water consumption data is maintaining. The record will be submitted to Ministry Regional office annually.
xiii	Before starting the disposal of ash into mine voids , the NOC /Permission from the mine owner is to be obtained in case the mine closure activity are not completed or State Government in case the mine has been handed over to the State Govt. after its closure. A copy of such NOC / Permission is to be submitted to the ministry and its Regional Office	Noted

STACK MONITORING REPORT (4x600MW TPP) OF APRIL, 2022 TO SEPTEMBER, 2022

Month	Name of the Unit	Stack height (Mtr.)	Stack diameter (Mtr.)	Exit Velocity (m/sec)	Concentration of PM (mg/Nm ³)
Apr-22	Unit-1	275	6.70	22.8	42.6
	Unit-2			23.4	39.4
	Unit-3			23.6	41.2
	Unit-4			23.2	40.5
May-22	Unit-1	275	6.70	23.1	41.6
	Unit-2			22.9	43.3
	Unit-3			23.2	38.5
	Unit-4			23.7	42.7
Jun-22	Unit-1	275	6.70	23.4	37.8
	Unit-2			23.3	40.6
	Unit-3			22.9	36.7
	Unit-4			22.8	39.6
Jul-22	Unit-1	275	6.70	USD	USD
	Unit-2			22.8	42
	Unit-3			23.3	38
	Unit-4			23.1	40
Aug-22	Unit-1	275	6.70	23.5	37.4
	Unit-2			23.2	40.6
	Unit-3			22.8	42.3
	Unit-4			23.1	38.6
Sep-22	Unit-1	275	6.70	23.7	38.4
	Unit-2			23.5	40.6
	Unit-3			23.2	42.7
	Unit-4			22.8	41.3

GREEN BELT DEVELOPMENT

2021-22 (APRIL, 2022 TO SEPTEMBER, 2022)		
Location	No. of Saplings planted	Name of the main species
Plant Area(2400MW + 1000MW),ShaktiVihar-2 , Infront of Main Gate ,Near Gate No.2 , CHP & Washery , Rabo dam area,and Gare IV/1 Mines	89000	Gulmohar, Chakundi, Mango, Teak , Peltophorm, Jamun, Alostonia, Neem,Mango,Sal, Jamun,Amla, Shisham,Amrud, Kaju,Semar Kathal, Neem,Bel,Arjun,Ashok etc.

Corporate Social Responsibility -Jindal Power Limited -Tamnar

Financial Expenditure- April -September-22 (FY-2022-23) CSR JPL Tamnar

S. No.	Area of intervention	Proposed Project	Annual expenditure 22-23 (In Lakh)
1	Health & Nutrition	Mobile Health camp	3.39
		Vatsalya Project	11.38
		Chiranjivi Project	2.35
		Health Awareness Program	1.20
		Multi speciality Hospital	64.00
		Support to PHC/CHC	0.40
		Sanjivini Rural Health Care Centre/ Tele Medicine/ e health centre	2.18
		Subhangi-Menstural health & Hygeine	2.42
		Support to poor patients	1.50
		HIV/AIDS Awareness program	0.00
Sub total of Health & Nutrition			88.82
2	Drinking water & Sanitation	Drinking water facilities in villages	5.06
		Supply of safe drinking water thorough water tanker	0.90
		Solar based drinking water pump	0.00
		ODF	0.70
Total Drinking Water & Sanitation			6.66
3	Community Education	Parivartan project	1.67
		Pre school education Little angel school	2.16
		Community teacher	1.99
		Knowledge Park & CLC	1.07
		OP JSTAR/JEWELS	4.00
		School Infra	18.81
		Exposure visit/coaching /carrere counselling	0.00
		National event celebration	1.50
		Pre Primary education -Birhor Community	1.99
		Asha The hope	2.57
		OPJS Kunjumera	41.53
Total Community Education			77.29
4	Sustainable Livelihood & Women Empowerment	Swawlamban project	1.84
		Rennovation of Livelihood Resource Center	1.00
		Establishment of Livlihood Respource Center	4.00
		Terracotta	8.79
		Aakriti	1.80
		Swa-Shakti	2.85
Total Sustainable Livelihood & Women Empowerment			20.28
5	Environment & Agriculture Development	Scientific Technology in Agriculture	0.00
		Wadi Development Program	1.71
		Community Plantation	4.80
		Creating carbon Sinks	12.03
		Promotion of SRI method in paddy cultivation	3.36
		Promotion of Agriculture practices among Birhor community	0.87
		Farmers training/ exposure	0.30
		Promotion of vegetable cultivation	0.60

		Mushroom production	1.89
		Farm mechanization -Agriculture implements for FPO/ Farmers club	0.00
		Watershed managemnet	0.00
		Support to Farmers for agriculture implents/ irrigation facilities	0.00
		Total of NRM	25.56
6	Sports	Maintenance of OP Jindal Ghargoda Stadium	1.72
		OP Jindal Cricket Academy	8.30
		Sports promotion & cultural activities among youths	0.17
		Renovation of sports ground	1.00
		Total Sports	11.19
7	Art & Culture	CSR WEEK CELEBRATION/ SOCIAL ENTREPREUR DAY/ THESE DAYS OBSERVATION	3.00
		Total Sports	3.00
8	Social inclusion	Support to old age home & sr. citizen	0.81
		Jindal Children Home	111.60
		Special Project (Dry Rashaan,kind support to poor widows, single parents , parentsless & disable childrens	2.30
		Support in marriage for poor girl attaining legal age of marriage	0.00
			114.71
9	Rural Infrastructure	Construction/ rennovation of Muktidham	1.50
		Construction of CC Road	7.21
		Construction of Muroom road	0.29
		Construction of community building/rennovation/additional room in community building	0.00
		Rennovation /Painting/ of community Infrastructures i.e. School building/Aganwadi	0.41
		Construction of small culvert to link villages	15.71
		Misc. infra work as per request of District Authorities/ local leaders	0.00
		Construction of drain	0.86
		Installation of street light/ high mask light at village	2.00
		Construction of 05 bathing Ghats	5.40
		Need based project (village infra/ water/ other miscellaneous) in surrounding area of Kalma water reservoir	6.44
		Total Rural Infrastructure	39.82
10	Administrative expense	Personnel	13.77
		Petrol for staff	1.80
		Vehicle hire	4.80
		Training, Exposure visit, capacity building of staff, HoD meet, conference, ,Branding ,Application for Awards etc.	0.00
		CSR projects documentary, photograph	0.00
		Total of Administrative expense	20.37
		GRAND TOTAL	407.70

Physical Achievement Report JPL- CSR 2022-23 (April- 2022 to Sept - 2022)

1. Health & Nutrition

1.0 Rural Health Camps- 179 health camps were organised through mobile dispensary against the target of 180 camps in which 2686 (Male- 546, Female-1039, Children-914 and Old Age-187) patients were catered. 65 Patients were referred to e- health centre for consultancy from super specialist and further treatment. 38 patients were referred to Fortis OP Jindal Hospital Tamnar and 27 patients were referred to Govt. hospital. Disease wise bifurcations of the patients are as following:-

Hypertension	46	Dental	55
Pregnant women(ANC)	77	URTI	658
Under nutrition	366	GI	174
Fever	150	Skin	341
Gyne	31	Anemia	142
PNC	74	Cataract	0
Other general patients	507	Referred	65

1.1 Project Vatsalya- Community based village health volunteers i.e. Swasthya Sanginis were played a very catalytic role in mother and child health care in their respective villages. They are the point of contacts in their respective villages as a resource person about disseminating preventive awareness messages, vaccination details and other related aspects. Following activities were done under project Vatsalya:-

- Antenatal care services were provided to 472 women against the target of 472 women. During the pregnancy period of an expecting mother, care is being taken for early registration, ante natal check-ups ensuring intake of IFA tablets, TT injections and necessary tests.
- The lactating mothers received Post-natal care service (403 women, 100% target achieved) ensuring Colostrum feeding to the new born child, exclusive breast feeding, and supplementary nutrition for both the mother and the child was ensured.

Apart from the above stated, following activities were carried out to ensure maternal & child health care- nutrition and health education in this quarter:-

- 664 community meetings were organised (against target of 360 meetings) with 7235 women.
- 266 Ante Natal & 240 Post Natal care sessions were organised against a target of 240 sessions (120 ANC and 120 PNC sessions) attended by 1333 pregnant women and 1804 mothers respectively.
- 394 health education sessions (Khelwadi) was organized against the target of 400 sessions in which 5002 children participated.

- 200 meetings with the Village Health and Sanitation Committee (VHSC) was organised against the target of 200. The "Swasthaya Sanginis" strengthen the existing VHSC formed under the NRHM.

On 9th of every month, safe motherhood day is observed in coordination with Health department in which complete care for ante natal and post-natal is done at Community Health Centre by specialist. The VHV's mobilized and facilitate the target women to avail the services. *During the period of April to Sept'22, 383 pregnant mothers attended the safe motherhood day sensitization programme.*

Reduction in maternal and child mortality is a major objective of Vatsalya program. Zero MMR reported in this quarter.

During the said period, a total 261 institutional deliveries out of 264 deliveries were facilitated, achieving 98.86% of the target.

1527 out of targeted 1527 children got vaccination for proper immunization achieving 100 % of the target.

422 Kishori Swasthaya Pathshala by VHV's were organised against the target of 240 in which 2595 adolescent girls participated.

In the Pathshalas, 175 counselling sessions of adolescent girls were carried out in Vatsalya Kendra out of which 135 identified girls were referred to e-hc for the treatment of anaemia and menstruation related problems.

1.2 Project Chiranjeevi- JPL CSR has successfully undertaken the project Chiranjeevi in convergence with ICDS. Under the project, BMI of 2228 children (age group: 6 months old to 5 years) was measured. 250 malnourished children were identified (**Moderate-205, Severe -45**) from 38 villages. Under this project regular clinical and nutritional intervention is being taken care for all 250 identified children.

The identified malnourished children are linked to ICDS schemes with the help of "Swasthaya Sangini" (VHV's) for nutrition supplement. For better clinical support these children were referred to further treatment at e-health centre. 06 sever malnourished children referred to NRC for further treatment.

Take Home Ration (THR) and Ready to Eat food was provided to the children in convergence with ICDS. *By providing regular nutritional and clinical support. In this period a total 64 malnourished children turned to normal category.*

1.3 E-health centre- 902 patients were registered in the period of July to Sept-22. The details of patient footfall are as: Gyne- 25, Paediatric-222, Internal medicine-486, General surgery- 09, other general patients-160.

1.4 Population stabilization programme-242 eligible couple meetings were organised against the target of 240 by VHV's in which 2564 couple attended. 895 individual counselling was done at the Vatsalya Centre, and the total contraceptive users registered in the village were 9730.

1.6 High Risk Pregnancy check up and treatment camp

To reduce IMR & MMR Vatsalaya program is executing in 44 villages of Plant, Rabo, under the Vatsalaya project 46 Swasthya Sangini is working to ensure safe mother hood and child care. In the operational area 32 high risk pregnant women identified. To counsel and ensure better health of high risk mother 04 special camps organized at OPJHRC- Tamnar. All 26 high risk mothers attended and counselled and treated with Gyne specialist Dr. Bishkha Day. The follow-up of the mothers will be continued. Out of 26 -11 mother turned from high risk -09 safe deliveries reported

1.7 Theme days & Health awareness program

1.7.1 National Doctors day

National doctors day observed on 1st July -22 at OPJHRC –Tamnar. On the occasion felicitation program of doctors organized. In the program Dr. D.S. Painkara Block medical officer –Tamnar ,Dr. U.K. Patti-CMO –OPJHRC Tamnar Dr. Rajesh Patel -Medical officer PHC-Libra , Dr. Bishkha Day –Gynaecologist, Dr. Vinay Kumar Patel –Sonologist, Dr. Priya Rai – General surgeon were presented and honoured .

1.7.2 World Population Day

World Population Day is celebrated annually on 11 July to focus attention on the urgency and importance of population issues. On the occasion JSPL Foundation in JPL Tamnar organised a felicitations program for ideal couple who were married on right age of marriage, maintained three year of spacing between first and second child and adopted sterilization as a family planning norms on completion of family (1/2 child) . In the program resource person from CHC Tamnar sensitized to all Swasthya Sangini about various scheme and services of population stabilization. Total 06 ideal couples were felicitated. A weeklong awareness program from 11th to 17th July organized in operational villages more than 300 people attended

1.7.3 World Hepatitis Day

On 28th July -22 World Hepatitis day observed in JPL Tamnar under aegis of JSPL Foundation at village Tamnar. Medical officer of Mobile dispensary unit sensitized to the women about preventive and curative aspects of the disease, more than 50 women attended.

1.7.4 World Breast Feeding week (1st to 7th August)

To encourage breastfeeding and improve the health of babies, world breast feeding week celebrated from 1st to 7th August in operational area under Vatsalaya project. Under the week awareness program organized in operational villages.

1.7.5 Blood Donation Camp-10th August-22

Blood Donation Camp was organized on 10th August at OPJHRC Tamnar in joint collaboration with RED Cross Society and OPJHRC-Raigarh. In the camp 43 unit blood were voluntarily donated by JPL employee.

1.7.6 World Mosquito day

To prevent the disease is to avoid bites by infected mosquitoes, world mosquito day observed on 20th August-22. On the day awareness program organized in villages to make aware people to prevent from mosquito, more than 150 people attended.

1.7.7 National Nutrition week

National Nutrition Week (NWN) is observed from 1-7 every year to educate the populace about the significance of nutrition. Adequate nutrition is the corner stone that determines the overall well-being of a person, as it supports individuals in mainstreaming health status and average growth and development. To lead a healthy lifestyle and stay disease free, every individual should adopt mindful eating practices. JSP Foundation in JPL Tamnar observed National Nutrition week awareness and nutrition classes organized among parents of malnourished children, Pregnant and lactating mothers. The program organised in 10 villages more than 250 people attended.

1.7.8 World First AID day

On the occasion of World First AID Day 10th September, first Aid training organized by JSP Foundation in JPL Tamnar for Swasthya Sangini –Women Village Health workers working under Vatsalaya project. Dr. Ashwani Patel MO –OPJHRC Tamnar delivered the training. 50 women village health worker participated.

1.7.9 National Eye care week

Promoting the importance of good eye health and the need of regular eye test for all. National eye care week observed from 1st to 7th September-22 by JSP Foundation in JPL Tamnar. Under the program eye health awareness and eye test program conducted in the Govt. schools. More than 300 students attended awareness program and eye check-up of 150 students done.

2. Drinking water & Sanitation

2.1 ODF- 119 meetings were organised against a target of 120 and 1305 people attended the meetings. *The attendees were sensitized on hygiene and cleanliness aspects.*

2.2 Drinking water facilities in villages

Drinking water arranged in 05 villages (Janjgeer, Jharadeeh, Basanpali, Hoonkaradeepa and Bharbhata Tamnar, more than 365 family benefiting.

2.3 Supply of safe drinking water through water Tanker

110 water tanker / 5500 people (drinking water supplied in villages through water tanker in stress period

2.4 Project Shubhangi- The project is being implemented among adolescent girls and women in reproductive age group through awareness drives and social marketing of low cost sanitary napkins so as to promote menstrual health and hygiene. In the period of July -22 to Sept.-22, 454 educational sessions with 5070 women & adolescent girls was organised in 38 villages through VHVs.

The social business model of manufacturing and distribution of sanitary napkin witnessed a total sale of 11188 packets of Sanitary Napkins amongst 3750 women and adolescent girls against the target of 4250 packet SNs worth Rs 3.13 Lakhs from the Vatsalya centre. The VHVs and the depot holder earned Rs 0.62 Lakhs whereas the SHG earned Rs.0.12 Lakhs.

3.00 COMMUNITY EDUCATION :

3.1 Education to Birhor Community- Balwadi classes are being organised at village Kachkova, for Birhor children from the primitive tribes. A total 22 Birhor children are in Balwadi centre mid-day meal on regular basis providing to 22 Birhor Children. *All the community children are undergoing Pre -school education with Mid-day meal and health check-up facilities. 17 children mainstreamed enrolled in nearby Govt. schools.*

3.2 Little Angels Schools- Pre-Primary education is being undertaken at 6 Little Angels Schools in 6 villages with strength of 180 children. In education session 2022-23, 90 children mainstreamed in nearby by schools for further education

3.3 Knowledge Park- The Knowledge Park is located at Libra and Rabo. The centres consist of library and indoor sports facilities for school children in the form of Child Learning centre and Community Information centre for rural youths. Newspapers, Magazines, Books, Journals and associated resource materials are available at the centres. 900 children and youths are the part of the centres in the said period.

3.4 OP Jindal Primary School Rabo and OP Jindal Secondary School Kunjemura are running successfully with strength of 225 at Rabo and 919 at Kunjemura against the target of 240 and 1000 children respectively. OP Jindal Primary School Rabo upgraded up-to standard VII. 51 poor children are benefiting from RTE (43 at OPJS Kunjemura and 08 at OPJS Rabo). In OPJS Rabo 90 and in OPJS Kunjemura 190 new admission done.

3.5 Scholarship programme- OP Jindal Star Scholarship was awarded to 15 students, selected as per merit i.e. marks secured in class X board examination and income of parents below 2 lakhs per year. Under the scheme 11 students awarded OPJ Star scholarship and 04 under OP Jindal Jewel Scholarship programme for pursuing technical education in B.Tech.

3.6 Parivartan Project :

To enhance the skill of the parentless girl child residing in Chhakradhar Balika Grih Raigarh, Project Parivartan is being executed where classical music (Bhav Sangeet, Tabla) Kathak Nirtaya and Sewing training is being imparted among 75 girl children of the home. 15 girls in Music training (Bhav Sangeet, Tabla to be certify from Parayag Sangeet Samiti Allahabad) out of that 02 girls completed 2nd year and 02 girls completed 3rd year, 11 are in 1st year Diploma course .Now they will peruse in next level

Diploma course. 22 girls in Kathak Nirtya, out of that 03 completed 2nd year, 09 completed 3rd Year and 01 completed 5th year & 09 are in 1st year of "Kathak Nirtya" under Junior and senior diploma course from Prayag Sangeet Samiti Allahabad. This year they will peruse next level of Diploma Course .Kumari Radha the Kathak dance trainee participated in national level dance competition organised by Akhil Lok kala Cultural organisation Pune. 14 girls are in 06 month basic stitching training whereas 25 girls are in Art & Craft. Kumari Radha a parentless girl is perusing BSc. Nursing from Career College of Nursing Raigarh.

3.7 Computer training for orphan children

To provide computer skill to orphan children, 06 month Computer training program initiated at Chhakradhar Bal Sadan- orphan girls home Raigarh and Neelanchal Bal Grih - Orphan Age home boys. Mr. Deepak Dansena District Child Protection officer Raigarh inaugurated the training program in presence of Mrs. Jayanti Behra institutional officer, Mr. Mohanti Director Unnayak Seva Samiti.

3.8 Facilitation program of meritorious students

On 6th September-22 facilitation program was organized for meritorious students of OP Jindal School Savitri Nagar, and OPJS Kunjemura who were passed class 10th & 12th with excellent number. Plant head Sh. C.N. Singh graced the occasion. Under the program 60 students awarded with certificate and mementoes.

4. ENTREPRENEURSHIP DEVELOPMENT PROGRAMME

4.1 Mushroom Production:

Training and Capacity Building- The mushroom production resource centre has been established to provide technical support to the farmers and entrepreneurs. Technical assistance to 1160 farmers is being provided from the centre. During the period of July to Sept.-22, 34 training programmes have been conducted on Paddy straw mushroom cultivation with 669 SHGs/ farmers.

4.2 Mushroom Spawn production: *A total 7469 spawn bottles of Rs.1.64 lakhs was produced in this period.* This self-sustaining center supplies seeds to 200 mushroom growers of the Tamnar block as well as to the mushroom producers majorly in Raigarh, Korba, Ambikapur and adjoining districts of Chhattisgarh.

4.3 Mushroom Production – Mushroom production is very popular among farmers because of its high protein values. More than 950 farmers, women SHGs members are regularly producing mushroom and this is an easy livelihood generation option for them. For Mushroom production July-September is off season, its start from mid-June. In month June a total 3136 kg mushrooms (Paddy straw) were produced, worth Rs.3.14 Lakhs.

4.4 Swawlamban Project:

Income generation of SHGs: The 73 SHGs comprising 772 women earned an income Rs. 39.84 Lakhs from various income generation activities like manufacturing of paper plates/plates made of locally

available leaves, poultry farming, Tent/ Sound system leasing, Agricultural activities, Mid-day meal, Pickle making, Soft Toys, Atta Chakki, Mushroom Production, Grocery shop, Food items manufacturing, NTFP (Non Timber Forest Produce), Concrete Mixture Machine, Lac Cultivation, Multi-purpose IGA.

4.5 Shaksham:

4.5.1 Aakriti Sewing and Design School and Aakriti Production Centre-

During the period of July to Sept-22, the members of Aakriti cooperative society stitched cotton mask, ladies suit, purse, home furnished items, VHV's dresses etc. *Total earnings of the Aakriti women beneficiaries in this quarter is Rs.13.67 Lakhs (Centre - Rs.6.50 Lakhs Periphery village- Rs. 7.17 Lakhs)*

4.5.2 Swa -Shakti

Under project Swa-Shakti (women SHG formation and strengthening), 159 SHGs have been formed in 38 villages wherein 1709 women are associated. *In the period of April to September-22 Rs.6.456 lakh Lakhs have been saved and inter loaning of Rs. 7.73 Lakhs has been done, loan repayment of Rs.7.73 Lakhs and income from interest/ penalty is Rs.3.08 Lakhs. Cumulative saving of SHGs are Rs.94.50 Lakhs.*

4.5.3 Terracotta

Technical and Marketing support to 73 terracotta artisans is continued at villages Mahloi (14), Basanpali (24) and Auraimuda (35). *The Terracotta artisans have earned Rs. 12.02 Lakhs in this period from exhibitions and sale of the products.*

4.5.4 National Daughters Day

National Daughters Day observed on 25th September is a day to celebrate and cherish our daughters who bring so much love and into our lives. JSP Foundation in JPL Tamnar observed National Daughters day. On the day Rangoli, Menhdi competition, sports and motivational program competition organized at CLC –Libra & Rabo.

5.0 Environment :

5.1 WADI Development Programme:

The WADI development programme in convergence with NABARD is implemented in 335 acres (phase one 159 acres and phase two 176 acres) against the target of 500 acre (phase one 250 acre and phase two 250 acre). In the period of April to Sept-22 by selling of mangoes, cashew, lemon, vegetables & intercropping farmers earned Rs.51.80 Lakhs.

5.2 Environment awareness program

Following awareness program organised under environment protection

5.2.1 World Paper Bag Day

World Paper Bag Day observed by JSPL Foundation in JPL Tamnar on July 12 to raise awareness of the importance of using paper bags instead of plastic bags. The awareness program organized in 05 operational villages and harmful effect of use of plastic bag on environment and people health discussed, more than 125 people attended.

5.2.2 Nature conservation day

World Nature Conservation Day 2022: In a bid to create a sustainable environment and protect our mother earth, every year on July 28 World Nature Conservation Day is celebrated. JSPL Foundation in JPL Tamnar observed the day, drawing competition organized in Govt. High school Kachkova, more than 45 children participated

5.2.3 Van Mahostava

To promote tree plantation Van Mahostava observed from 1st to 7th July-22 at village –Tamnar, Mahloj, Padigaon, Kachkova, Amaghat, Chharatangar, and Dokurbuda. Under the week 2000 plantation done on above mentioned villages

5.3 Community Plantation

Under the community plantation project in this season 3650 samplings done in community places, 1000 plantation under gap filling of the wadi project. Forest 2000 plantation under Boundry plantation in wadi. Van Mahostava organised from 1st to 7th July, under the week and till date 3000 plantation done.

5.4 Create Carbon Sink

To create carbon sink Pond deepening work done at village Tapranga Pond & Tehlirampur- Mahadev Pond done benefiting more than 950 people.

6.0 Agriculture Development

6.1 Promotion of Paddy cultivation through SRI

To enhance the income of farmers, paddy cultivation through SRI is being promoted in 186 acres of land, benefitting 180 farmers. The System of Rice Intensification (SRI) is a methodology for increasing the yield of rice produced in farming. In this quarter training and hybrid paddy seed provided to 180 farmers.

6.2 Training to adopt innovative practices in farming

To improve the skill of farmers and make them adequate enough on new technologies and innovative practices in farming, 20 training programmes were organised with 450 Farmers in collaboration with Agriculture Department. In the training new technique in Paddy cultivation, crop insurance, other govt. schemes for farmers, promotion of pulses cultivation was discussed and appraised.

6.3 Promotion of Vegetable cultivation – To increase the income of farmer's vegetable cultivation among farmers is being promoted. 40 farmers have been undertaking vegetable cultivation. In the said quarter, 40 farmers earned Rs.5.60 Lakhs as an additional income from vegetable selling.

7.00 Sports, Art & culture

7.1 Maintenance of sports infrastructure: Maintenance of Gharghoda stadium is continued wherein sports like Cricket, Football and Badminton are organised regularly, benefiting more than 250 youths from the peripheral villages. Infrastructure support like installation and maintenance of bore wells along with motor pump has been done so as to ensure regular maintenance of the stadium field.

7.2 OP Jindal cricket Academy- OP Jindal cricket academy is running in Gharghoda which is fully equipped with latest infrastructure like Bowling machine, cricket net for net practise, equipped cricket kit. Regular practice matches were organised benefiting more than 250 youths of the area.

From OPJ Cricket Academy Mr. Ayush Sharma became selected in under 16 of Chhattisgarh state cricket team. Similarly Ku. Mamta Bhagat from OP Jindal Cricket Academy representing CG state under -19 women cricket, Mr. Azhrul Kadri selected for district level cricket team representing as vice-captain, Mr. Asif Khan, Devendra Bhojwani, Mr. Binay Painkra & Mr. Mohar Sai Yadav representing district level team under -19, Mr. Prince Kanojiya from the Academy is caption of Raigarh District team (Under-19). 06 players selected in district level cricket team and representing Raigarh district (Mr. Sobit Tiwari, Mr. Prince Knojiya, Mr. Asif Khan, Mr. Mohar Yadav , Mr.Azharul Khan, Mr. Sakham Chaubey).

7.3 CSR week celebration

CSR week celebrated from 7th to 13th August-22. Various community development and social welfare programs organized under the Mahila Sammelan -8th August ,World Tribal day -9th August, Blood Donation camp -10th August-43 unit blood collected, serving old age people-11th August, International Youth day -12thAugust, Har Ghar Tiranga campaign -13th August organized more than 1600 people attended

8.00 Social inclusion

8.1 Jindal Children home

Jindal Children home establish at JPL Tamnar with an approval of 50 boys & 50 girls from February-22 with 35 orphan children. The home is executing under JJ Act -2015, regular monitoring of home is being done by Child welfare committee –Raigarh and district Child protection officer. At present 86 boys & girls are residing in the home (boys-48, girls -39).

8.2 Dry Rashan and other supporting material under Sneh Project- Under SNEH project JSPL Foundation implementing special project to provide support to identified poor widows, Parentless, Single Parents, Disables and COVID affected families. In JPL Tamnar a total 126 banifaciries identified (Poor widows-56, Parentless children-10, single parents -13, senior citizen-21 Covid affected families-15, especially abled-11). Regularly Dry Rashan and kind support providing to 126 families from July-2021. One time kind support (Blanket, sharee, shawl, Dhoti, torch, school dress, umbrella, mosquito net, and education material) provided to senior citizen, parentless and single parents children.

9.0 Rural Infrastructure Development: - Under RDP following work executed in operational villages

- **Community Building construction/ renovation:** - Construction of community building at Tamnar, benefiting more than 1800 people
 - **Crimination centre construction /renovation :-** Construction of crimination centre at village – Bandhapali and renovation at Muktidham -Tamnar
 - **Construction of CC Road:-** A total 110 RM CC road constructed at Kunjemura-110 RM
 - **Construction of Bathing Ghats :-** 01 bathing Ghats –Jhinkabahal –Bagwadi pond benefiting more than 900 people
 - **Small culvert :-** Small culvert at village –Kunjemura, benefiting more than 650 people
 - **Cultural Shed :-** Construction of cultural shed at village- Jhingol , benefiting more than 250 people
 - **Construction of drain :-** 150 RM drain at village –Kudripara-Tamnar
-

Status of the Implementation of the Schemes for Tribal families for the period from April -2022 to Sept-2022 –FY-2022-23

Sl. No.	Scheme	Information about the tribal community	Information about OPJSKS-CSR JPL Tamnar
1.	Balwadi (pre-school education centre) for the children of Birhor primitive tribes in Seetapara of Kachkova village	Birhor is one of the primitive tribes residing in Seetapara of Kachkova Panchayats. At present there are 26 families who are mainly dependent on rope making from plastic gunny bags and wage labour work for their livelihood. The educational status of the community is very poor as out of total 86 people of the community, only 08 people are class 8 th pass and rest are either primary pass or illiterate.	To improve the educational status of the community, especially the children, a Balwadi centre is being run by OPJSKS-CSR JPL Tamnar since 2009. The organization constructed the building to run the centre and provided Teaching & Learning Materials (TLMs), Uniforms to the children, one Balwadi teacher, one cook and regularly providing mid-day meal to the 23 children. CSR JPL ensuring health & Sanitation of above primitive tribe, 06 health camps through Mobile dispensary organised, 04 health awareness programs organised in Birhor community. To promote agriculture practices among Birhor tribe, Land labelling done at 05 acre, seed, irrigation facilities and equipment provided.
2.	Wadi Development Program with the support of NABARD for the small and marginal tribal farmers	Indiscriminate exploitation of forest resources and poor crop production practices has resulted into low productivity, degradation of agriculture land and depletion of forest resources. As a result because of shortage of food and livelihood opportunities the tribal of the area use to migrate to nearby town for the substance. The 'TDF Wadi Development Programme' (WDP) is the first and rare most attempt of JPL, where the farmer are taught about modern techniques of agriculture after making their lands fertile and productive.	The Wadi project is successfully executed in 335 acre (Phase-I - 159 Phase- II- 176) with 335 tribal families. Fruiting of mango, cashew & lemon are continue in 335 acre Wadi, farmers also doing intercropping, vegetable cultivation in their field growing and selling cash crop regularly. In the period of April-22 to September-22 FY-2022-23 farmers earned Rs.51.80 Lakhs. by sell of Mango, lemon, cashew vegetable & other inter cropping. Irrigation facilities completed in all 335 acre Wadi, farmers growing seasonal vegetable, pulses in Wadis. Vegetable seed and Fertilizer distributed to wadi farmers for WADI & vegetable cultivation. 1000 mango plant provided to the farmers for Gap filling, 3000 Boundry plantation
	Health improvement programme specifically for the tribal women	Health is another challenging area where facilities for health are still far from the reach of rural people specifically tribal. Age old traditional health practices, home based delivery, High MMR and IMR, water borne diseases, communicable diseases have been quite prevalent in the area. Remoteness, unawareness, lack of facilities to access the available resource/institutions has further aggravated the condition. To address the issues of health of tribal, last year	In the period of April-22 to Sept-22- FY-2022-23 a total 264 delivery was reported out of which institutional was 261 which is around 98.86 % 4738 adolescent girls aware on health & hygiene through 422 Kishori Swasthaya Pathsala, 40 Vatsalya Centre running to provide counselling and first aid service benefited more than 3668 people. Total vaccination among children 1527 against the target of 1527 which is 100% In convergence with ICDS has successfully undertaken the nourishment care of 250 malnourished children (Moderate-206, Severe-44) by providing regular growth monitoring, parents counselling and clinical support. The identified malnourished children were linked to

		an integrated approach was designed and implemented.	ICDS schemes with the help of Swasthaya Sangini (VHVs) for nutrition supplement. For better clinical support these children were called for further treatment at e health centre. out of 250 malnourished children 64 had turned to normal category. Under Muskan project 150 identified anaemic girls were covered by providing regular treatment and counselling 130 girls cured from anemia. Under Shubhangi project 454 menstrual health and hygiene session organised and ensuring access of 5070 adolescent. Social marketing of 11188 packets of Sanitary Napkins done. In the period of April-22 to Sept-22 FY- 2022-22 SHGs and VHVs earned Rs.0.74 Lakhs
4	Rural Health Camp through Mobile Dispensary	To provide basic healthcare services at the doorstep of villagers specifically for vulnerable social group- Tribal	In the period of April-22 to Sept-22- FY 2022-22, a total 179 Rural Health camp organised under the camp 2686 patients were treated. The bifurcation of the patients are as- Male- 546, Female-1039, Children-914, Old age-187
5	Women Empowerment through Self Help Group (SHG) and Income Generation Program (IGP)	Self Help Group of women is a medium to empower women by initiating regular meetings and thrift and credit. Once the groups become strengthen, Income Generation Activities (IGAs) are initiated to involve all the women of the groups in some meaningful activities.	Self Help Groups have been formed in the villages of homogeneous communities. At present 159 SHGs have been formed which constitutes around 1709 women members and the total corpus of the groups is around Rs. 94.50 Lakhs. Around 73 SHGs have initiated IGAs in different villages. Women are involved in goat rearing, Mushroom Cultivation, vegetable cultivation, Poultry, Goatry, multipurpose agricultural activities, flour making, paper plate making etc. In the period of April to Sept-22 FY 2022-23 women earned Rs.39.84 Lakhs. from IGAs.
6.	Mushroom Cultivation	More than 1900 people were trained on Mushroom cultivation.700 farmers are directly involved in production and selling.	Mushroom Cultivation executing in 44 operational villages involved 700 individual cultivators and members of women SHGs who were supported and guided by the CSR JPL. In the period of April - to Sept-22, FY 2022-23, 3136 Kg. of Paddy straw Mushroom were produced worth Rs.3.14 Lakhs. Tamnar Samahit Samuh' -- a common interest group of youths supported by CSR JPL to produce 7469 bottles of spawn were produced which was sold of Rs. 1.64 Lakhs. This self-sustaining center supplies seeds to mushroom growers of the Tamnar & Ghargoda block as well as the producers in Raigarh, Korba, Ambikapur districts.
7	Pre -Primary education -Little Angel Centres & OP star scholarship	06 Little Angel Centre in 06 villages , more than 180 tribal children studying	To provide pre-primary English medium education for children's 2.5 year to 4 years with the objective to mainstream them in nearby English medium schools. Under Little Angel 170 tribal children studying. OPJ star scholarship providing to 03 tribal children @ Rs.12000/. Per year who have passed class 10 th with 75% 59 tribal children studying under RTE in both schools.

8	Promotion of Agriculture among tribals	Promotion of yield in Paddy cultivation and vegetable cultivation to ensure additional income for their livelihood	Promotion of Paddy cultivation by adopting SRI method with 98 tribal farmers by providing technical support hybrid seed and fertilizer. Vegetable cultivation with 40 tribal farmers. Farmers earned from vegetable cultivation 5.60 Lakhs. Farmers earned from SRI Rs.47 Lakhs
9	DRY Rashan for Poor tribal families	Hunger reduction	DRY Rashan distributed to 126 poor widows, single parents, parent less and disables etc.
10	Jindal Children Home	To provide shelter , education, health & holistic development of Orphan Children	Jindal Children home boys & girls establish at Savitri Nagar with the strength of 50 boys & 50 girls. The home is executing under JJ Act. At present 87 orphan children are in the home. Out of 87 children 15 are tribal (05 girls & 10 boys)

GROUND WATER QUALITY MONITORING REPORT



HDD-272, Phase III, Near JP Chowk
Ring Road No. 2, Sahar Nagar Raipur (C.G.) - 492099
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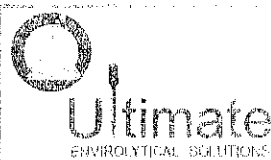
Recognized by Ministry of Environment Forest and Climate Change under EP act 1986

To, Jindal Power Limited P.O. Tamnar, District: Raigarh 496107 (C.G.)		Report No	UES/TR/22-23/01547	
		Lab Ref No	UES/22-23/W/01875-01876	
		Date of Sampling	28/04/2022	
		Date of Receipt	29/04/2022	
		Date of Report	08/05/2022	
		Date of analysis	Start: 29/04/2022	END: 08/05/2022
SAMPLE DETAILS				
Customer Sample Id / Sampling Location	1. Piezometer - 01 (Near Gate No. 03)	Latitude	22.13197	
	2. Piezometer - 02 (SW near Ash Dyke S.V.2)	Longitude	83.45947	
Customer Ref. No. & Date	4400014853, Dated : 07/10/2021		Latitude	22.11586
Sample Type	Groundwater		Longitude	83.45075
Packing Of Sample	Plastic Bottle (5.0 ltr.), Glass Bottle (1.0 ltr.)			
Sample Collected By	Laboratory Chemist			
Sample Condition At Receipt	Ok			

REPORT NO. 01547

TEST REPORT							
SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Piezometer 01	Piezometer 02
A. Organoleptic & Physical Parameters							
1	Colour	Hazen	IS:3025:(Part-4)	5	15	<1	<1
2	Odour	-	IS 3025(part-5)	Agreeable	Agreeable	Agreeable	Agreeable
3	pH Value at 25.4°C	-	IS:3025:(Part-11)	6.5-8.5	No Relaxation	7.64	7.62
4	Taste	-	IS 3025(part-9)	Agreeable	Agreeable	Agreeable	Agreeable
5	Turbidity	NTU	IS 3025:(Part-10)	1	5	3.2	2.5
6	Total Dissolved Solids	mg/L	IS:3025:(Part-16)	500	2000	207.5	231
B. General Parameters Concerning Substances undesirable in excessive amounts							
1	Aluminium (as Al)	mg/L	IS 3025(part-55)	0.03	0.2	N.D.	N.D.
2	Ammonia (as total ammonia-N)	mg/L	IS 3025(part-34)	0.5	No Relaxation	N.D.	N.D.
3	Anionic Detergent (as MBAS)	mg/L	Annex K of IS:13428	0.2	1.0	N.D.	N.D.
4	Barium (as Ba)	mg/L	Annex F of IS:13428	0.7	No Relaxation	N.D.	N.D.
5	Boron (as B)	mg/L	IS 3025:(Part-57)	0.5	1.0	N.D.	N.D.

AN ISO : 9001:2015 / ISO: 14001:2015 / ISO 45001:2018 CERTIFIED LABORATORY



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Recognized by Ministry of Environment Forest and Climate Change under EP act 1986

REPORT NO. 01547

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Piezometer 01	Piezometer 02
6	Calcium (as Ca)	mg/L	IS 3025: (Part-40)	75	200	25.65	53.70
7	Chloramines (as Cl ₂)	mg/L	IS 3025: (Part-26)	4.0	No Relaxation	N.D.	N.D.
8	Chloride (as Cl)	mg/L	IS 3025: (Part-32)	250	1000	29.99	24.99
9	Copper (as Cu)	mg/L	IS 3025(part-42)	0.05	1.5	N.D.	N.D.
10	Fluoride (as F)	mg/L	IS 3025(part-60)	1	1.5	0.16	0.1
11	Free Residual Chlorine	mg/L	IS 3025: (Part-26)	0.2	1	N.D.	N.D.
12	Iron (as Fe)	mg/L	IS 3025(part-53)	0.3	No Relaxation	N.D.	N.D.
13	Magnesium (as Mg)	mg/L	IS 3025: (Part-46)	30	100	13.60	13.60
14	Manganese (as Mn)	mg/L	IS 3025(part-59)	0.1	0.3	N.D.	N.D.
15	Mineral Oil	mg/L	Clause 6 of IS 3025 (Part-39) Infrared partition method	0.5	No Relaxation	N.D.	N.D.
16	Nitrate (as NO ₃)	mg/L	IS 3025(part-34)	45	No Relaxation	2.31	1.27
17	Phenolic Compound (as C ₆ H ₅ OH)	mg/L	IS 3025(part-48)	0.001	0.002	N.D.	N.D.
18	Selenium (as Se)	mg/L	IS 3025(part-56)	0.01	No Relaxation	N.D.	N.D.
19	Silver (as Ag)	mg/L	Annex J of IS 13428	0.1	No Relaxation	N.D.	N.D.
20	Sulphate (as SO ₄)	mg/L	IS 3025: (Part-24)	200	400	9.45	13.14
21	Sulphide (as H ₂ S)	mg/L	IS 3025: (Part-29)	0.05	No Relaxation	N.D.	N.D.
22	Total Alkalinity (as CaCO ₃)	mg/L	IS 3025: (Part-23)	200	600	170	150
23	Total Hardness (as CaCO ₃)	mg/L	IS 3025: (Part-21)	200	600	120	190
24	Zinc (as Zn)	mg/L	IS 3025(part-49)	5	15	N.D.	N.D.
C. Parameters concerning toxic substances:-							
1	Cadmium (as Cd)	mg/L	IS 3025(part-41)	0.003	No Relaxation	N.D.	N.D.
2	Cyanide (as CN)	mg/L	IS 3025(part-27)	0.05	No Relaxation	N.D.	N.D.
3	Lead (as Pb)	mg/L	IS 3025(part-47)	0.01	No	N.D.	N.D.

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HDD 272, Phase II, Near IP Chowk
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REPORT NO. 01547

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Piezometer 01	Piezometer 02
					Relaxation		
4	Mercury (as Hg)	mg/L	IS 3025(part-46)	0.001	No Relaxation	N.D.	N.D.
5	Molybdenum (as Mo)	mg/L	IS 3025(part-2)	0.07	No Relaxation	N.D.	N.D.
6	Nickel (as Ni)	mg/L	IS 3025(part-54)	0.02	No Relaxation	N.D.	N.D.
7	Polychlorinated biphenyls	mg/L	ASTM 5175	0.0005	No Relaxation	N.D.	N.D.
8	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	APHA 6440	0.0001	No Relaxation	N.D.	N.D.
9	Arsenic (as As)	mg/L	IS 3025(part-37)	0.01	0.05	N.D.	N.D.
10	Chromium (as Cr)	mg/L	Annex J of IS:13428	0.05	No Relaxation	N.D.	N.D.
11	Trihalomethanes:						
a)	Bromoform	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.
b)	Dibromochloromethane	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.
c)	Bromodichloromethane	mg/L	APHA 6232	0.06	No Relaxation	N.D.	N.D.
d)	Chloroform	mg/L	APHA 6232	0.2	No Relaxation	N.D.	N.D.
D.	Pesticides:-						
1	Alpha HCH	µg/l	USEPA 508		0.01	N.D.	N.D.
2	Beta HCH	µg/l	USEPA 508		0.04	N.D.	N.D.
3	Delta HCH	µg/l	USEPA 508		0.04	N.D.	N.D.
4	Alachlor	µg/l	USEPA 525.2, 507		20	N.D.	N.D.
5	Aldrin / Dieldrin	µg/l	USEPA 508		0.03	N.D.	N.D.
6	Atrazine	µg/l	USEPA 525.2, 8141 A		2	N.D.	N.D.
7	Butachlor	µg/l	USEPA 525.2, 8141 A		125	N.D.	N.D.
8	Chlorpyrifos	µg/l	USEPA 525.2, 8141 A		30	N.D.	N.D.
9	DDT (o,p and p, p-Isomers of DDT, DDE and DDD)	µg/l	USEPA 508		1	N.D.	N.D.
10	Gamma HCH	µg/l	USEPA 508		2	N.D.	N.D.
11	2,4-Dichlorophenoxy acetic Acid	µg/l	USEPA 515.1		30	N.D.	N.D.
12	Endosulphan (alpha, beta	µg/l	USEPA 508		0.4	N.D.	N.D.

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HDD 272, Phase III, Near JP Chowk
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REPORT NO. 04547

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Piezometer 01	Piezometer 02
	and sulphate)						
13	Ethion	µg/l	USEPA 1657 A		3	N.D.	N.D.
14	Isoproturon	µg/l	USEPA 532		9	N.D.	N.D.
15	Malathion	µg/l	USEPA 8141 A		190	N.D.	N.D.
16	Methyl Parathion	µg/l	USEPA 8141 A		0.3	N.D.	N.D.
17	Monocrotophos	µg/l	USEPA 8141 A		1	N.D.	N.D.
18	Phorate	µg/l	USEPA 8141 A		2	N.D.	N.D.
E. Microbial Parameters							
1	Total Coliform	MPN/100ml	IS:1622:1981:RA:2019	-		Absent	Absent
2	E. Coli	MPN/100ml	IS:1622:1981:RA:2019	-		Absent	Absent

Note: mg/lit.: milligram per liter, N.D.: Not Detected.

REMARKS: RESULTS ARE AS ABOVE

Terms & conditions

- The use of the report for publication, arbitration or as legal dispute is forbidden.
- Test sample will be retained for 15 days after issue of test report unless otherwise agreed with customer.
- This is for information as the party has asked for test report only.

 08/05/22 REVIEWED BY	 For ULTIMATE ENVIROLYTICAL SOLUTIONS	 08/05/22 AUTHORIZED SIGNATORY
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End of the test report



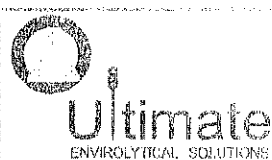
HDD-27/2 Phase III Near JP Chowk
Ring Road No. 2, Rajar Nagar, Raipur (C.G.) - 492099
Ph: 0771-402777 Email: ultimatenviro@gmail.com

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To, Jindal Power Limited P.O. Tamnar, District: Raigarh 496107 (C.G.)	Report No	UES/TR/22-23/01548	
	Lab Ref No	UES/22-23/W/01877-01879	
	Date of Sampling	28/04/2022	
	Date of Receipt	29/04/2022	
	Date of Report	08/05/2022	
	Date of analysis	Start: 29/04/2022	End: 08/05/2022
SAMPLE DETAILS			
Customer Sample Id / Sampling Location	1. Borewell - 06 (NW Near ash Dyke Reagan Village Side)	Latitude	22.11468
		Longitude	83.46731
	2. Piezometer - 07 (NE Near ash Dyke village pata village)	Latitude	22.13273
		Longitude	83.45694
	3. Piezometer - (Savitri Nagar Colony)	Latitude	22.11468
		Longitude	83.45507
Customer Ref. No. & Date	4400014853, Dated : 07/10/2021		
Sample Type	GroundWater		
Packing Of Sample	Plastic Bottle (5.0 ltr.) Glass Bottle (1.0 ltr.)		
Sample Collected By	Laboratory Chemist		
Sample Condition At Receipt	Ok		

REPORT NO. 01548

TEST REPORT								
SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible Limit	Borewell -06	Piezometer -07	Piezometer SN Colony
A. Organoleptic & Physical Parameters								
1	Colour	Hazen	IS:3025: (Part-4)	5	15	<1	<1	<1
2	Odour	-	IS:3025: (part-5)	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	pH Value at 25.2°C	-	IS:3025: (Part-11)	6.5-8.5	No Relaxation	8.06	7.54	7.45
4	Taste	-	IS:3025: (part-8)	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
5	Turbidity	NTU	IS:3025: (Part-10)	1	5	3.84	2.96	2.14
6	Total Dissolved Solids	mg/L	IS:3025: (Part-16)	500	2000	230.5	181.8	141.7
B. General Parameters Concerning Substances undesirable in excessive amounts								
1	Aluminium (as Al)	mg/L	IS:3025: (part-55)	0.03	0.2	N.D.	N.D.	N.D.
2	Ammonia (as total ammonia-N)	mg/L	IS:3025: (part-34)	0.5	No Relaxation	N.D.	N.D.	N.D.
3	Anionic Detergent (as MBAS)	mg/L	Annex K of IS:13428	0.2	1.0	N.D.	N.D.	N.D.



HDD-27/2, Phase III, Near JP Chowk
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REPORT NO. 01548

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Borewell 06	Piezometer 07	Piezometer SN Colony
4	Barium (as Ba)	mg/L	Annex F of IS:13428	0.7	No Relaxation	N.D.	N.D.	N.D.
5	Boron (as B)	mg/L	IS 3025: (Part-57)	0.5	1.0	N.D.	N.D.	N.D.
6	Calcium (as Ca)	mg/L	IS 3025: (Part-40)	75	200	25.65	20.04	20.04
7	Chloramines (as Cl ₂)	mg/L	IS 3025: (Part-26)	4.0	No Relaxation	N.D.	N.D.	N.D.
8	Chloride (as Cl)	mg/L	IS 3025: (Part-32)	250	1000	19.99	19.99	14.99
9	Copper (as Cu)	mg/L	IS 3025: (part-42)	0.05	1.5	N.D.	N.D.	N.D.
10	Fluoride (as F)	mg/L	IS 3025: (part-60)	1	1.5	0.21	0.20	0.18
11	Free Residual Chlorine	mg/L	IS 3025: (Part-26)	0.2	1	N.D.	N.D.	N.D.
12	Iron (as Fe)	mg/L	IS 3025: (part-53)	0.3	No Relaxation	N.D.	N.D.	N.D.
13	Magnesium (as Mg)	mg/L	IS 3025: (Part-46)	30	100	16.52	14.58	24.30
14	Manganese (as Mn)	mg/L	IS 3025: (part-55)	0.1	0.3	N.D.	N.D.	N.D.
15	Mineral Oil	mg/L	Clause 6 of IS 3025 (Part-39) Infrared partition method	0.5	No Relaxation	N.D.	N.D.	N.D.
16	Nitrate (as NO ₃)	mg/L	IS 3025: (part-34)	45	No Relaxation	0.03	0.01	0.01
17	Phenolic Compound (as C ₆ H ₅ OH)	mg/L	IS 3025: (part-43)	0.001	0.002	N.D.	N.D.	N.D.
18	Selenium (as Se)	mg/L	IS 3025: (part-56)	0.01	No Relaxation	N.D.	N.D.	N.D.
19	Silver (as Ag)	mg/L	Annex J of IS 13428	0.1	No Relaxation	N.D.	N.D.	N.D.
20	Sulphate (as SO ₄)	mg/L	IS 3025: (Part-24)	200	400	8.63	6.51	18.78
21	Sulphide (as H ₂ S)	mg/L	IS 3025: (Part-29)	0.05	No Relaxation	N.D.	N.D.	N.D.
22	Total Alkalinity (as CaCO ₃)	mg/L	IS 3025: (Part-23)	200	600	210	158	80
23	Total Hardness (as CaCO ₃)	mg/L	IS 3025: (Part-21)	200	600	132	110	150
24	Zinc (as Zn)	mg/L	IS 3025: (part-49)	5	15	N.D.	N.D.	N.D.
C.	Parameters concerning toxic substances:-							
1	Cadmium (as Cd)	mg/L	IS 3025: (part-41)	0.003	No Relaxation	N.D.	N.D.	N.D.
2	Cyanide (as CN)	mg/L	IS 3025: (part-27)	0.05	No Relaxation	N.D.	N.D.	N.D.

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HDD-272, Plot-5, Vihar, Near J.P. Chowk
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REPORT NO. 01548

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible Limit	Borewell 06	Piezometer 07	Piezometer SH Colony
3	Lead (as Pb)	mg/L	IS 3025(part-47)	0.01	No Relaxation	N.D.	N.D.	N.D.
4	Mercury (as Hg)	mg/L	IS 3025(part-48)	0.001	No Relaxation	N.D.	N.D.	N.D.
5	Molybdenum (as Mo)	mg/L	IS 3025(part-2)	0.07	No Relaxation	N.D.	N.D.	N.D.
6	Nickel (as Ni)	mg/L	IS 3025(part-54)	0.02	No Relaxation	N.D.	N.D.	N.D.
7	Polychlorinated biphenyls	mg/L	ASTM 5175	0.0005	No Relaxation	N.D.	N.D.	N.D.
8	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	APHA 6440	0.0001	No Relaxation	N.D.	N.D.	N.D.
9	Arsenic (as As)	mg/L	IS 3025(part-37)	0.01	0.05	N.D.	N.D.	N.D.
10	Chromium (as Cr)	mg/L	Annex J of IS:13428	0.05	No Relaxation	N.D.	N.D.	N.D.
11	Trihalomethanes:							
a)	Bromoform	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.	N.D.
b)	Dibromochloromethane	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.	N.D.
c)	Bromodichloromethane	mg/L	APHA 6232	0.06	No Relaxation	N.D.	N.D.	N.D.
d)	Chloroform	mg/L	APHA 6232	0.2	No Relaxation	N.D.	N.D.	N.D.
D.	Pesticides:-							
1	Alpha HCH	µg/l	USEPA 508		0.01	N.D.	N.D.	N.D.
2	Beta HCH	µg/l	USEPA 508		0.04	N.D.	N.D.	N.D.
3	Delta HCH	µg/l	USEPA 508		0.04	N.D.	N.D.	N.D.
4	Alachlor	µg/l	USEPA 525.2, 507		20	N.D.	N.D.	N.D.
5	Aldrin / Dieldrin	µg/l	USEPA 508		0.03	N.D.	N.D.	N.D.
6	Atrazine	µg/l	USEPA 525.2, 8141 A		2	N.D.	N.D.	N.D.
7	Butachlor	µg/l	USEPA 525.2, 8141 A		125	N.D.	N.D.	N.D.
8	Chlorpyrifos	µg/l	USEPA 525.2, 8141 A		30	N.D.	N.D.	N.D.
9	DDT (o,p and p, p-isomers of DDT, DDE and DDD)	µg/l	USEPA 508		1	N.D.	N.D.	N.D.
10	Gamma HCH	µg/l	USEPA 508		2	N.D.	N.D.	N.D.

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HDD-272 (Plot 8911) Near JP Chowk
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REPORT NO. 01548

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Borewell 06	Piezometer 07	Piezometer SN Colony
11	2,4-Dichlorophenox yacetic Acid	µg/l	USEPA 515.1		30	N.D.	N.D.	N.D.
12	Endosulphan (alpha, beta and sulphate)	µg/l	USEPA 508		0.4	N.D.	N.D.	N.D.
13	Ethion	µg/l	USEPA 1657 A		3	N.D.	N.D.	N.D.
14	Isoproturon	µg/l	USEPA 532		9	N.D.	N.D.	N.D.
15	Malathion	µg/l	USEPA 8141 A		190	N.D.	N.D.	N.D.
16	Methyl Parathion	µg/l	USEPA 8141 A		0.3	N.D.	N.D.	N.D.
17	Monocrotophos	µg/l	USEPA 8141 A		1	N.D.	N.D.	N.D.
18	Phorate	µg/l	USEPA 8141 A		2	N.D.	N.D.	N.D.
E. Microbial Parameters								
1	Total Coliform	MPN/100ml	IS:1622:1981:RA: 2019	-	-	Absent	Absent	Absent
2	E. Coli	MPN/100ml	IS:1622:1981:RA: 2019	-	-	Absent	Absent	Absent

Note: mg/lit.: milligram per liter, N.D.: Not Detected.

REMARKS: RESULTS ARE AS ABOVE

Terms & conditions

- The use of the report for publication, arbitration or as legal dispute is forbidden.
- Test sample will be retained for 15 days after issue of test report unless otherwise agreed with customer.
- This is for information as the party has asked for above test(s) only.

 08/05/22 REVIEWED BY	 For ULTIMATE ENVIROLYTICAL SOLUTIONS	 08/05/22 AUTHORIZED SIGNATORY
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End of the test report



HDD-272, Pithampur, Near JP Chowk
Ring Road No. 2, Kolar Nagar, Raipur (C.G.) - 492099
Ph. 0771-2402777 Email: ultimateenviro@gmail.com

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To, Jindal Power Limited P.O. Tamnar, District: Raigarh 496107 (C.G.)		Report No UES/TR/22-23/01549
		Lab Ref No UES/22-23/W/01880-01882
		Date of Sampling 28/04/2022
		Date of Receipt 29/04/2022
		Date of Report 08/05/2022
		Date of analysis Start:29/04/2022 END: 08/05/2022
SAMPLE DETAILS		
Customer Sample Id /Sampling Location	1. Pata Village	Latitude 22.13781
		Longitude 83.46132
	2. Kunjemura Village	Latitude 22.13519
		Longitude 83.46135
	3. Tamnar Village	Latitude 22.07879
		Longitude 83.42356
Customer Ref. No. & Date	J400014853, Dated :07/10/2021	
Sample Type	Ground Water	
Packing Of Sample	Plastic Bottle (5.0ltr.) Glass Bottle (1.0 ltr.)	
Sample Collected By	Laboratory Chemist	
Sample Condition At Receipt	OK	

REPORT NO. 01549

TEST REPORT								
SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptabl e Limit	Permissible Limit	Pata Village	Kunjemura Village	Tamnar Village
A. Organoleptic & Physical Parameters								
1	Colour	Hazen	IS:3025: (Part-4)	5	15	<1	<1	<1
2	Odour	-	IS 3025(part-5)	Agreeab le	Agreeeab le	Agreeea ble	Agreeea ble	Agreeea ble
3	pH Value at 25.2°C	-	IS:3025: (Part-11)	6.5-8.5	No Relaxation	7.38	7.12	7.78
4	Taste	-	IS 3025(part-8)	Agreeab le	Agreeeab le	Agreeea ble	Agreeea ble	Agreeea ble
5	Turbidity	NTU	IS 3025: (Part-10)	1	5	2.26	3.60	3.96
6	Total Dissolved Solids	mg/L	IS:3025: (Part-16)	500	2000	444.2	170.1	265.5
B. General Parameters Concerning Substances undesirable in excessive amounts								
1	Aluminium (as Al)	mg/L	IS 3025(part-55)	0.03	0.2	N.D.	N.D.	N.D.
2	Ammonia (as total ammonia-N)	mg/L	IS 3025(part-34)	0.5	No Relaxation	N.D.	N.D.	N.D.
3	Anionic Detergent (as MBAS)	mg/l	Annex K of IS:13428	0.2	1.0	N.D.	N.D.	N.D.

AN ISO : 9001:2015 / ISO: 14001:2015 / ISO 45001:2018 CERTIFIED LABORATORY



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REPORT NO. 01549

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Pata Village	Kunjemura Village	Tannar Village
4	Barium (as Ba)	mg/L	Annex F of IS:13428	0.7	No Relaxation	N.D.	N.D.	N.D.
5	Boron (as B)	mg/L	IS 3025:(Part-57)	0.5	1.0	N.D.	N.D.	N.D.
6	Calcium (as Ca)	mg/L	IS 3025:(Part-40)	75	200	92.18	30.46	41.68
7	Chloramines (as Cl ₂)	mg/L	IS 3025:(Part-26)	4.0	No Relaxation	N.D.	N.D.	N.D.
8	Chloride (as Cl)	mg/L	IS 3025:(Part-32)	250	1000	44.98	3.99	64.97
9	Copper (as Cu)	mg/L	IS 3025(part-42)	0.05	1.5	N.D.	N.D.	N.D.
10	Fluoride (as F)	mg/L	IS 3025(part-60)	1	1.5	0.11	0.18	0.20
11	Free Residual Chlorine	mg/L	IS 3025:(Part-26)	0.2	1	N.D.	N.D.	N.D.
12	Iron (as Fe)	mg/L	IS 3025(part-53)	0.3	No Relaxation	0.16	0.24	0.09
13	Magnesium (as Mg)	mg/L	IS 3025:(Part-46)	30	100	30.61	22.84	20.89
14	Manganese (as Mn)	mg/L	IS 3025(part-59)	0.1	0.3	N.D.	N.D.	N.D.
15	Mineral Oil	mg/L	Clause 6 of IS 3025 (Part-39) Infrared partition method	0.5	No Relaxation	N.D.	N.D.	N.D.
16	Nitrate (as NO ₃)	mg/L	IS 3025(part-34)	45	No Relaxation	0.04	0.12	0.43
17	Phenolic Compound (as C ₆ H ₅ OH)	mg/L	IS 3025(part-43)	0.001	0.002	N.D.	N.D.	N.D.
18	Selenium (as Se)	mg/L	IS 3025(part-56)	0.01	No Relaxation	N.D.	N.D.	N.D.
19	Silver (as Ag)	mg/L	Annex J of IS 13428	0.1	No Relaxation	N.D.	N.D.	N.D.
20	Sulphate (as SO ₄)	mg/L	IS 3025:(Part-24)	200	400	25.18	131.46	23.22
21	Sulphide (as H ₂ S)	mg/L	IS 3025:(Part-29)	0.05	No Relaxation	N.D.	N.D.	N.D.
22	Total Alkalinity (as CaCO ₃)	mg/L	IS 3025:(Part-23)	200	600	148	104	156
23	Total Hardness (as CaCO ₃)	mg/L	IS 3025:(Part-21)	200	600	356	170	190
24	Zinc (as Zn)	mg/L	IS 3025(part-49)	5	15	N.D.	N.D.	N.D.
C. Parameters concerning toxic substances:-								
1	Cadmium (as Cd)	mg/L	IS 3025(part-41)	0.003	No Relaxation	N.D.	N.D.	N.D.
2	Cyanide (as CN)	mg/L	IS 3025(part-27)	0.05	No Relaxation	N.D.	N.D.	N.D.

AN ISO : 9001:2015 / ISO: 14001:2015 / ISO 45001:2018 CERTIFIED LABORATORY



HDD-272, Phase II, Near JP Chowk
Ring Road, Kumbhari Nagar, Raipur (C.G.) - 492039
Ph: 0771-2400772 Email: ultimateenviro@gmail.com

Recognized by Ministry of Environment Forest and Climate Change under EP act 1986

REPORT NO. 01549

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Pata Village	Kunjumara Village	Tannar Village
3	Lead (as Pb)	mg/L	IS 3025(part-47)	0.01	No Relaxation	N.D.	N.D.	N.D.
4	Mercury (as Hg)	mg/L	IS 3025(part-48)	0.001	No Relaxation	N.D.	N.D.	N.D.
5	Molybdenum (as Mo)	mg/L	IS 3025(part-2)	0.07	No Relaxation	N.D.	N.D.	N.D.
6	Nickel (as Ni)	mg/L	IS 3025(part-54)	0.02	No Relaxation	N.D.	N.D.	N.D.
7	Polychlorinated biphenyls	mg/L	ASTM 5175	0.0005	No Relaxation	N.D.	N.D.	N.D.
8	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	APHA 6440	0.0001	No Relaxation	N.D.	N.D.	N.D.
9	Arsenic (as As)	mg/L	IS 3025(part-37)	0.01	0.05	N.D.	N.D.	N.D.
10	Chromium (as Cr)	mg/L	Annex J of IS:13428	0.05	No Relaxation	N.D.	N.D.	N.D.
11	Trihalomethanes:							
a)	Bromoform	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.	N.D.
b)	Dibromochloromethane	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.	N.D.
c)	Bromodichloromethane	mg/L	APHA 6232	0.06	No Relaxation	N.D.	N.D.	N.D.
d)	Chloroform	mg/L	APHA 6232	0.2	No Relaxation	N.D.	N.D.	N.D.
D.	Pesticides:-							
1	Alpha HCH	µg/l	USEPA 508	0.01		N.D.	N.D.	N.D.
2	Beta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.	N.D.
3	Delta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.	N.D.
4	Alachlor	µg/l	USEPA 525.2, 507	20		N.D.	N.D.	N.D.
5	Aldrin / Dieldrin	µg/l	USEPA 508	0.03		N.D.	N.D.	N.D.
6	Atrazine	µg/l	USEPA 525.2, 8141 A	2		N.D.	N.D.	N.D.
7	Butachlor	µg/l	USEPA 525.2, 8141 A	125		N.D.	N.D.	N.D.
8	Chlorpyrifos	µg/l	USEPA 525.2, 8141 A	30		N.D.	N.D.	N.D.
9	DDT (o,p and p, p-Isomers of DDT, DDE and DDD)	µg/l	USEPA 508	1		N.D.	N.D.	N.D.
10	Gamma HCH	µg/l	USEPA 508	2		N.D.	N.D.	N.D.

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HDD-27, P. S. Hill, Near J.P. Chowk
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Ph: 0771-4402777 Email: ultimateenviro@gmail.com

Recognized by Ministry of Environment Forest and Climate Change under EP act 1986

REPORT NO. 01549

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Pata Village	Kunjemura Village	Tannar Village
11	2,4-Dichlorophenoxyacetic Acid	µg/l	USEPA 515.1		30	N.D.	N.D.	N.D.
12	Endosulphan (alpha, beta and sulphate)	µg/l	USEPA 508		0.4	N.D.	N.D.	N.D.
13	Ethion	µg/l	USEPA 1657 A		3	N.D.	N.D.	N.D.
14	Isoproturon	µg/l	USEPA 532		9	N.D.	N.D.	N.D.
15	Malathion	µg/l	USEPA 8141 A		190	N.D.	N.D.	N.D.
16	Methyl Parathion	µg/l	USEPA 8141 A		0.3	N.D.	N.D.	N.D.
17	Monocrotophos	µg/l	USEPA 8141 A		1	N.D.	N.D.	N.D.
18	Phorate	µg/l	USEPA 8141 A		2	N.D.	N.D.	N.D.
E. Microbial Parameters								
1	Total Coliform	MPN/100ml	IS:1622:1981:RA : 2019		-	Absent	Absent	Absent
2	E. Coli	MPN/100ml	IS:1622:1981:RA : 2019		-	Absent	Absent	Absent

Note: mg/lit.: milligram per liter, N.D.: Not Detected.

REMARKS: RESULTS ARE AS ABOVE

Terms & conditions

- > The above analysis report refers to the particular sample received at our end and the use of the report for publication, arbitration or as legal dispute is forbidden.
- > Test sample will be retained for 15 days after issue of test report unless otherwise agreed with customer.
- > This is for information as the party has asked for above report only.

 08/05/22 REVIEWED BY	 For ULTIMATE ENVIROLYTICAL SOLUTIONS 08/05/22 AUTHORIZED SIGNATORY
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-----End of the test report-----



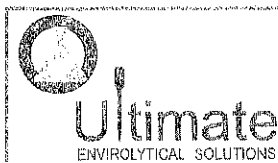
HDD-272 Phase III - Near JP Chowk
Ring Road No. 2, Kabir Nagar, Raipur (C.G.) - 492099
Ph: 0771-4027777 | Email: ultimatenviro@gmail.com

To, Jindal Power Limited P.O. Tamnar, District: Raigarh 496107 (C.G.)		Report No	UES/TR/22-23/03055	
		Lab Ref No	UES/22-23/W/08236-08237	
		Date of Sampling	23/08/2022	
		Date of Receipt	24/08/2022	
		Date of Report	29/08/2022	
		Date of analysis	Start: 24/08/2022	END: 29/08/2022
SAMPLE DETAILS				
Customer Sample Id /Sampling Location	1. Piezometer - 01 (Near Gate No. 03)	Latitude	22.13197	
	2. Piezometer - 02 (SW near Ash Dyke S.V.2)	Longitude	83.45947	
Customer Ref. No. & Date	4400014853, Dated :07/10/2021	Latitude	22.11586	
Sample Type	Groundwater	Longitude	83.45075	
Packing Of Sample	Plastic Bottle (5.0 ltr.), Glass Bottle (1.0 ltr.)			
Sample Collected By	Laboratory Chemist			
Sample Condition At Receipt	Ok			

REPORT NO. 03055

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Piezometer 01	Piezometer 02
A.	Organoleptic & Physical Parameters						
1	Colour	Hazen	IS:3025:(Part-4)	5	15	<1.0	<1.0
2	Odour	-	IS 3025(part-5)	Agreeable	Agreeable	Agreeable	Agreeable
3	pH Value at 25.4°C	-	IS:3025:(Part-11)	6.5-8.5	No Relaxation	7.56	7.65
4	Taste	-	IS 3025(part-8)	Agreeable	Agreeable	Agreeable	Agreeable
5	Turbidity	NTU	IS 3025:(Part-10)	1	5	2.86	0.86
6	Total Dissolved Solids	mg/L	IS:3025:(Part-16)	500	2000	126.4	190.2
B.	General Parameters Concerning Substances undesirable in excessive amounts						
1	Aluminium (as Al)	mg/L	IS 3025(part-55)	0.03	0.2	BDL	BDL
2	Ammonia (as total ammonia-N)	mg/L	IS 3025(part-34)	0.5	No Relaxation	N.D.	N.D.
3	Anionic Detergent (as MBAS)	mg/L	Annex K of IS:13428	0.2	1.0	BDL	BDL
4	Barium (as Ba)	mg/L	Annex F of IS:13428	0.7	No Relaxation	N.D.	N.D.
5	Boron. (as B)	mg/L	IS 3025:(Part-57)	0.5	1.0	N.D.	N.D.



HDD-272, Phase III - Near JP Chowk
Ring Road No. 2, Kabil Nagar, Raipur (C.G.) - 492099
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REPORT NO. 03055

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible Limit	Piezometer 01	Piezometer 02
6	Calcium (as Ca)	mg/L	IS 3025: (Part-40)	75	200	29.66	38.48
7	Chloramines (as Cl ₂)	mg/L	IS 3025: (Part-26)	4.0	No Relaxation	N.D.	N.D.
8	Chloride (as Cl)	mg/L	IS 3025: (Part-32)	250	1000	26.9	32.9
9	Copper (as Cu)	mg/L	IS 3025 (part-42)	0.05	1.5	BDL	BDL
10	Fluoride (as F)	mg/L	IS 3025 (part-60)	1	1.5	0.11	0.16
11	Free Residual Chlorine	mg/L	IS 3025: (Part-26)	0.2	1	BDL	BDL
12	Iron (as Fe)	mg/L	IS 3025 (part-53)	0.3	No Relaxation	BDL	BDL
13	Magnesium (as Mg)	mg/L	IS 3025: (Part-46)	30	100	7.2	9.35
14	Manganese (as Mn)	mg/L	IS 3025 (part-59)	0.1	0.3	BDL	BDL
15	Mineral Oil	mg/L	Clause 6 of IS 3025 (Part-39) Infrared partition method	0.5	No Relaxation	N.D.	N.D.
16	Nitrate (as NO ₃)	mg/L	IS 3025 (part-34)	45	No Relaxation	0.56	0.28
17	Phenolic Compound (as C ₆ H ₅ OH)	mg/L	IS 3025 (part-43)	0.001	0.002	BDL	BDL
18	Selenium (as Se)	mg/L	IS 3025 (part-56)	0.01	No Relaxation	BDL	BDL
19	Silver (as Ag)	mg/L	Annex J of IS 13428	0.1	No Relaxation	N.D.	N.D.
20	Sulphate (as SO ₄)	mg/L	IS 3025: (Part-24)	200	400	26.4	12.8
21	Sulphide (as H ₂ S)	mg/L	IS 3025: (Part-29)	0.05	No Relaxation	N.D.	N.D.
22	Total Alkalinity (as CaCO ₃)	mg/L	IS 3025: (Part-23)	200	600	60	80
23	Total Hardness (as CaCO ₃)	mg/L	IS 3025: (Part-21)	200	600	80	110
24	Zinc (as Zn)	mg/L	IS 3025 (part-49)	5	15	BDL	BDL
C. Parameters concerning toxic substances:-							
1	Cadmium (as Cd)	mg/L	IS 3025 (part-41)	0.003	No Relaxation	BDL	BDL
2	Cyanide (as CN)	mg/L	IS 3025 (part-27)	0.05	No Relaxation	BDL	BDL
3	Lead (as Pb)	mg/L	IS 3025 (part-47)	0.01	No	BDL	BDL

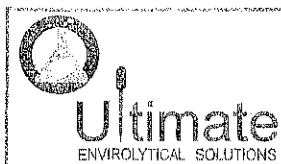


HDD 272 Phase II - Near JP Chowk
Ring Road No-2, Kabir Nagar, Raipur (C.G.) - 492099
Ph : 0771 - 4027777 | Email : ultimateenviro@gmail.com

REPORT NO. 03055

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible Limit	Piezometer 01	Piezometer 02
					Relaxation		
4	Mercury (as Hg)	mg/L	IS 3025 (part-48)	0.001	No Relaxation	BDL	BDL
5	Molybdenum (as Mo)	mg/L	IS 3025 (part-2)	0.07	No Relaxation	N.D.	N.D.
6	Nickel (as Ni)	mg/L	IS 3025 (part-54)	0.02	No Relaxation	N.D.	N.D.
7	Polychlorinated biphenyls	mg/L	ASTM 5175	0.0005	No Relaxation	N.D.	N.D.
8	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	APHA 6440	0.0001	No Relaxation	N.D.	N.D.
9	Arsenic (as As)	mg/L	IS 3025 (part-37)	0.01	0.05	N.D.	N.D.
10	Chromium (as Cr)	mg/L	Annex J of IS:13428	0.05	No Relaxation	N.D.	N.D.
11	Trihalomethanes:						
a)	Bromoform	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.
b)	Dibromochloromethane	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.
c)	Bromodichloromethane	mg/L	APHA 6232	0.06	No Relaxation	N.D.	N.D.
d)	Chloroform	mg/L	APHA 6232	0.2	No Relaxation	N.D.	N.D.
D.	Pesticides:-						
1	Alpha HCH	µg/l	USEPA 508	0.01		N.D.	N.D.
2	Beta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.
3	Delta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.
4	Alachlor	µg/l	USEPA 525.2, 507	20		N.D.	N.D.
5	Aldrin / Dieldrin	µg/l	USEPA 508	0.03		N.D.	N.D.
6	Atrazine	µg/l	USEPA 525.2, 8141 A	2		N.D.	N.D.
7	Butachlor	µg/l	USEPA 525.2, 8141 A	125		N.D.	N.D.
8	Chlorpyrifos	µg/l	USEPA 525.2, 8141 A	30		N.D.	N.D.
9	DDT (o,p and p, p-Isomers of DDT, DDE and DDD)	µg/l	USEPA 508	1		N.D.	N.D.
10	Gamma HCH	µg/l	USEPA 508	2		N.D.	N.D.
11	2,4-Dichlorophenoxy acetic Acid	µg/l	USEPA 515.1	30		N.D.	N.D.
12	Endosulphan (alpha, beta	µg/l	USEPA 508	0.4		N.D.	N.D.



HDD-272 Phase III - Near JP Chowk
Ring Road No. 2, Kabir Nagar, Raipur (C.G.) - 492099
Ph: 0771-4027777 | Email: ultimatenviro@gmail.com

REPORT NO. 03055

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible Limit	Piezometer 01	Piezometer 02
	and sulphate)						
13	Ethion	µg/l	USEPA 1657 A		3	N.D.	N.D.
14	Isoproturon	µg/l	USEPA 532		9	N.D.	N.D.
15	Malathion	µg/l	USEPA 8141 A		190	N.D.	N.D.
16	Methyl Parathion	µg/l	USEPA 8141 A		0.3	N.D.	N.D.
17	Monocrotophos	µg/l	USEPA 8141 A		1	N.D.	N.D.
18	Phorate	µg/l	USEPA 8141 A		2	N.D.	N.D.
E. Microbial Parameters							
1	Total Coliform	MPN/100ml	IS:1622:1981:RA:2019		-	Absent	Absent
2	E. Coli	MPN/100ml	IS:1622:1981:RA:2019		-	Absent	Absent

Note: mg/lit.: milligram per liter, N.D.: Not Detected.

REMARKS: RESULTS ARE AS ABOVE*Terms & conditions*

- The use of the report for publication, arbitration or as legal dispute is forbidden.
- Test sample will be retained for 15 days after issue of test report unless otherwise agreed with customer.
- This is for information as the party has asked for above test(s) only.

 28/08/22 REVIEWED BY		For ULTIMATE ENVIROLYTICAL SOLUTIONS 29/8/22 AUTHORIZED SIGNATORY
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-----End of the test report-----



HDD-272 Phase III - Near JP Chowk
Ring Road No-2 Kabir Nagar Raipur (C.G.) - 492099
Ph: 0771-4027777 | Email: ultimatenviro@gmail.com

To, Jindal Power Limited P.O. Tamnar, District: Raigarh 496107 (C.G.)		Report No UES/TR/22-23/03056	
		Lab Ref No UES/22-23/W/08238-08240	
		Date of Sampling 23/08/2022	
		Date of Receipt 24/08/2022	
		Date of Report 29/08/2022	
		Date of analysis Start: 24/08/2022 End: 29/08/2022	
SAMPLE DETAILS			
Customer Sample Id / Sampling Location	1. Borewell - 06 (NW Near ash Dyke Reagan Village Side)	Latitude	22.11468
		Longitude	83.46731
	2. Piezometer - 07 (NE Near ash Dyke village pata village)	Latitude	22.13273
		Longitude	83.45694
	3. Piezometer - (Savitri Nagar Colony)	Latitude	22.11468
		Longitude	83.45807
Customer Ref. No. & Date	4400014853, Dated: 07/10/2021		
Sample Type	Ground Water		
Packing Of Sample	Plastic Bottle (5.0 ltr.) Glass Bottle (1.0 ltr.)		
Sample Collected By	Laboratory Chemist		
Sample Condition At Receipt	Ok		

REPORT NO. 03056

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Borewell 06	Piezometer 07	Piezometer SN Colony
A.	Organoleptic & Physical Parameters							
1	Colour	Hazen	IS:3025: (Part-4)	5	15	<1.0	<1.0	<1.0
2	Odour	-	IS:3025: (part-5)	Agreeabl e	Agreeable	Agreeabl le	Agreeabl le	Agreeabl le
3	pH Value at 25.2°C	-	IS:3025: (Part-11)	6.5-8.5	No Relaxation	7.59	7.01	6.5
4	Taste	-	IS:3025: (part-8)	Agreeabl e	Agreeable	Agreeabl e	Agreeabl e	Agreeabl e
5	Turbidity	NTU	IS:3025: (Part-10)	1	5	0.68	1.22	0.74
6	Total Dissolved Solids	mg/L	IS:3025: (Part-16)	500	2000	275.4	420	203.2
B.	General Parameters Concerning Substances undesirable in excessive amounts							
1	Aluminium (as Al)	mg/L	IS:3025: (part-55)	0.03	0.2	BDL	BDL	BDL
2	Ammonia (as total ammonia-N)	mg/L	IS:3025: (part-34)	0.5	No Relaxation	N.D.	N.D.	N.D.
3	Anionic Detergent (as MBAS)	mg/L	Annex K of IS:13428	0.2	1.0	N.D.	N.D.	N.D.
4	Barium (as Ba)	mg/L	Annex F of IS:13428	0.7	No Relaxation	N.D.	N.D.	N.D.

AN ISO : 9001:2015 / ISO: 14001:2015 / ISO 45001:2018 CERTIFIED LABORATORY



HDD-272 Phase III - Near JP Chowk
Ring Road No.-2, Kabir Nagar, Raipur (C.G.) - 492039
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REPORT NO. 03056

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Borewell 06	Piezometer 07	Piezometer SN Colony
5	Boron (as B)	mg/L	IS 3025: (Part-57)	0.5	1.0	N.D.	N.D.	N.D.
6	Calcium (as Ca)	mg/L	IS 3025: (Part-40)	75	200	36.87	48.9	31.26
7	Chloramines (as Cl ₂)	mg/L	IS 3025: (Part-26)	4.0	No Relaxation	N.D.	N.D.	N.D.
8	Chloride (as Cl)	mg/L	IS 3025: (Part-32)	250	1000	64.9	120.9	42.9
9	Copper (as Cu)	mg/L	IS 3025 (part-42)	0.05	1.5	BDL	BDL	BDL
10	Fluoride (as F)	mg/L	IS 3025 (part-60)	1	1.5	0.14	0.12	0.16
11	Free Residual Chlorine	mg/L	IS 3025: (Part-26)	0.2	1	BDL	BDL	BDL
12	Iron (as Fe)	mg/L	IS 3025 (part-53)	0.3	No Relaxation	BDL	BDL	BDL
13	Magnesium (as Mg)	mg/L	IS 3025: (Part-46)	30	100	8.9	11.8	7.53
14	Manganese (as Mn)	mg/L	IS 3025 (part-59)	0.1	0.3	BDL	BDL	BDL
15	Mineral Oil	mg/L	Clause 6 of IS 3025 (Part-39) Infrared partition method	0.5	No Relaxation	N.D.	N.D.	N.D.
16	Nitrate (as NO ₃)	mg/L	IS 3025 (part-34)	45	No Relaxation	0.34	0.58	0.34
17	Phenolic Compound (as C ₆ H ₅ OH)	mg/L	IS 3025 (part-43)	0.001	0.002	BDL	BDL	BDL
18	Selenium (as Se)	mg/L	IS 3025 (part-56)	0.01	No Relaxation	BDL	BDL	BDL
19	Silver (as Ag)	mg/L	Annex J of IS 13428	0.1	No Relaxation	N.D.	N.D.	N.D.
20	Sulphate (as SO ₄)	mg/L	IS 3025: (Part-24)	200	400	18.4	20.6	26.8
21	Sulphide (as H ₂ S)	mg/L	IS 3025: (Part-29)	0.05	No Relaxation	N.D.	N.D.	N.D.
22	Total Alkalinity (as CaCO ₃)	mg/L	IS 3025: (Part-23)	200	600	140	210	110
23	Total Hardness (as CaCO ₃)	mg/L	IS 3025: (Part-21)	200	600	180	240	130
24	Zinc (as Zn)	mg/L	IS 3025 (part-49)	5	15	BDL	BDL	BDL
C. Parameters concerning toxic substances:-								
1	Cadmium (as Cd)	mg/L	IS 3025 (part-41)	0.003	No Relaxation	N.D.	N.D.	N.D.
2	Cyanide (as CN)	mg/L	IS 3025 (part-27)	0.05	No Relaxation	N.D.	N.D.	N.D.
3	Lead (as Pb)	mg/L	IS 3025 (part-47)	0.01	No Relaxation	N.D.	N.D.	N.D.



HDD-272, Phase II - Near JP Chowk
Ring Road No-2, Kabir Nagar, Raipur (C.G.) - 492099
Ph - 0771 - 4027777 | Email - ultimateenviro@gmail.com

REPORT NO. 03056

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Borewell 06	Piezometer 07	Piezometer SN Colony
4	Mercury (as Hg)	mg/L	IS 3025 (part-48)	0.001	No Relaxation	N.D.	N.D.	N.D.
5	Molybdenum (as Mo)	mg/L	IS 3025 (part-2)	0.07	No Relaxation	N.D.	N.D.	N.D.
6	Nickel (as Ni)	mg/L	IS 3025 (part-54)	0.02	No Relaxation	N.D.	N.D.	N.D.
7	Polychlorinated biphenyls	mg/L	ASTM 5175	0.0005	No Relaxation	N.D.	N.D.	N.D.
8	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	APHA 6440	0.0001	No Relaxation	N.D.	N.D.	N.D.
9	Arsenic (as As)	mg/L	IS 3025 (part-37)	0.01	0.05	N.D.	N.D.	N.D.
10	Chromium (as Cr)	mg/L	Annex J of IS:13428	0.05	No Relaxation	N.D.	N.D.	N.D.
11	Trihalomethanes:							
a)	Bromoform	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.	N.D.
b)	Dibromochloromethane	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.	N.D.
c)	Bromodichloromethane	mg/L	APHA 6232	0.06	No Relaxation	N.D.	N.D.	N.D.
d)	Chloroform	mg/L	APHA 6232	0.2	No Relaxation	N.D.	N.D.	N.D.
D.	Pesticides:-							
1	Alpha HCH	µg/l	USEPA 508	0.01		N.D.	N.D.	N.D.
2	Beta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.	N.D.
3	Delta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.	N.D.
4	Alachlor	µg/l	USEPA 525.2, 507	20		N.D.	N.D.	N.D.
5	Aldrin / Dieldrin	µg/l	USEPA 508	0.03		N.D.	N.D.	N.D.
6	Atrazine	µg/l	USEPA 525.2, 8141 A	2		N.D.	N.D.	N.D.
7	Butachlor	µg/l	USEPA 525.2, 8141 A	125		N.D.	N.D.	N.D.
8	Chlorpyrifos	µg/l	USEPA 525.2, 8141 A	30		N.D.	N.D.	N.D.
9	DDT (o,p and p, p-Isomers of DDT, DDE and DDD)	µg/l	USEPA 508	1		N.D.	N.D.	N.D.
10	Gamma HCH	µg/l	USEPA 508	2		N.D.	N.D.	N.D.
11	2,4-Dichlorophenoxyacetic Acid	µg/l	USEPA 515.1	30		N.D.	N.D.	N.D.

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Ring Road No. 2, Kabin Nagar, Raipur (C.G.) - 492099
Ph: 0771 - 4027777 | Email: ultimatenviro@gmail.com

REPORT NO. 03056

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Borewell 06	Piezometer 07	Piezometer SN Colony
12	Endosulphan (alpha, beta and sulphate)	µg/l	USEPA 508		0.4	N.D.	N.D.	N.D.
13	Ethion	µg/l	USEPA 1657 A		3	N.D.	N.D.	N.D.
14	Isoproturon	µg/l	USEPA 532		9	N.D.	N.D.	N.D.
15	Malathion	µg/l	USEPA 8141 A		190	N.D.	N.D.	N.D.
16	Methyl Parathion	µg/l	USEPA 8141 A		0.3	N.D.	N.D.	N.D.
17	Monocrotophos	µg/l	USEPA 8141 A		1	N.D.	N.D.	N.D.
18	Phorate	µg/l	USEPA 8141 A		2	N.D.	N.D.	N.D.
E.	Microbial Parameters							
1	Total Coliform	MPN/100ml	IS:1622:1981:RA: 2019		-	Absent	Absent	Absent
2	E. Coli	MPN/100ml	IS:1622:1981:RA: 2019		-	Absent	Absent	Absent

Note: mg/ltr: milligram per liter, N.D.: Not Detected.

REMARKS: RESULTS ARE AS ABOVE*Terms & conditions*

- The use of the report for publication, arbitration or as legal dispute is forbidden.
- Test sample will be retained for 15 days after issue of test report unless otherwise agreed with customer.
- This is for information as the party has asked for above test(s) only.

 29/08/22 REVIEWED BY	 For ULTIMATE ENVIROLYTICAL SOLUTIONS 29/8/22 AUTHORIZED SIGNATORY
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-----End of the test report-----



Ultimate
ENVIROLYTICAL SOLUTIONS

HDD-272 Phase III - Near JP Chowk
Ring Road No-2, Kabir Nagar, Raipur (C.G.) - 492099
Ph: 0771-4027777 | Email: ultimatenviro@gmail.com

To, Jindal Power Limited P.O. Tamnar, District: Raigarh 496107 (C.G.)		Report No		UES/TR/22-23/03057	
		Lab Ref No		UES/22-23/W/08241-08243	
		Date of Sampling		23/08/2022	
		Date of Receipt		24/08/2022	
		Date of Report		29/08/2022	
		Date of analysis		Start: 24/08/2022	END: 29/08/2022
SAMPLE DETAILS					
Customer Sample Id /Sampling Location	1. Pata Village	Latitude	22.13781		
		Longitude	83.46132		
	2. Kunjemura Village	Latitude	22.13519		
		Longitude	83.46135		
	3. Tamnar Village	Latitude	22.07879		
		Longitude	83.42356		
Customer Ref. No. & Date		4400014853, Dated :07/10/2021			
Sample Type		Ground Water			
Packing Of Sample		Plastic Bottle (5.0ltr.) Glass Bottle (1.0 ltr.)			
Sample Collected By		Laboratory Chemist			
Sample Condition At Receipt		Ok			

REPORT NO. 03057

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptabl e Limit	Permissible limit	Pata Village	Kunjemura Village	Tamnar Village
A.	Organoleptic & Physical Parameters							
1	Colour	Hazen	IS:3025:(Part-4)	5	15	<1.0	<1	<1.0
2	Odour	-	IS 3025(part-5)	Agreeab le	Agreeable	Agreeab le	Agreea ble	Agreeab le
3	pH Value at 25.2°C	-	IS:3025:(Part-11)	6.5-8.5	No Relaxation	6.49	7.04	7.32
4	Taste	-	IS 3025(part-8)	Agreeab le	Agreeable	Agreeabl e	Agreea ble	Agreeabl e
5	Turbidity	NTU	IS 3025:(Part-10)	1	5	0.45	1.24	1.22
6	Total Dissolved Solids	mg/L	IS:3025:(Part-16)	500	2000	236.4	196.4	271.6
B.	General Parameters Concerning Substances undesirable in excessive amounts							
1	Aluminium (as Al)	mg/L	IS 3025(part-55)	0.03	0.2	N.D.	N.D.	N.D.
2	Ammonia (as total ammonia-N)	mg/L	IS 3025(part-34)	0.5	No Relaxation	N.D.	N.D.	N.D.
3	Anionic Detergent (as MBAS)	mg/L	Annex K of IS:13428	0.2	1.0	N.D.	N.D.	N.D.



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Ring Road No. 2, Kabil Nagar, Raipur (C.G.) - 492099
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REPORT NO. 03057

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Pata Village	Kunjimura Village	Tannar Village
4	Barium (as Ba)	mg/L	Annex F of IS:13428	0.7	No Relaxation	N.D.	N.D.	N.D.
5	Boron (as B)	mg/L	IS 3025: (Part-57)	0.5	1.0	N.D.	N.D.	N.D.
6	Calcium (as Ca)	mg/L	IS 3025: (Part-40)	75	200	28.06	20.8	42.48
7	Chloramines (as Cl ₂)	mg/L	IS 3025: (Part-26)	4.0	No Relaxation	N.D.	N.D.	N.D.
8	Chloride (as Cl)	mg/L	IS 3025: (Part-32)	250	1000	36.9	12.9	34.9
9	Copper (as Cu)	mg/L	IS 3025: (part-42)	0.05	1.5	N.D.	N.D.	N.D.
10	Fluoride (as F)	mg/L	IS 3025: (part-60)	1	1.5	0.11	0.11	0.14
11	Free Residual Chlorine	mg/L	IS 3025: (Part-26)	0.2	1	N.D.	N.D.	N.D.
12	Iron (as Fe)	mg/L	IS 3025: (part-53)	0.3	No Relaxation	BDL	0.14	BDL
13	Magnesium (as Mg)	mg/L	IS 3025: (Part-46)	30	100	6.81	16.4	10.3
14	Manganese (as Mn)	mg/L	IS 3025: (part-59)	0.1	0.3	N.D.	N.D.	N.D.
15	Mineral Oil	mg/L	Clause 6 of IS 3025 (Part-39) Infrared partition method	0.5	No Relaxation	N.D.	N.D.	N.D.
16	Nitrate (as NO ₃)	mg/L	IS 3025: (part-34)	45	No Relaxation	0.28	0.32	0.33
17	Phenolic Compound (as C ₆ H ₅ OH)	mg/L	IS 3025: (part-43)	0.001	0.002	BDL	BDL	BDL
18	Selenium (as Se)	mg/L	IS 3025: (part-56)	0.01	No Relaxation	BDL	BDL	BDL
19	Silver (as Ag)	mg/L	Annex J of IS 13428	0.1	No Relaxation	N.D.	N.D.	N.D.
20	Sulphate (as SO ₄)	mg/L	IS 3025: (Part-24)	200	400	42.4	28.4	23.22
21	Sulphide (as H ₂ S)	mg/L	IS 3025: (Part-29)	0.05	No Relaxation	N.D.	N.D.	N.D.
22	Total Alkalinity (as CaCO ₃)	mg/L	IS 3025: (Part-23)	200	600	140	114	88
23	Total Hardness (as CaCO ₃)	mg/L	IS 3025: (Part-21)	200	600	160	180	104
24	Zinc (as Zn)	mg/L	IS 3025: (part-49)	5	15	N.D.	N.D.	N.D.
C. Parameters concerning toxic substances:-								
1	Cadmium (as Cd)	mg/L	IS 3025: (part-41)	0.003	No Relaxation	N.D.	N.D.	N.D.
2	Cyanide (as CN)	mg/L	IS 3025: (part-27)	0.05	No Relaxation	N.D.	N.D.	N.D.

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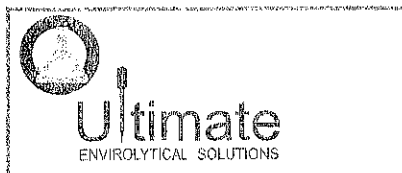
HDD-272 Phase III - Near JP Chowk
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Ph: 0771-4027777 | Email: ultimatenviro@gmail.com

REPORT NO. 03057

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Pata Village	Kunjemura Village	Tannar Village
3	Lead (as Pb)	mg/L	IS 3025(part-47)	0.01	No Relaxation	N.D.	N.D.	N.D.
4	Mercury (as Hg)	mg/L	IS 3025(part-48)	0.001	No Relaxation	N.D.	N.D.	N.D.
5	Molybdenum (as Mo)	mg/L	IS 3025(part-2)	0.07	No Relaxation	N.D.	N.D.	N.D.
6	Nickel (as Ni)	mg/L	IS 3025(part-54)	0.02	No Relaxation	N.D.	N.D.	N.D.
7	Polychlorinated biphenyls	mg/L	ASTM 5175	0.0005	No Relaxation	N.D.	N.D.	N.D.
8	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	APHA 6440	0.0001	No Relaxation	N.D.	N.D.	N.D.
9	Arsenic (as As)	mg/L	IS 3025(part-37)	0.01	0.05	N.D.	N.D.	N.D.
10	Chromium (as Cr)	mg/L	Annex J of IS:13428	0.05	No Relaxation	N.D.	N.D.	N.D.
11	Trihalomethanes:							
a)	Bromoform	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.	N.D.
b)	Dibromochloromethane	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.	N.D.
c)	Bromodichloromethane	mg/L	APHA 6232	0.06	No Relaxation	N.D.	N.D.	N.D.
d)	Chloroform	mg/L	APHA 6232	0.2	No Relaxation	N.D.	N.D.	N.D.
D.	Pesticides:-							
1	Alpha HCH	µg/l	USEPA 508	0.01		N.D.	N.D.	N.D.
2	Beta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.	N.D.
3	Delta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.	N.D.
4	Alachlor	µg/l	USEPA 525.2, 507	20		N.D.	N.D.	N.D.
5	Aldrin / Dieldrin	µg/l	USEPA 508	0.03		N.D.	N.D.	N.D.
6	Atrazine	µg/l	USEPA 525.2, 8141 A	2		N.D.	N.D.	N.D.
7	Butachlor	µg/l	USEPA 525.2, 8141 A	125		N.D.	N.D.	N.D.
8	Chlorpyrifos	µg/l	USEPA 525.2, 8141 A	30		N.D.	N.D.	N.D.
9	DDT (o,p and p, p-Isomers of DDT, DDE and DDD)	µg/l	USEPA 508	1		N.D.	N.D.	N.D.
10	Gamma HCH	µg/l	USEPA 508	2		N.D.	N.D.	N.D.

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REPORT NO. 03057

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT		
				Acceptable Limit	Permissible limit	Pata Village	Kunjemura Village	Tamnar Village
11	2,4-Dichlorophenox yacetic Acid	µg/l	USEPA 515.1		30	N.D.	N.D.	N.D.
12	Endosulphan (alpha, beta and sulphate)	µg/l	USEPA 508		0.4	N.D.	N.D.	N.D.
13	Ethion	µg/l	USEPA 1657 A		3	N.D.	N.D.	N.D.
14	Isoproturon	µg/l	USEPA 532		9	N.D.	N.D.	N.D.
15	Malathion	µg/l	USEPA 8141 A		190	N.D.	N.D.	N.D.
16	Methyl Parathion	µg/l	USEPA 8141 A		0.3	N.D.	N.D.	N.D.
17	Monocrotophos	µg/l	USEPA 8141 A		1	N.D.	N.D.	N.D.
18	Phorate	µg/l	USEPA 8141 A		2	N.D.	N.D.	N.D.
E.	Microbial Parameters							
1	Total Coliform	MPN/100ml	IS:1622:1981:RA :2019		-	Absent	Absent	Absent
2	E. Coli	MPN/100ml	IS:1622:1981:RA : 2019		-	Absent	Absent	Absent

Note: mg/lit.: milligram per liter, N.D.: Not Detected.

REMARKS: RESULTS ARE AS ABOVE*Terms & conditions*

- The above analysis report refers to the particular sample received at our end and the use of the report for publication, arbitration or as legal dispute is forbidden.
- Test sample will be retained for 15 days after issue of test report unless otherwise agreed with customer.
- This is for information as the party has asked for above test(s) only.

 29/08/22 REVIEWED BY		For ULTIMATE ENVIROLYTICAL SOLUTIONS 29/8/22 AUTHORIZED SIGNATORY
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-----End of the test report-----

SURFACE WATER QUALITY MONITORING REPORT



HDD 2721, P.O. Box 10, Rajgarh, Raigarh (C.G.) - 492099
 Ph: 07774 222222, Email: ultimateenviro@gmail.com

Recognized by Ministry of Environment Forest and Climate Change under EP act 1986

To, Jindal Power Limited P.O. Yamnar, District: Raigarh 496107 (C.G.)		Report No UES/TR/22-23/01550
		Lab Ref No UES/22-23/W/01883-01884
		Date of Sampling 28/04/2022
		Date of Receipt 29/04/2022
		Date of Report 08/05/2022
		Date of analysis Start: 29/04/2022 End: 08/05/2022
SAMPLE DETAILS		
Customer Sample Id /Sampling Location 1. Kelo River Upstream 2. Kelo River Downstream	Latitude 22.69700 Longitude 83.42118	
Customer Ref. No. & Date 4400014853, Dated : 07/10/2021		
Sample Type Surface Water		
Packing Of Sample Plastic Bottle (5.0ltr.) Glass Bottle (1.0 ltr.)		
Sample Collected By Laboratory Chemist		
Sample Condition At Receipt Ok		

REPORT NO. 01550

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Kelo River Upstream	Kelo River Down stream
A. Organoleptic & Physical Parameters							
1	Colour	Haze n	IS:3025:(Part-4)	5	15	11.5	13.5
2	Odour	-	IS:3025:(part-5)	Agreeable	Agreeable	Agreeabl e	Agreeabl e
3	pH Value at 25.2°C	-	IS:3025:(Part-11)	6.5-8.5	No Relaxation	7.47	7.55
4	Taste	-	IS 3025(part-8)	Agreeable	Agreeable	Agreeabl e	Agreeabl e
5	Turbidity	NTU	IS 3025:(Part-10)	1	5	92.5	87.4
6	Total Dissolved Solids	mg/L	IS:3025:(Part-16)	500	2000	324.9	309.9
B. General Parameters Concerning Substances undesirable in excessive amounts							
1	Aluminium (as Al)	mg/L	IS 3025(part-55)	0.03	0.2	N.D.	N.D.
2	Ammonia (as total ammonia-N)	mg/L	IS 3025(part-34)	0.5	No Relaxation	N.D.	N.D.
3	Anionic Detergent (as MBAS)	mg/L	Annex K of IS:13428	0.2	1.0	N.D.	N.D.
4	Barium (as Ba)	mg/L	Annex F of IS:13428	0.7	No Relaxation	N.D.	N.D.
5	Boron (as B)	mg/L	IS 3025:(Part-57)	0.5	1.0	N.D.	N.D.
6	Calcium (as	mg/L	IS 3025:(Part-40)	75	200	28.93	33.86

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REPORT NO. 01550

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Kelo River Upstream	Kelo River Down stream
	Ca)						
7	Chloramines (as Cl ₂)	mg/L	IS 3025:(Part-26)	4.0	No Relaxation	N.D.	N.D.
8	Chloride (as Cl)	mg/L	IS 3025:(Part-32)	250	1000	14.97	13.99
9	Copper (as Cu)	mg/L	IS 3025(part-42)	0.05	1.5	N.D.	N.D.
10	Fluoride (as F)	mg/L	IS 3025(part-60)	1	1.5	0.24	0.16
11	Free Residual Chlorine	mg/L	IS 3025:(Part-26)	0.2	1	N.D.	N.D.
12	Iron (as Fe)	mg/L	IS 3025(part-53)	0.3	No Relaxation	0.24	0.22
13	Magnesium (as Mg)	mg/L	IS 3025:(Part-46)	30	100	23.81	36.22
14	Manganese (as Mn)	mg/L	IS 3025(part-59)	0.1	0.3	N.D.	N.D.
15	Mineral Oil	mg/L	Clause 6 of IS 3025 (Part-39) Infrared partition method	0.5	No Relaxation	N.D.	N.D.
16	Nitrate (as NO ₃)	mg/L	IS 3025(part-34)	45	No Relaxation	0.48	0.53
17	Phenolic Compound (as C ₆ H ₅ OH)	mg/L	IS 3025(part-43)	0.001	0.002	N.D.	N.D.
18	Selenium (as Se)	mg/L	IS 3025(part-56)	0.01	No Relaxation	N.D.	N.D.
19	Silver (as Ag)	mg/L	Annex J of IS 13428	0.1	No Relaxation	N.D.	N.D.
20	Sulphate (as SO ₄)	mg/L	IS 3025:(Part-24)	200	400	20.26	23.70
21	Sulphide (as H ₂ S)	mg/L	IS 3025:(Part-29)	0.05	No Relaxation	N.D.	N.D.
22	Total Alkalinity (as CaCO ₃)	mg/L	IS 3025:(Part-23)	200	600	20	24
23	Total Hardness (as CaCO ₃)	mg/L	IS 3025:(Part-21)	200	600	40	50
24	Zinc (as Zn)	mg/L	IS 3025(part-49)	5	15	N.D.	N.D.
C. Parameters concerning toxic substances:-							
1	Cadmium (as Cd)	mg/L	IS 3025(part-41)	0.003	No Relaxation	N.D.	N.D.
2	Cyanide (as CN)	mg/L	IS 3025(part-27)	0.05	No Relaxation	N.D.	N.D.
3	Lead (as Pb)	mg/L	IS 3025(part-47)	0.01	No Relaxation	N.D.	N.D.



HDD-272, Phase II, Near J.P. Chowk,
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Recognized by Ministry of Environment Forest and Climate Change under EP act 1986

REPORT NO. 01550

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible Limit	Kelo River Upstream	Kelo River Down stream
4	Mercury (as Hg)	mg/L	IS 3025 (part-48)	0.001	No Relaxation	N.D.	N.D.
5	Molybdenum (as Mo)	mg/L	IS 3025 (part-2)	0.07	No Relaxation	N.D.	N.D.
6	Nickel (as Ni)	mg/L	IS 3025 (part-54)	0.02	No Relaxation	N.D.	N.D.
7	Polychlorinated biphenyls	mg/L	ASTM 5175	0.0005	No Relaxation	N.D.	N.D.
8	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	APHA 6440	0.0001	No Relaxation	N.D.	N.D.
9	Arsenic (as As)	mg/L	IS 3025 (part-37)	0.01	0.05	N.D.	N.D.
10	Chromium (as Cr)	mg/L	Annex J of IS:13428	0.05	No Relaxation	N.D.	N.D.
11	Trihalomethanes:						
a)	Bromoform	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.
b)	Dibromochloromethane	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.
c)	Bromodichloromethane	mg/L	APHA 6232	0.06	No Relaxation	N.D.	N.D.
d)	Chloroform	mg/L	APHA 6232	0.2	No Relaxation	N.D.	N.D.
D.	Pesticides:-						
1	Alpha HCH	µg/l	USEPA 508	0.01		N.D.	N.D.
2	Beta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.
3	Delta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.
4	Alachlor	µg/l	USEPA 525.2, 507	20		N.D.	N.D.
5	Aldrin / Dieldrin	µg/l	USEPA 508	0.03		N.D.	N.D.
6	Atrazine	µg/l	USEPA 525.2, 8141 A	2		N.D.	N.D.
7	Butachlor	µg/l	USEPA 525.2, 8141 A	125		N.D.	N.D.
8	Chlorpyrifos	µg/l	USEPA 525.2, 8141 A	30		N.D.	N.D.
9	DDT (o,p and p, p-Isomers of DDT, DDE and DDD)	µg/l	USEPA 508	1		N.D.	N.D.
10	Gamma HCH	µg/l	USEPA 508	2		N.D.	N.D.
11	2,4-Dichlorophenox	µg/l	USEPA 515.1	30		N.D.	N.D.

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HDD-272, The Mall, Near JP Chowk
Ring Road No. 2, Bhopal Nagar, Raipur (C.G.) - 492099
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Recognized by Ministry of Environment Forest and Climate Change under EP act 1986

REPORT NO. 01550

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Kelo River Upstream	Kelo River Down stream
	acetic Acid						
12	Endosulphan (alpha, beta and sulphate)	µg/l	USEPA 508		0.4	N.D.	N.D.
13	Ethion	µg/l	USEPA 1657 A		3	N.D.	N.D.
14	Isoproturon	µg/l	USEPA 532		9	N.D.	N.D.
15	Malathion	µg/l	USEPA 8141 A		190	N.D.	N.D.
16	Methyl Parathion	µg/l	USEPA 8141 A		0.3	N.D.	N.D.
17	Monocrotophos	µg/l	USEPA 8141 A		1	N.D.	N.D.
18	Phorate	µg/l	USEPA 8141 A		2	N.D.	N.D.
E. Microbial Parameters							
1	Total Coliform	MPN/100ml	IS:1622:1981:RA: 019		-	34	30
2	E. Coli	MPN/100ml	IS:1622:1981:RA: 2019		-	17	13

Note: mg/lit.: milligram per liter, N.D.: Not Detected.

REMARKS: RESULTS ARE AS ABOVE

Terms & conditions:

- > The above analysis report refers to the particular sample received at our and the use of the report for publication, arbitration or as legal dispute is forbidden.
- > Test sample will be retained for 15 days after issue of test report unless otherwise agreed with customer.
- > This is for information as the party has asked for above test(s) only.

 08/05/22 REVIEWED BY	 For ULTIMATE ENVIROLYTICAL SOLUTIONS 08/05/22 AUTHORIZED SIGNATORY
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End of the test report



HDD-272, Phase III - Near JP Chowk
Ring Road No-2, Kabil Nagar, Raipur (C.G.) - 492099
Ph - 0771- 4027777 | Email - ultimatenviro@gmail.com

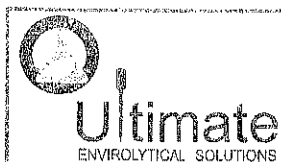
To, Jindal Power Limited P.O. Tamnar, District: Raigarh 496107 (C.G.)		Report No	UES/TR/22-23/03058	
		Lab Ref No	UES/22-23/W/08244-08245	
		Date of Sampling	23/08/2022	
		Date of Receipt	24/08/2022	
		Date of Report	29/08/2022	
		Date of analysis	Start: 24/08/2022	End: 29/08/2022
SAMPLE DETAILS				
Customer Sample Id /Sampling Location	1. Kelo River Upstream 2. Kelo River Downstream	Latitude	22.69700	
		Longitude	83.42118	
Customer Ref. No. & Date.	4400014853, Dated :07/10/2021			
Sample Type	Surface Water			
Packing Of Sample	Plastic Bottle (5.0ltr.) Glass Bottle (1.0 ltr.)			
Sample Collected By	Laboratory Chemist			
Sample Condition At Receipt	ok			

REPORT NO. 03058

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Kelo River Upstream	Kelo River Down stream
A.	Organoleptic & Physical Parameters						
1	Colour	Haze n	IS:3025: (Part-4)	5	15	25	20
2	Odour	-	IS:3025: (part-5)	Agreeable	Agreeable	Agreeable	Agreeable
3	pH Value at 25.2°C	-	IS:3025: (Part-11)	6.5-8.5	No Relaxation	7.2	7.75
4	Taste	-	IS 3025(part-8)	Agreeable	Agreeable	Agreeable	Agreeable
5	Turbidity	NTU	IS 3025: (Part-10)	1	5	37.7	17.07
6	Total Dissolved Solids	mg/L	IS:3025: (Part-16)	500	2000	84.8	190.4
B.	General Parameters Concerning Substances undesirable in excessive amounts						
1	Aluminium (as Al)	mg/L	IS 3025(part-55)	0.03	0.2	BDL	BDL
2	Ammonia (as total ammonia-N)	mg/L	IS 3025(part-34)	0.5	No Relaxation	N.D.	N.D.
3	Anionic Detergent (as MBAS)	mg/L	Annex K of IS:13428	0.2	1.0	BDL	BDL
4	Barium (as Ba)	mg/L	Annex F of IS:13428	0.7	No Relaxation	N.D.	N.D.
5	Boron (as B)	mg/L	IS 3025: (Part-57)	0.5	1.0	N.D.	N.D.
6	Calcium (as Ca)	mg/L	IS 3025: (Part-40)	75	200	14.43	36.87

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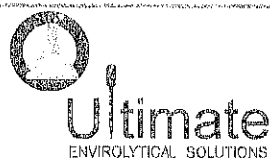


HDD-272 Phase III - Near JP Chowk
Ring Road No-2, Kabir Nagar, Raipur (C.G.) - 492099
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REPORT NO. 03058

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Kelo River Upstream	Kelo River Down stream
7	Chloramines (as Cl_2)	mg/L	IS 3025: (Part-26)	4.0	No Relaxation	N.D.	N.D.
8	Chloride (as Cl)	mg/L	IS 3025: (Part-32)	250	1000	16.9	28.9
9	Copper (as Cu)	mg/L	IS 3025(part-42)	0.05	1.5	0.06	0.12
10	Fluoride (as F)	mg/L	IS 3025(part-60)	1	1.5	0.24	0.34
11	Free Residual Chlorine	mg/L	IS 3025: (Part-26)	0.2	1	BDL	BDL
12	Iron (as Fe)	mg/L	IS 3025(part-53)	0.3	No Relaxation	0.24	0.34
13	Magnesium (as Mg)	mg/L	IS 3025: (Part-46)	30	100	3.5	8.95
14	Manganese (as Mn)	mg/L	IS 3025(part-59)	0.1	0.3	BDL	BDL
15	Mineral Oil	mg/L	Clause 6 of IS 3025 (Part-39) Infrared partition method	0.5	No Relaxation	N.D.	N.D.
16	Nitrate (as NO_3)	mg/L	IS 3025(part-34)	45	No Relaxation	1.2	6.49
17	Phenolic Compound (as $\text{C}_6\text{H}_5\text{OH}$)	mg/L	IS 3025(part-43)	0.001	0.002	BDL	BDL
18	Selenium (as Se)	mg/L	IS 3025(part-56)	0.01	No Relaxation	BDL	BDL
19	Silver (as Ag)	mg/L	Annex J of IS 13428	0.1	No Relaxation	N.D.	N.D.
20	Sulphate (as SO_4)	mg/L	IS 3025: (Part-24)	200	400	26.4	42.8
21	Sulphide (as H_2S)	mg/L	IS 3025: (Part-29)	0.05	No Relaxation	N.D.	N.D.
22	Total Alkalinity (as CaCO_3)	mg/L	IS 3025: (Part-23)	200	600	20	40
23	Total Hardness (as CaCO_3)	mg/L	IS 3025: (Part-21)	200	600	40	68
24	Zinc (as Zn)	mg/L	IS 3025(part-49)	5	15	BDL	BDL
C. Parameters concerning toxic substances:-							
1	Cadmium (as Cd)	mg/L	IS 3025(part-41)	0.003	No Relaxation	BDL	BDL
2	Cyanide (as CN)	mg/L	IS 3025(part-27)	0.05	No Relaxation	BDL	BDL
3	Lead (as Pb)	mg/L	IS 3025(part-47)	0.01	No Relaxation	BDL	BDL
4	Mercury (as Hg)	mg/L	IS 3025(part-48)	0.001	No Relaxation	BDL	BDL



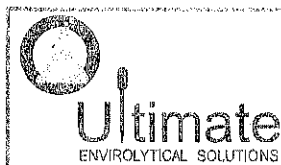
HDD-272, Phase III - Near JP Chowk
Ring Road No. 2, Kabir Nagar, Raipur (C.G.) - 492099
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REPORT NO. 03058

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Kelo River Upstream	Kelo River Down stream
5	Molybdenum (as Mo)	mg/L	IS 3025(part-2)	0.07	No Relaxation	N.D.	N.D.
6	Nickel (as Ni)	mg/L	IS 3025(part-54)	0.02	No Relaxation	N.D.	N.D.
7	Polychlorinated biphenyls	mg/L	ASTM 5175	0.0005	No Relaxation	N.D.	N.D.
8	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	APHA 6440	0.0001	No Relaxation	N.D.	N.D.
9	Arsenic (as As)	mg/L	IS 3025(part-37)	0.01	0.05	BDL	BDL
10	Chromium (as Cr)	mg/L	Annex J of IS:13428	0.05	No Relaxation	BDL	BDL
11	Trihalomethanes:						
a)	Bromoform	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.
b)	Dibromochloromethane	mg/L	APHA 6232	0.1	No Relaxation	N.D.	N.D.
c)	Bromodichloromethane	mg/L	APHA 6232	0.06	No Relaxation	N.D.	N.D.
d)	Chloroform	mg/L	APHA 6232	0.2	No Relaxation	N.D.	N.D.
D.	Pesticides:-						
1	Alpha HCH	µg/l	USEPA 508	0.01		N.D.	N.D.
2	Beta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.
3	Delta HCH	µg/l	USEPA 508	0.04		N.D.	N.D.
4	Alachlor	µg/l	USEPA 525.2, 507	20		N.D.	N.D.
5	Aldrin / Dieldrin	µg/l	USEPA 508	0.03		N.D.	N.D.
6	Atrazine	µg/l	USEPA 525.2, 8141 A	2		N.D.	N.D.
7	Butachlor	µg/l	USEPA 525.2, 8141 A	125		N.D.	N.D.
8	Chlorpyrifos	µg/l	USEPA 525.2, 8141 A	30		N.D.	N.D.
9	DDT (o,p and p, p-Isomers of DDT, DDE and DDD)	µg/l	USEPA 508	1		N.D.	N.D.
10	Gamma HCH	µg/l	USEPA 508	2		N.D.	N.D.
11	2,4-Dichlorophenoxyacetic Acid	µg/l	USEPA 515.1	30		N.D.	N.D.

AN ISO : 9001:2015 / ISO: 14001:2015 / ISO 45001:2018 CERTIFIED LABORATORY



HDD-272 Phase II - Near JP Chowk
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REPORT NO. 03058

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	AS PER IS 10500:2012		RESULT	
				Acceptable Limit	Permissible limit	Kelo River Upstream	Kelo River Down stream
12	Endosulphan (alpha, beta and sulphate)	µg/l	USEPA 508		0.4	N.D.	N.D.
13	Ethion	µg/l	USEPA 1657 A		3	N.D.	N.D.
14	Isoproturon	µg/l	USEPA 532		9	N.D.	N.D.
15	Malathion	µg/l	USEPA 8141 A		190	N.D.	N.D.
16	Methyl Parathion	µg/l	USEPA 8141 A		0.3	N.D.	N.D.
17	Monocrotophos	µg/l	USEPA 8141 A		1	N.D.	N.D.
18	Phorate	µg/l	USEPA 8141 A		2	N.D.	N.D.
E. Microbial Parameters							
1	Total Coliform	MPN/100m 1	IS:1622:1981:RA:2 019		-	40	50
2	E. Coli	MPN/100m 1	IS:1622:1981:RA: 2019		-	20	30

Note: mg/lit.: milligram per liter, N.D.: Not Detected.

REMARKS: RESULTS ARE AS ABOVE**Terms & conditions**

- The above analysis report refers to the particular sample received at our end and the use of the report for publication, arbitration or as legal dispute is forbidden.
- Test sample will be retained for 15 days after issue of test report unless otherwise agreed with customer.
- This is for information as the party has asked for above test(s) only.

 23/08/22 REVIEWED BY	 For ULTIMATE ENVIROLYTICAL SOLUTIONS	 23/8/22 AUTHORIZED SIGNATORY
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-----End of the test report-----

AMBIENT AIR QUALITY MONITORING DATA FOR THE MONTH OF APRIL 2022

Date	Location-1						Location-2						Location-3						Location-4					
	New Switch Yard						Near Hostel 5						Savitrinagar Colony (Tehlirampur village)						Tamnar village					
	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	
Distance (KM) (w.r.t stack)	0.2						0.5						5.0						3.0					
Direction (w.r.t stack)	NW						ESE						ENE						S					
04.04.2022	41.6	19.8	13.3	NA	0.43		28.4	19.1	28.3	0.69		58.6	17.7	10.5	23.2	0.5		54.1	16.9	16.7	25.8	0.78		
07.04.2022	49.1	20.2	18.6	NA	0.44		31.3	16.1	26.6	0.62		55.8	16.8	13.2	23.6	0.5		NA	NA	NA	NA	NA		
11.04.2022	47.5	16.2	15.4	NA	0.48		65.2	14.8	16.8	27.2	0.63	47.8	17.4	14.6	25.3	0.5		50.8	15.6	10.8	25.8	0.78		
14.04.2022	53.2	18.5	16.7	NA	0.46		62.8	19.8	15.3	27.4	0.65	55.6	18.3	14.1	26.1	0.6		52.3	15.8	13.2	25.1	0.63		
18.04.2022	48.6	14.6	13.1	NA	0.36		64.2	25.3	15.1	26.9	0.63	55.5	18.4	13.3	27.7	0.4		NA	NA	NA	NA	NA		
21.04.2022	49.4	11.4	14.5	NA	0.45		62.6	30.1	10.6	27.1	0.66	41.2	19.1	11.4	25.3	0.5		NA	NA	NA	NA	NA		
25.04.2022	52.3	12.7	12.6	NA	0.28		60.8	23.7	16.9	26.6	0.69	55.3	16.4	13.1	25.7	0.5		46.5	20.1	10.8	23.2	0.67		
28.04.2022	56.6	14.1	15.6	NA	0.32		57.5	22.7	14.4	25.9	0.64	60.5	15.2	10.5	25.1	0.4		NA	NA	NA	NA	NA		
Permissible Limits	100	60	80	80	2		100	60	80	80	2	100	60	80	80	2		100	60	80	80	2		
Date	Location-5						Location-6						Location-7						Location-8					
	JIPT Building						Gorhi village						Regaon village						Nirman Bhavan					
	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	
Distance (KM) (w.r.t stack)	0.2						4.5						3.0						0.2					
Direction (w.r.t stack)	W						SSW						N						S					
04.04.2022	58.5	23.2	15.3	26.3	0.54		NA	13.2	NA	0.63		53.4	16.9	13.4	23.4	0.6		65.3	25.3	15.3	26.3	0.59		
07.04.2022	62.4	25.4	13.2	27.3	0.52		NA	13.6	NA	0.61		53.4	17.7	17.2	25.2	0.6		67.2	27.3	16.2	27.4	0.52		
11.04.2022	60.6	24.1	14.5	26.8	0.48		NA	12.3	NA	0.62		44.1	12.4	15.1	25.6	0.7		58.6	23.7	14.8	25.8	0.49		
14.04.2022	57.6	22.3	13.6	26.4	0.45		NA	13.7	NA	0.64		41.4	12.3	16.2	25.3	0.6		55.7	22.1	15.2	24.6	0.55		
18.04.2022	63.8	25.8	14.3	25.8	0.63		NA	12.4	NA	0.62		40.8	15.8	13.8	25.2	0.6		60.6	24.6	16.5	26.5	0.65		
21.04.2022	56.7	22.3	13.2	24.6	0.55		NA	13.6	NA	0.64		45.5	12.6	16.2	24.6	0.6		62.5	25.3	17.4	27.4	0.62		
25.04.2022	52.8	20.7	12.8	23.7	0.47		NA	14.6	NA	0.77		41.7	12.8	14.1	23.7	0.6		56.8	22.8	13.6	24.9	0.58		
28.04.2022	65.4	25.3	16.3	25.6	0.49		NA	26.6	NA	0.73		43.6	11.7	16.3	26.2	0.5		63.5	23.2	14.3	26.4	0.56		
Permissible Limits	100	60	80	80	2		100	60	80	80	2	100	60	80	80	2		100	60	80	80	2		

Note: All Units in $\mu\text{g}/\text{m}^3$ except CO (in mg/m^3)

AMBIENT AIR QUALITY MONITORING DATA FOR THE MONTH OF MAY, 2022

Date	Location-1						Location-2						Location-3						Location-4					
	New Switch Yard						Near Hostel 5						Savitrinagar Colony (Tehlrampur village)						Tamnar village					
	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	
Distance (KM) (w.r.t stack)	0.2						0.5						5.0						3.0					
Direction (w.r.t stack)	NW						ESE						ENE						S					
02.05.2022	49.4	12.1	13.7	NA	0.32		54.7	17.8	14.6	27.2	0.64		58.7	15.5	12.7	25.7	0.5		NA	NA	NA	NA	NA	NA
05.05.2022	47.2	13.4	15.3	NA	0.28		65.6	24.1	13.5	26.4	0.48		64.6	19.3	13.5	24.5	0.6		50.5	16.5	12.7	24.3	0.65	0.65
09.05.2022	53.4	13.2	14.5	NA	0.32		59.1	22.5	15.8	27.5	0.42		58.4	17.8	14.3	25.2	0.6		NA	NA	NA	NA	NA	NA
12.05.2022	52.5	12.5	14.4	NA	0.28		50.6	16.4	16.3	25.8	0.45		47.1	15.4	13.5	25.3	0.5		45.3	13.2	10.4	25.3	0.52	0.52
16.05.2022	53.8	18.7	12.4	NA	0.37		64.2	25.7	18.2	27.5	0.57		59.5	17.6	11.5	24.8	0.8		NA	NA	NA	NA	NA	NA
19.05.2022	49.4	13.7	14.8	NA	0.34		58.5	27.1	18.6	26.3	0.63		57.6	16.5	13.4	25.7	0.6		53.6	15.5	16.8	24.2	0.64	0.64
23.05.2022	NA	13	16.7	NA	0.35		47.8	15.4	19.2	24.2	0.65		NA	14.8	12.4	24.2	0.5		50.3	16.3	11.5	22.7	0.62	0.62
26.05.2022	NA	14.3	18.4	NA	0.29		NA	NA	NA	NA	NA		57.6	23.7	14.5	22.4	0.6		52.2	17.6	15.3	23.5	0.58	0.58
30.05.2022	62.6	21.4	19.7	26.7	0.45		NA	NA	NA	NA	NA		50.4	17.3	12.3	23.7	0.4		54.1	15.5	13.4	24.8	NA	NA
Permissible Limits	100	60	80	80	2		100	60	80	80	2		100	60	80	80	2		100	60	80	80	2	2
Date	Location-5						Location-6						Location-7						Location-8					
	JIPT Building						Gorhi village						Regaon village						Nirman Bhavan					
	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	
Distance (KM) (w.r.t stack)	0.2						4.5						3.0						0.2					
Direction (w.r.t stack)	W						SSW						N						S					
02.05.2022	56.2	17.8	13.5	25.3	0.53		NA	17.2	13.1	NA	0.54		41.7	13.4	15.3	25.2	0.6		58.6	18.3	14.3	24.9	0.56	0.56
05.05.2022	62.4	21.3	12.8	26.4	0.57		NA	18.6	14.5	NA	0.68		44.4	17.9	14.3	24.5	0.5		64.5	23.4	16.2	26.7	0.52	0.52
09.05.2022	60.7	18.3	16.3	27.2	0.55		NA	NA	14.3	NA	0.64		NA	NA	NA	NA	NA		61.8	21.5	15.8	25.2	0.57	0.57
12.05.2022	58.9	17.6	15.4	26.8	0.45		NA	NA	13.6	NA	0.68		NA	NA	NA	NA	NA		60.7	20.6	16.4	25.8	0.62	0.62
16.05.2022	53.4	16.8	13.6	25.3	0.43		NA	NA	NA	NA	NA		NA	NA	NA	NA	NA		56.4	18.4	15.2	26.3	0.64	0.64
19.05.2022	54.6	17.2	14.2	24.7	0.48		NA	20.3	15.8	NA	0.67		NA	NA	NA	NA	NA		58.7	19.1	15.6	25.7	0.55	0.55
23.05.2022	57.6	18.3	13.9	25.3	0.54		NA	19.5	16.1	26.5	0.64		NA	NA	NA	NA	NA		64.3	22.6	17.4	23.8	0.63	0.63
26.05.2022	55.3	17.8	12.7	23.8	0.56		NA	25.3	15.4	27.3	0.58		NA	NA	NA	NA	NA		60.2	20.1	16.3	24.6	0.58	0.58
30.05.2022	64.2	23.2	16.4	26.4	0.52		NA	24.1	14.2	25.3	0.57		NA	NA	NA	NA	NA		66.3	24.7	17.8	25.3	0.59	0.59
Permissible Limits	100	60	80	80	2		100	60	80	80	2		100	60	80	80	2		100	60	80	80	2	2

AMBIENT AIR QUALITY MONITORING DATA FOR THE MONTH OF JUNE, 2022

Date	Location-1					Location-2					Location-3					Location-4				
	New Switch Yard					Near Hostel 5					Savitrinagar Colony (Tehlrampur village)					Tamnar village				
Distance (Km) (w.r.t stack)	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO
	0.2					0.5					5.0					3.0				
Direction (w.r.t stack)	NW					ESE					ENE					S				
02.06.2022	64.6	30.1	20	26.9	0.43	65.5	NA	17.5	26.1	NA	NA	17.9	11.6	24	0.4	51.6	22.7	11.6	23.7	0.67
06.06.2022	54.6	23.4	19.6	26.7	0.45	47.1	NA	15.7	27.1	NA	58.1	17.8	10.4	23.8	0.5	51.7	14.6	10.1	23.9	0.74
09.06.2022	62.3	24.3	17.4	27.1	0.46	67.6	24.3	16.5	25.3	NA	66.4	17.1	14.9	23.5	0.5	51.3	24.3	13.2	24.8	0.65
13.06.2022	60.5	25.7	14.6	26.7	0.44	60.5	16.6	18.7	28.8	NA	42.3	18.8	14.1	23.7	0.4	63.8	17.3	13.8	24.5	0.51
16.06.2022	47.4	13.2	16.2	24.2	0.43	49.4	21.7	14.4	29.5	0.42	54.8	18.6	10.6	24.7	0.5	55.3	13.3	12.3	24.6	0.79
20.06.2022	35.7	15.7	20.1	NA	0.43	50.7	12.2	13.9	25.2	NA	52.6	12.6	10.9	24.8	0.3	45.2	11.7	11.1	24.3	0.68
23.06.2022	67.2	25.6	14.2	NA	0.42	63.8	14.5	13.1	24.5	NA	NA	13.3	12.3	25.5	0.6	50.3	16.5	12.4	24.8	0.65
27.06.2022	21.7	19.5	12.3	NA	0.32	43.1	11.8	16.2	26.4	0.44	61.2	12.9	14.3	27.3	0.4	62.1	16.9	9.4	23.6	0.64
30.06.2022	50.8	22.1	13.2	25.6	0.29	52.6	16.2	16.6	27.8	0.34	58.8	17.8	11.5	26.4	0.5	50.2	19.2	10.6	23.8	0.66
Permissible Limits	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2
Date	Location-5					Location-6					Location-7					Location-8				
	JIPT Building					Gorhi village					Regaon village					Nirman Bhavan				
Distance (Km) (w.r.t stack)	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO
	0.2					4.5					3.0					0.2				
Direction (w.r.t stack)	W					SSW					N					S				
02.06.2022	52.6	16.3	12.3	24.5	0.56	NA	24.7	11.5	NA	0.77	NA	NA	NA	NA	NA	56.5	16.5	13.8	25.3	0.55
06.06.2022	54.8	17.5	12.7	24.9	0.58	NA	26.3	13.5	NA	0.63	42.1	12.9	13.8	NA	0.7	58.5	18.2	14.5	25.6	0.59
09.06.2022	56.8	18.2	13.4	25.7	0.62	NA	28.3	12.3	NA	0.66	42.6	16	16.1	NA	0.7	54.8	16.2	13.1	24.8	0.62
13.06.2022	62.4	19.5	14.3	27.1	0.65	NA	21.7	14.7	NA	0.63	43.4	16.3	15.2	NA	0.7	66.3	23.7	16.8	27.4	0.63
16.06.2022	57.6	17.6	15.2	26.8	0.59	NA	NA	NA	NA	NA	41.8	12.5	10.8	24.6	0.7	64.5	22.6	15.7	26.4	0.67
20.06.2022	64.3	21.3	16.3	27.4	0.65	NA	NA	NA	NA	NA	43.5	13.6	11.1	26.3	0.7	60.3	20.8	15.2	25.6	0.61
23.06.2022	60.5	20.6	15.7	26.2	0.61	NA	NA	NA	NA	NA	43.6	13.5	10.2	23.5	0.7	57.6	18.6	14.3	25.2	0.58
27.06.2022	58.6	19.4	14.6	25.3	0.57	NA	NA	NA	NA	NA	41.1	NA	9.2	NA	0.4	55.8	17.8	13.5	24.2	0.54
30.06.2022	55.7	16.8	13.8	24.5	0.53	NA	NA	NA	NA	NA	44.7	16.6	9.4	25.5	0.7	54.6	15.6	12.8	23.9	0.52
Permissible Limits	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2

Note: All Units in $\mu\text{g}/\text{m}^3$ except CO (in mg/m^3)

AMBIENT AIR QUALITY MONITORING DATA FOR THE MONTH OF JULY, 2022

Date	Location-1							Location-2							Location-3							Location-4						
	New Switch Yard							Near Hostel 5							Savitrinagar Colony (Tehlrirampur village)							Tanniar village						
	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO			
Distance (KM) (w.r.t stack)	0.2							0.5							5.0							3.0						
Direction (w.r.t stack)	NW							ESE							ENE							S						
04.07.2022	37.3	18.4	11.4	26.3	0.22	41.3	16.1	16.7	27.6	0.51	45.2	19.5	11.6	27.1	0.6	47.2	19.8	8.2	26	0.62								
07.07.2022	31.2	NA	9.3	25.2	0.29	37.2	17.3	13.4	26.5	0.48	46.7	14.7	10.4	27.2	0.6	49.2	25.8	9.3	24	0.56								
11.07.2022	45.8	NA	12.8	25.7	0.28	48.4	15.3	14.5	27.3	0.58	43.6	17.3	10.8	26.4	0.5	46.4	18.2	9.8	24	0.68								
14.07.2022	35.6	10.8	14.1	26.8	0.46	32.5	16.8	12.7	25.9	0.56	42	14.6	8.5	28.5	0.6	32.5	11.3	9.1	24	0.59								
18.07.2022	51.2	14.3	13.1	27.4	0.34	47.3	17.4	10.3	26.8	0.53	43.3	19.6	8.2	27.5	0.5	41.3	12.6	13.8	26	0.72								
21.07.2022	48.5	12.3	14.2	27.2	0.35	56.6	18.6	12.1	28.2	0.58	36.8	14.2	8.5	24.4	0.6	54.1	12.6	14.4	25	0.57								
25.07.2022	43.3	11.4	12.2	26.7	0.33	33.8	10.1	8.2	27.3	0.51	24.5	13.8	7.8	25.2	0.5	31.7	11.1	11.8	26	0.69								
28.07.2022	55.1	15.1	14.7	26.6	0.51	58.5	22.4	13.5	27.5	0.57	51.6	14.8	11.4	27.5	0.4	44.8	18.5	11.7	27	0.68								
Permissible Limits	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2								
Date	Location-5							Location-6							Location-7							Location-8						
	JIPT Building							Gorhi village							Regaon village							Nirman Bhavan						
	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO			
Distance (KM) (w.r.t stack)	0.2							4.5							3.0							0.2						
Direction (w.r.t stack)	W							SSW							N							S						
04.07.2022	48.6	14.6	15.3	26.3	0.56	NA	NA	NA	NA	NA	41	13.7	8.4	26.5	0.5	40.5	13.6	14.5	27	0.62								
07.07.2022	50.4	15.2	13.2	25.4	0.52	NA	NA	NA	NA	NA	42.5	14.8	8.6	27.3	0.6	42.3	14.4	15.3	27	0.57								
11.07.2022	46.8	14.4	13.5	24.5	0.54	NA	NA	NA	NA	NA	43.4	13.3	7.8	26.2	0.6	34.6	12.3	13.1	25	0.63								
14.07.2022	34.3	13.3	12.6	23.9	0.63	NA	NA	NA	NA	NA	37.7	13.5	7.2	24.4	0.5	44.3	14.8	12.4	25	0.59								
18.07.2022	42.8	14.8	11.8	26.3	0.65	NA	NA	NA	NA	NA	45.4	17.8	8.8	26.7	0.6	50.8	15.7	11.6	25	0.56								
21.07.2022	47.2	16.5	10.6	25.7	0.68	NA	NA	NA	NA	NA	44.8	16.7	10.1	25.8	0.5	48.3	16.2	13.8	26	0.58								
25.07.2022	53.2	18.4	14.5	27.6	0.64	NA	NA	NA	NA	NA	35.8	12.1	11.5	24.3	0.3	55.4	18.6	14.3	27	0.63								
28.07.2022	60.7	19.3	14.1	27.3	0.61	NA	NA	NA	NA	NA	45.3	15.3	12.4	24.5	0.4	62.2	20.4	15.4	28	0.65								
Permissible Limits	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2								

Note: All Units in $\mu\text{g}/\text{m}^3$ except CO (in mg/m^3)

AMBIENT AIR QUALITY MONITORING DATA FOR THE MONTH OF AUGUST, 2022

Date	Location-1					Location-2					Location-3					Location-4				
	New Switch Yard					Near Hostel 5					Savitrinagar Colony (Tehlrampur village)					Tannar village				
	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO
Distance (KM) (w.r.t stack)	0.2					0.5					5.0					3.0				
Direction (w.r.t stack)	NW					ESE					ENE					S				
01.08.2022	58.2	19.5	11.4	26.7	0.58	64.7	22.1	13.5	26.9	0.55	NA	17.2	12.1	25.6	0.42	45.7	22.3	12.7	27.4	0.62
04.08.2022	48.3	16.4	9.7	25.7	0.53	46.3	19.4	11.4	27.6	0.56	43.2	15.6	10.2	25.8	0.36	44.2	12.9	13.1	26.9	0.65
08.08.2022	39.8	14.3	10.1	26.4	0.56	43.7	16.2	11.8	27.3	0.54	47.6	16.8	NA	24.8	0.52	44.6	13.5	11.7	27.6	0.71
11.08.2022	38.6	12.7	11.1	25.8	0.54	36.8	14.5	12.1	25.6	0.48	30.1	11.3	9.7	23.5	0.47	32.2	11.3	9.6	25.7	0.62
15.08.2022	32.5	12.1	10.9	26.3	0.52	35.4	13.6	19.2	27.5	0.67	38.4	12.7	13.7	24.3	0.54	36.2	11.7	12.3	26.2	0.66
18.08.2022	58.6	17.8	12.6	27.2	0.59	60.3	23.2	18.1	26.5	0.58	46.4	17.5	9.8	25.4	0.44	45.6	15.3	13.4	25.8	0.62
22.08.2022	44.6	12.5	12.4	26.8	0.52	39.5	18.5	16.8	27.2	0.52	NA	15.8	10.7	26.3	0.36	40.6	15.3	13.1	27.4	0.63
25.08.2022	48.2	14.3	13.2	26.7	0.49	52.8	20.7	17.5	26.7	0.43	55.7	16.7	11.4	26.7	0.45	40.1	15.6	12.7	25.4	0.59
29.08.2022	51.3	16.8	14.2	27.3	0.58	58.5	22.8	18.3	26.4	0.62	50.3	14.6	11.5	26.2	0.36	50.3	16.4	13.6	27.2	0.65
Permissible Limits	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2
Date	Location-5					Location-6					Location-7					Location-8				
	JIPT Building					Gorhi village					Regaon village					Nirman Bhavan				
	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO
Distance (KM) (w.r.t stack)	0.2					4.5					3.0					0.2				
Direction (w.r.t stack)	W					SSW					N					S				
01.08.2022	56.5	16.3	13.6	25.6	0.57	NA	NA	NA	NA	NA	41.7	12.6	11.9	24.3	0.38	54.3	17.8	12.3	27.6	0.56
04.08.2022	52.5	15.8	13.1	26.4	0.53	NA	NA	NA	NA	NA	42.8	13.5	10.3	24.3	0.32	56.2	17.6	13.2	26.8	0.54
08.08.2022	57.8	16.9	15.4	25.8	0.46	NA	NA	NA	NA	NA	41.5	12.7	12.8	24.3	0.27	55.7	18.1	14.5	27.2	0.52
11.08.2022	54.5	15.2	13.6	26.3	0.48	NA	NA	NA	NA	NA	32.5	11.6	9.8	23.2	0.38	52.6	17.2	12.6	26.7	0.49
15.08.2022	50.7	14.6	12.4	27.4	0.52	NA	NA	NA	NA	NA	39.2	10.5	11.7	NA	0.28	48.6	16.3	13.5	26.3	0.57
18.08.2022	46.3	13.2	11.2	26.1	0.55	NA	NA	NA	NA	NA	40.5	15.3	12.6	NA	0.45	42.7	14.5	12.1	25.3	0.48
22.08.2022	42.5	12.8	10.4	25.4	0.58	35.4	13.7	11.7	25.7	0.66	34.5	12.9	11.8	NA	0.45	40.3	15.4	10.5	24.8	0.53
25.08.2022	58.2	17.6	12.8	26.5	0.54	42.2	15.6	12.8	26.3	0.58	36.8	12.7	12.3	NA	0.53	53.5	16.2	13.7	25.6	0.55
29.08.2022	60.6	18.7	13.6	27.5	0.63	50.4	16.5	13.2	26.7	0.63	48.3	16.4	13.6	NA	0.44	63.5	20.3	15.2	26.3	0.59
Permissible Limits	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2

AMBIENT AIR QUALITY MONITORING DATA FOR THE MONTH OF SEPTEMBER, 2022

Date	Location-1						Location-2						Location-3						Location-4					
	New Switch Yard						Near Hostel 5						Savitrinagar Colony (Tehlrampur village)						Tamnar village					
	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	
Distance (KM) (w.r.t stack)	0.2						0.5						5.0						3.0					
Direction (w.r.t stack)	NW						ESE						ENE						S					
01.09.2022	64.7	NA	22.6	26.7	0.54	60.6	19.1	15.7	26.3	0.48	65.7	15.5	11.5	26.3	0.38	48.7	18.6	12.9	26.7	0.63				
05.09.2022	50.9	NA	25.7	26.6	0.52	69.4	19.2	14.2	26.2	NA	56	13.5	12.3	26.3	0.31	44.4	13.5	12.6	26.4	0.38				
08.09.2022	42.1	14.4	16.6	26.6	0.49	52.6	18.7	15.3	26.7	NA	36.2	10.6	12.5	27.2	0.46	45.2	16.3	12.4	27.6	0.67				
12.09.2022	38	12.3	17.1	26.5	0.48	26.6	13.8	16.9	26.2	0.42	35.7	13.2	12.1	24.2	0.32	33.1	NA	14.1	27.1	0.73				
15.09.2022	46.7	20.5	15.7	26.9	0.48	NA	NA	NA	NA	NA	48.8	15.2	12.1	26.2	0.64	47.3	23.7	11.1	26.9	0.47				
19.09.2022	36.2	11.8	13.4	26.8	0.43	NA	NA	NA	NA	NA	42.1	9.5	12.1	23.7	0.37	45.9	17.6	14.7	27.2	0.58				
22.09.2022	51.4	12.9	15.7	27.2	0.53	NA	NA	NA	NA	NA	56.7	15.7	12.2	19.2	0.63	49.7	16.8	10.7	27.2	0.79				
26.09.2022	60.6	22.4	18.2	26.8	0.52	NA	NA	NA	NA	NA	61.3	18.4	13.2	24.4	0.51	50.9	NA	11.8	27.6	0.56				
29.09.2022	40.4	19.3	17.1	27.3	0.47	NA	NA	NA	NA	NA	NA	18.2	12.4	24.7	0.48	51.3	NA	13.6	27.3	0.75				
Permissible Limits	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2				
Date	Location-5						Location-6						Location-7						Location-8					
	JIPT Building						Gorhi village						Regaon village						Nirman Bhavan					
	PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	
Distance (KM) (w.r.t stack)	0.2						4.5						3.0						0.2					
Direction (w.r.t stack)	W						SSW						N						S					
01.09.2022	56.3	18.6	14.6	26.3	0.49	50.6	17.8	14.2	26.9	0.66	43.8	16.2	13.8	25.3	0.54	52.5	16.5	13.2	28.3	0.65				
05.09.2022	52.4	16.4	14.2	28.2	0.58	45.2	16.5	13.8	27.3	0.68	41.4	13.3	8	24.1	0.33	49.3	16.2	12.8	26.8	0.63				
08.09.2022	48.3	13.8	13.5	27.3	0.64	46.5	18.4	14.1	26.8	0.58	41.5	12.4	8.6	25	0.38	45.4	14.5	14.2	27.6	0.59				
12.09.2022	42.5	12.4	12.6	25.9	0.55	35.2	13.7	12.8	26.3	0.65	31.2	12.4	8	25	0.32	38.6	13.4	13.4	26.1	0.55				
15.09.2022	40.6	11.6	12.2	26.3	0.47	53.6	18.2	14.3	27.1	0.69	53.2	16.8	9.4	25.8	0.65	34.5	14.1	12.6	25.3	0.52				
19.09.2022	36.8	10.8	11.7	25.4	0.43	44.5	16.2	14.3	27.3	0.66	42.5	13.8	8.5	25.2	0.61	32.6	13.2	11.7	24.9	0.49				
22.09.2022	43.5	14.2	12.3	24.8	0.48	41.2	14.6	12.5	26.4	0.67	38.3	17.4	9.6	25.3	0.56	40.2	14.2	12.7	25.8	0.47				
26.09.2022	48.2	15.8	12.8	25.8	0.52	46.2	18.2	13.7	27.6	0.61	64.3	25.6	NA	NA	0.66	46.5	15.6	13.5	27.4	0.43				
29.09.2022	53.6	19.6	13.2	27.3	0.56	48.3	19.4	14.2	27.5	0.62	NA	15.6	NA	NA	0.58	56.8	18.6	14.8	26.8	0.47				
Permissible Limits	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2	100	60	80	80	2				

Note: All Units in $\mu\text{g}/\text{m}^3$ except CO (in mg/m^3)

Jindal Power Limited, Tamnar

Annexure- VIII

ROOF TOP SOLAR ENERGY GENERATION DETAILS

S.NO.	MONTH	TOTAL SOLAR ENERGY GENERATED IN KWH
1	Apr-22	14938
2	May-22	20648
3	Jun-22	16656
4	Jul-22	15558
5	Aug-22	126658
6	Sep-22	104607
Total		299063

FLY ASH UTILIZATION REPORT FROM APRIL , 2022 TO SEPTEMBER, 2022 (4x600 MW)							
Month	Ash generation (Tonnes)	Utilization of Fly Ash (Tonnes)				Total utilization (Tonnes)	(%) Utilization
		Supply to Cement Plant	Brick making plant	Stone Mine Filling	Mine filling		
Apr-22	452424	17027	0	7053	300000	324080	71.63
May-22	415116	15175	0	0	323700	338875	81.63
Jun-22	402906	8334	0	0	335404	343738	85.31
Jul-22	259937	5897	0	0	292887	298784	114.94
Aug-22	262580	3546	0	0	209165	212711	81.01
Sep-22	364346	6585	0	0	287882	294467	80.82

STUDY ON

LEACHING EFFECT OF ASH DYKE AND ASH DISPOSAL AREAS

AT

JINDAL POWER LIMITED,
TAMNAR, RAIGARH, CHATTISGARH

Submitted to



JINDAL POWER LIMITED, TAMNAR, RAIGARH (CG)

By



Department of Environmental Science and Engineering
Indian Institute of Technology (Indian School of Mines)
Dhanbad – 826 004

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**CENTRE OF MINING ENVIRONMENT
DEPARTMENT OF ENVIRONMENTAL SCIENCE & ENGG.
INDIAN INSTITUTE OF TECHNOLOGY (ISM)
DHANBAD – 826004, JHARKHAND, INDIA**

(Established under Section 3 of the UGC ACT 1956 vide notification No.F11-4/67-U3,
dated 18th September 1967 of the Government of India)

Reference No.: JPL/2021-2022/876/ESE
June 30, 2022

CERTIFICATE

Certified that “Study on leaching effect of ash dyke and ash disposal areas at Jindal Power Limited, Tamnar, Raigarh, Chattisgarh” has been carried out by the Centre of Mining Environment/ Department of Environmental Science & Engineering, Indian Institute of Technology (Indian School of Mines), Dhanbad.

✓ *30-06-2022*
(Gurdeep Singh)
Professor (Emeritus)

EXECUTIVE SUMMARY

Study on Leaching effect of Ash Dyke and Ash disposal areas at Jindal Power Limited, Tamnar, Raigarh, Chattisgarh has been carried out by Indian Institute of Technology (Indian School of Mines), Dhanbad vide JPL Service order 4400015275 dated 17.01.2022.

The study envisaged collection and testing of ground water and soil samples at different locations of the site, elemental characterization by XRF and mineralogical analysis by XRD. Various leaching tests carried out were Acid Digest, ASTM Shake, TCLP at different pH conditions, SLP, modified SLP, open column percolation experiments and actual leachate analysis from Ash Dyke.

The study concluded that there has been no significant leaching effect of Ash Dyke as reflected by the analysis results of leachates generated from various leaching tests/ experiments and also the leachates collected from actual ash dyke coupled with no major issue of contamination of ground or surface water and soils around the ash dyke. The study established that the fly ash and bottom ash from the plant are as such environmentally benign materials and opportunity of appropriate low technology high volume utilization should be evolved.

STUDY OF LEACHING EFFECT OF FLY ASH DYKE AT O.P. JINDAL SUPER THERMAL POWER PLANT OF JINDAL POWER LIMITED (JPL), TAMNAR, RAIGARH (C.G.)

1. LEACHING PROPERTIES OF ASH

Introduction

Fly ash is one of the mineral residues resulting from the combustion of pulverized coal in the boilers of thermal power plants. Coal contains many trace elements in significant quantities and a major portion of these elements are retained in the fly ash after coal burning. Due to burning of coal, fly ash removed with electrostatic precipitators from the boiler has become an important environmental problem because of its huge quantity. The main problem of fly ash is its generation in high volume. Various alternatives are available for its utilization such as bricks, blocks, soil amendments etc. All these are mainly low volume utilization. Mine filling is an alternative environmental friendly use of fly ash. The major challenge for effective utilization of fly ash is its hydraulic transportation due to its various physical and chemical properties.

Fly ash amendment for agricultural soil can improve the physical and chemical properties of deficient soil, thereby improving soil fertility and crop yield. No judicious use, however, may lead to deterioration of soil texture and structure mainly in the upper soil layer, surface crust formation impeding the water intake capacity of the soil, addition of toxic elements and alteration in physico-chemical properties as pH, CEC and EC. These changes in the soil can affect the moisture availability, seedling emergence and crop establishment, root and shoot growth and consequent crop yields.

During transport, disposal and storage, the residues from ash samples are subjected to leaching effects and part of the undesirable compounds in the ash may contaminate both the surface and ground waters. Trace elements are present in fly ash in a relatively very small amount but due to their cumulative build-up, high toxicity and long life, they are of special interest. Trace elements which are present in ashes have tendency to leach out and pollute the environment particularly contamination of water bodies. Therefore, it is important to investigate the leaching properties of ash samples (fly ash and bottom ash) to prevent the harmful environmental impacts especially for the aquatic environment.

Leaching studies of the fly ash and ash pond samples were examined using different leaching methods as given below:

- Acid Digest Test
- ASTM 24-hour Shake Test
- Modified Synthetic Leaching Procedure
- Toxicity Characteristic Leaching Procedure (TCLP)
- Open Column Leachate Procedure (OCLP)

Potentiometric analysis of leachates was carried out using Digital pH Metre (El Model 101 E), Digital Conductivity Meter (El Model 612) and Digital TDS Meter (El Model 651 E), respectively. Elemental analysis was carried out using ICP-OES (Thermo Fisher Scientific, Model-iCAP 7400 Duo), Wavelength Dispersive X-Ray Fluorescence (WDXRF- Rigaku, Primus IV) and X-Ray Diffractometer (WRD- Rigaku, Supernova). A Minimum of 30 ml of solution is required for estimation of all elements in ICP-OES. Final sample solution should preferably be diluted in 1% HNO₃ solution for instrument efficiency and maintenance. Necessary operating conditions such as wavelength, lamp current, sensitivity was used for analysis as mentioned in the operation manual of WDXRF and XRD.

WDXRF Analysis

The analysis of the fly ash, ash pond and bottom ash samples were obtained by WDXRF, and the results are shown in **Table 1**, where this analysis showed that the samples consist mainly of oxides of Iron, Aluminium and Silicon. The mass percentage of the elemental oxides present in the samples were found to be in the order: SiO₂ < Al₂O₃ < Fe₂O₃ < TiO₂ < CaO < K₂O < MgO < P₂O₅ < MnO < Na₂O.

Table 1: Elemental analysis of Fly Ash and Ash Pond samples using WDXRF

Elemental oxides	Na ₂ O	MgO	Al ₂ O ₃	SiO ₂	P ₂ O ₅	K ₂ O	CaO	TiO ₂	MnO	Fe ₂ O ₃
Fly Ash (Mass %)	0.274	1.081	29.162	52.618	0.844	1.225	1.775	2.205	0.794	5.785
Ash Pond (Mass %)	0.249	0.814	26.972	46.993	0.827	1.023	1.185	2.232	0.803	5.579
Bottom Ash (Mass %)	0.245	0.883	24.460	47.611	0.481	1.069	0.874	2.011	0.096	7.831

XRD Analysis

The X-ray diffraction that characterizes the structural properties of the crystalline phases formed in the fly ash and ash pond samples is presented in Fig. 1a and 1b, respectively, where the phases observed in the XRD were compared with the elemental oxide analysis obtained by

WDXRF (Table 1). Analyzing the most intense peaks to determine the phases formed using the X'Pert High Score Plus software, it was possible to observe the presence of the main elements identified in the WDXRF analysis, where Silica, Aluminium and Iron is present in the following forms: SiO_2 , Mullite ($3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$) and Hematite (Fe_2O_3), respectively (Fig. 1A, 1B and 1C).

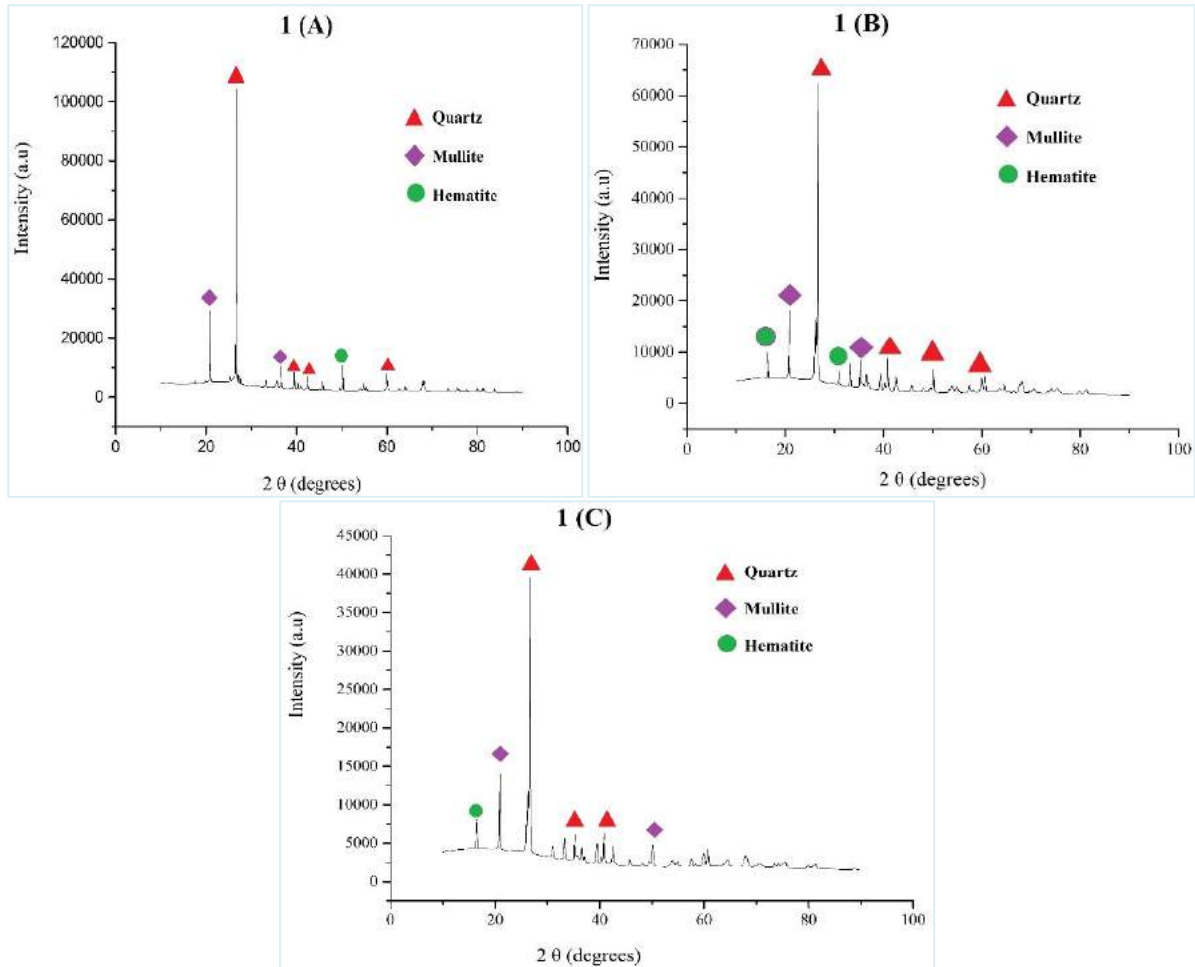


Fig. 1 X-ray diffraction of (A) Fly Ash sample, (B) Ash Pond sample and (C) Bottom Ash sample



Fig.2 X-Ray Diffractometer



Fig. 3 ICP-OES (Thermo Fisher Scientific, Model-iCAP 7400 Duo)



Fig. 4 Milipore Rotary Agitator (Y1320RAHW) for TCLP

• ACID DIGEST TEST

Strong acid digestion test was carried out in presence of acids to determine the elevated concentration levels of trace elements available in the ash. 200 mesh ash samples were dried in an oven at about 110°C for an hour. 0.5 g of oven dried ash sample was taken in a conical flask and moistened by 2 ml of perchloric acid and 10 ml of concentrated HNO₃. Then the mixture was heated to dryness on hot plate in a furnace hood chamber. Thereafter 20 ml of 10% HNO₃ was added, and sample was digested for 3 to 4 hours. This process was repeated until no residue was left in the flask. Finally, it was filtered by Whatman No. 40 filter paper and filtrate was made up to 100 ml and stored in the polypropylene bottles under refrigeration (4°C) for further elemental analysis.

Results of strong acid digestion test of ash samples are presented in **Table 2**. Various elements such as Sodium, Potassium, Calcium, Magnesium, Iron, Manganese, Cobalt, Cadmium, Zinc, Nickel, Copper and Lead were leached during the time of acid digestion test. The concentration of Iron was found highest amongst all the elements analyzed at 147.52 mg/l in fly ash sample and 89.34 mg/l in bottom ash sample. Concentration levels of Sodium, Potassium, Calcium and Magnesium were found to be 93 mg/l, 62 mg/l, 59 mg/l, 53 mg/l in fly ash sample and 78 mg/l, 44 mg/l, 40 mg/l, 32 mg/l in bottom ash samples, respectively. Manganese was also observed in the leachates of fly ash (9.89 mg/l) and bottom ash samples (7.43 mg/l). Nickel, Copper, Zinc and Lead concentration levels were found as 0.35 mg/l, 0.109 mg/l, 0.293 mg/l and 0.224 mg/l, respectively in fly ash and 0.14 mg/l, 0.128 mg/l, 0.174 mg/l and 0.165 mg/l, respectively in bottom ash. Cobalt was found in the concentration level of 0.079 mg/l in fly ash and 0.042 mg/l, respectively in bottom ash. Selenium and Arsenic were observed in the concentration level of 0.007 mg/l and 0.08 mg/l, respectively in fly ash and 0.005 mg/l and 0.06 mg/l, respectively in bottom ash. Concentration levels of Boron and Barium were observed as 0.71 mg/l and 0.07 mg/l, respectively in fly ash and 0.59 mg/l and 0.07 mg/l, respectively in bottom ash. Chromium was observed in the concentration level of 0.010 mg/l in fly ash and 0.008 mg/l in bottom ash. The concentration level of Mercury was observed as 0.004 mg/l in fly ash and 0.002 mg/l in bottom ash. Cadmium, Vanadium and Molybdenum were observed below detection limits. Acid Digest test established the available concentration levels of trace elements in fly ash and bottom ash through the forced leaching under strong acid leaching media and does not necessarily reflect the actual leaching behavior of trace elements in real world situations and also under various standard leaching tests.

Table 2 Results of Acid Digest Test of Fly Ash and Bottom Ash Samples

S. No.	Parameters	Samples	
		Fly Ash	Bottom Ash
1	Na	93	78
2	K	62	44
3	Ca	59	40
4	Mg	53	32
5	Fe	147.52	89.34
6	Mn	9.89	7.43
7	Ni	0.35	0.14
8	Cu	0.109	0.128
9	Zn	0.293	0.174
10	Pb	0.224	0.165
11	Cd	<0.001	<0.001
12	Co	0.079	0.042
13	V	<0.08	<0.03
14	Se	0.007	0.005
15	As	0.08	0.06
16	Hg	0.004	0.002
17	Ag	<0.005	<0.004
18	B	0.71	0.59
19	Ba	0.07	0.07
20	Cr	0.010	0.008
21	Mo	<0.01	<0.01

Concentration of elements are in mg/l

- **ASTM 24-HOUR SHAKE TEST**

This is a short-term leaching experiment where distilled water is used as a leachant. 80 g of fly ash and ash pond sample was taken in a measuring bottle and 2 litre of distilled water was added to it. The extraction bottle was closed tightly and secured in a rotary agitation device followed by end-on end rotation at 30 rpm for 24 hours. The extraction was performed in triplicate on each fly ash and ash pond sample and three replicates were then mixed to get the composite leachate sample. The leachate was filtered through Whatman No. 42 filter paper. After Potentiometric analysis few drops of 6 N nitric acid was added to polypropylene bottle to avoid contamination and the bottle was then stored under refrigeration for further elemental analysis. Results of leachate analysis from ASTM 24 hour shake test are given in **Table 3**. pH was observed to be 6.92 and 7.48 for fly ash and ash pond samples, respectively. Conductivity and TDS values were obtained as 98 μ S/cm and 57 mg/l in fly ash and 132 μ S/cm and 79 mg/l in ash pond samples, respectively. Iron was found to be 58.27 mg/l and 0.36 mg/l in fly ash and ash pond samples. Concentration levels of Sodium, Potassium, Calcium and Magnesium were observed 64 mg/l and 48 mg/l; 9.31 mg/l and 2.97 mg/l; 62.33 mg/l and 44.53 mg/l; 0.89

mg/l and 5.94 mg/l, respectively in fly ash and ash pond samples. Concentration levels of Barium (0.959 mg/l and 0.366 mg/l), Boron (1.502 mg/l and 0.165 mg/l), Nickel (0.083 mg/l and 0.008 mg/l), and Cadmium (0.911 mg/l and 0.001 mg/l) were found to exceed the desirable/permmissible limits in the fly ash and ash pond samples.

Elemental concentration levels in respect of Lead, Zinc, Copper, Cobalt, Chromium and Molybdenum, were found below the permmissible/desirable limits of IS: 2490 and IS: 10500, whereas in respect of Vanadium, Selenium, Silver, Arsenic and Mercury, the concentration levels were observed below the detection limits (< 0.001).

Table 3: Leachate Analysis Results of ASTM 24 Hour Shake Test for Fly Ash and Ash Pond Samples

Sl. No.	Parameters	Fly Ash	Ash Pond	Bottom Ash	IS: 2490 (1981)		IS: 10500 Drinking Water Quality Standard	
					Inland Surface Water	On Land for Irrigation	Permissible Limit	Desirable Limit
1	pH	6.92	7.48		5.5 – 9.0	5.5 – 9.0	No Relaxation	6.5 to 8.5
2	Conductivity	98	132		-	-	2250	-
3	TDS	57	79		2100	2100	2100	500
4	Si	6.10	15.03	16.65	-	-	-	-
5	Ti	80	0.047	0.034	-	-	-	-
6	Al	40	11.89	9.67	-	-	0.2	0.03
7	Fe	58.27	0.36	8.43	-	-	No Relaxation	0.3
8	Cr	0.03	0.04	0.047	-	-	No Relaxation	
9	Ca	62.33	44.53	27.23	-	-	200	75
10	Mg	0.89	5.94	3.37	-	-	100	30
11	Mn	0.07	0.33	0.615	-	-	0.3	0.1
12	Na	64	48	58	-	-	-	-
13	K	9.31	2.97	2.32	-	-	-	-
14	P	26.60	11.64	0.213	-	-	-	-
15	Rb	0.74	0.80	0.777	-	-	-	-
16	Sr	13.69	0.187	0.121	-	-	-	-
17	Ba	0.959	0.366	0.278	-	-	No Relaxation	0.7
18	Li	0.852	0.002	0.005	-	-	-	-
19	B	1.502	0.165	0.018	2	2	1.0	0.5
20	Mo	0.324	0.003	0.003	-	-	No Relaxation	0.07
21	Ni	0.083	0.008	0.019	0.05	-	No Relaxation	0.02
22	Sc	0.270	0.031	0.049	-	-	-	-
23	V	0.000	0.067	0.005	-	-	-	-
24	Co	0.016	0.010	0.005	-	-	-	-
25	Zn	0.199	0.422	0.308	5	-	15	5
26	Cu	0.063	0.082	0.038	3	-	1.5	0.05
27	Ga	0.027	0.012	0.040	-	-	-	-
28	Cd	0.911	0.001	0.001	2	-	No Relaxation	0.003
29	Sn	0.094	0.012	0.008	-	-	-	-
30	Hg	< 0.001	< 0.001	< 0.001	0.01	-	No Relaxation	0.001
31	As	< 0.001	< 0.001	< 0.001	0.2	0.2	0.05	0.01
32	Pb	< 0.001	< 0.001	< 0.001	0.1	-	No Relaxation	0.01
33	Se	< 0.001	< 0.001	< 0.001	0.05	-	No Relaxation	0.01
34	Ag	< 0.001	< 0.001	0.0132	-	-	-	-

Note: Conductivity in $\mu\text{S/cm}$, TDS and concentration of elements in mg/l

TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP) with Reagent Water pH- 4.93 ± 0.5

The US Environmental Protection Agency (USEPA) has developed a leaching method for the assessment of toxicity of potentially hazardous wastes known as the Toxicity Characteristic Leaching Procedure (TCLP) to decide whether a waste should be categorized as hazardous or not. TCLP (EPA Method No. 1311) is applicable for fly ash and ash pond samples for determination of metal leachability. TCLP is a short-term leaching test with a high liquid to solid ratio. This short-term leaching test provides a rapid indication of leachable concentration levels of trace elements from the fly ash and ash pond samples.

TCLP was performed using an extraction fluid made of a buffered acidic medium to run the test. Once the extraction fluid to be used in the test was determined, 80 g of the sample was taken and then extraction fluid equal to 20 times the amount of sample taken was added in the zero head extractor under pressure. The system was tightly closed and placed in an end-over-end rotary agitation device for 18 hours, rotating at 30 ± 2 rpm at a room temperature of about 25 °C. The leachates were then stored in the polypropylene bottles under refrigeration for elemental analysis.

Results of analysis of the leachates generated through the TCLP using reagent water with pH- 4.93 ± 0.5 are presented in **Table 4**. The concentration level of Sodium was observed highest in the leachate of reagent water with pH 4.93 ± 0.5 (70 mg/l in fly ash and 55 mg/l in ash pond). Similar trend was also observed with Potassium, Calcium, Magnesium, Iron, Manganese, Copper, Zinc, and Chromium. The concentration levels of Potassium were found to be 11.27 mg/l in fly ash and 3.43 mg/l in ash pond in the leachate of reagent water with pH- 4.93 ± 0.5 . The concentration levels of Calcium were found to be 65.421 mg/l and 47.769 mg/l in fly ash and ash pond in the leachate of reagent water with pH of 4.93 ± 0.5 . The concentration levels of Magnesium were observed to be 0.98 mg/l and 6.07 mg/l in fly ash and ash pond samples, respectively. Iron was observed in the concentration levels of 61.225 mg/l (fly ash) and 0.432 mg/l (ash pond) in the leachate of reagent water with pH- 4.93 ± 0.5 . The concentration levels of Manganese were observed as 0.087 mg/l (fly ash) and 0.365 mg/l (ash pond) in the leachate of reagent water with pH – 4.93 ± 0.5 . The concentration levels of Zinc were observed as 0.210 mg/l (fly ash) and 0.434 mg/l (ash pond) in the leachate of reagent water with pH- 4.93 ± 0.5 . Concentration levels of some of the RCRA elements such as Arsenic, Lead, Mercury, Silver and Selenium were observed well below the RCRA limits (1976). Elemental concentration levels in respect of Vanadium, Mercury and Arsenic were determined below the detection limits.

Table 4: Toxicity Characteristic Leaching Procedure (TCLP) of Fly Ash and Ash Pond samples with Reagent Water pH- 4.93 \pm 0.5

S.No.	Parameter	Concentration mg/l (With pH- 4.93 \pm 0.5)			RCRA Limits (mg/l)
		Fly Ash	Ash Pond	Bottom Ash	
1	Si	6.45	17.067	18.374	-
2	Ti	85	0.056	0.040	-
3	Al	47	13.543	11.456	-
4	Fe	61.225	0.432	11.763	-
5	Cr	0.048	0.062	0.051	0.2
6	Ca	65.421	47.769	31.418	-
7	Mg	0.987	6.078	4.546	-
8	Mn	0.087	0.365	0.790	-
9	Na	70	55	64	-
10	K	11.27	3.43	2.532	-
11	P	27.578	12.756	0.251	-
12	Rb	0.812	0.913	0.813	-
13	Sr	14.197	0.212	0.138	-
14	Ba	0.976	0.458	0.313	5
15	Li	0.869	0.003	0.006	-
16	B	1.664	0.232	0.023	-
17	Mo	0.345	0.005	0.004	-
18	Ni	0.094	0.009	0.022	-
19	Sc	0.288	0.037	0.056	-
20	V	0.000	0.072	0.006	-
21	Co	0.013	0.011	0.006	-
22	Zn	0.210	0.434	0.324	-
23	Cu	0.058	0.078	0.043	-
24	Ga	0.025	0.015	0.045	-
25	Cd	0.932	0.001	0.001	5
26	Sn	0.086	0.018	0.010	-
27	Hg	< 0.001	< 0.001	< 0.001	5
28	As	< 0.001	< 0.001	< 0.001	100
29	Pb	< 0.001	< 0.001	< 0.001	1
30	Se	< 0.001	< 0.001	< 0.001	5
31	Ag	< 0.001	< 0.001	0.0148	1

Note: Concentration of elements in mg/l

Modified Synthetic Leaching Procedure of Fly Ash, Ash Pond and Bottom Ash Samples

Results of analysis of the leachates generated through the Modified SLP using groundwater (collected from the site) as leaching media are presented in **Table 5**.

Concentration level of Sodium was observed as 55 mg/l, 42 mg/l and 5242 mg/l in fly ash, ash pond and bottom ash samples, respectively. Potassium was observed in the concentration level of 6.52 mg/l (fly ash), 2.865 mg/l (ash pond) and 2.13 mg/l (bottom ash). Concentration levels of Calcium (60.56 mg/l, 41.55 mg/l and 25.43 mg/l) Magnesium (0.79 mg/l, 5.27 mg/l and 3.02 mg/l), Molybdenum (0.303 mg/l, 0.002 mg/l and 0.003 mg/l) and Iron (55 mg/l, 0.312 mg/l and 7.98 mg/l) were observed in fly ash, ash pond and bottom ash samples, respectively. Elemental concentration levels of Iron were much higher than the permissible limit in the fly

ash sample. The concentration of Boron, Barium, Cadmium and Molybdenum was found to be slightly above the permissible/desirable limits of IS: 10500. Elemental concentration levels in respect of Calcium, Magnesium, Zinc, Copper, and Chromium were found below the permissible/desirable limits of IS: 2490 and IS: 10500 whereas elemental concentration levels in respect of Nickel, Lead, Cadmium, Arsenic, Silver and Mercury were found below detection limits.

Table 5: Leachate analysis results of modified synthetic leaching procedure (SLP) of Fly Ash and Ash Pond samples

S. No.	Parameters	Concentration (mg/l)			IS: 2490 (1981)		IS: 10500 Drinking Water Quality Standard	
		Fly Ash	Ash Pond	Bottom Ash	Inland Surface Water	On Land for Irrigation	Permissible Limit	Desirable Limit
1.	Si	6.06	14.45	15.09	-	-	-	-
2.	Ti	74	0.038	0.029	-	-	-	-
3.	Al	35	10.43	8.88	-	-	0.2	0.03
4.	Fe	55	0.312	7.98	-	-	No Relaxation	0.3
5.	Cr	0.025	0.042	0.041	-	-	No Relaxation	
6.	Ca	60.56	41.550	25.43	-	-	200	75
7.	Mg	0.791	5.276	3.02	-	-	100	30
8.	Mn	0.068	0.312	0.532	-	-	0.3	0.1
9.	Na	55	42	52	-	-	-	-
10.	K	6.52	2.865	2.13	-	-	-	-
11.	P	25.098	10.45	0.204	-	-	-	-
12.	Rb	0.654	0.732	0.654	-	-	-	-
13.	Sr	12.16	0.115	0.102	-	-	-	-
14.	Ba							
15.								
16.								
17.								
18.								
19.								
20.								
21.								
22.								
23.								
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Note: Concentration of elements in mg/l

OPEN COLUMN PERCOLATION LEACHING EXPERIMENTS

Open column percolation leaching experiments (**Table 6**) were carried out on the collected fly ash and ash pond sample which may be more helpful in determining actual environmental conditions for leaching. Open column percolation leaching experiments are very much suitable to determine the leaching potentiality of trace elements in fly ash and ash pond sample as these mimics the real-world situations of actual leaching of trace elements in contamination of adjoining water resources particularly groundwater.

In open column percolation experiments, deionized water is percolated through a packed column of fly ash and ash pond in the presence of oxygen at a rate which depends on the natural permeability of the material. The open column for leaching experiments was made of PVC pipes 10 cm in diameter and 60 cm in length. The column set-up involved packing of the fly ash and ash pond at an optimum moisture and density conditions as determined by the Proctor Test. Each packed material was scarified, by lightly scraping the top with a long thin rod to ensure proper interlocking of the material. The top 7.5 cm of the column was left unpacked to allow for addition and maintenance of the leaching medium. About 200 ml of leaching medium (deionized water) was added to the top of the column once every alternate day to maintain sufficient supply of water to the packed fly ash and ash pond material. The top end of the column was exposed to the atmosphere and the bottom end was connected to quarter inch tubing. The columns discharged the leachates through this tubing into 250 ml polypropylene beakers. Leachates were then collected in polypropylene bottles. After the potentiometric analysis was over, few drops of 6N HNO₃ solution were added to the polypropylene bottles to avoid any contamination. The polypropylene bottles were then stored under refrigeration for further elemental analysis. Finally elemental analysis of leachates was carried out by ICP-OES.

Table 6: Open Column Leaching Procedure (OCLP) for Fly Ash and Ash Pond Samples

Sl. No.	Parameters	Fly Ash	Ash Pond	Bottom Ash	IS: 2490 (1981)		IS: 10500 Drinking Water Quality Standard	
					Inland Surface Water	On Land for Irrigation	Permissible Limit	Desirable Limit
1	Si	5.26	12.45	14.65	-	-	-	-
2	Ti	66	0.024	0.023	-	-	-	-
3	Al	30	9.85	7.76	-	-	0.2	0.03
4	Fe	52	0.265	7.43	-	-	No Relaxation	0.3
5	Cr	0.017	0.037	0.037	-	-	No Relaxation	
6	Ca	54.13	36.52	22.65	-	-	200	75
7	Mg	0.598	4.124	2.86	-	-	100	30
8	Mn	0.057	0.242	0.456	-	-	0.3	0.1
9	Na	51	38	47	-	-	-	-
10	K	5.925	2.578	1.87	-	-	-	-

11	P	21.509	9.765	0.194	-	-	-	-
12	Rb	0.576	0.654	0.578	-	-	-	-
13	Sr	10.12	0.102	0.100	-	-	-	-
14	Ba	0.754	0.189	0.216	-	-	No Relaxation	0.7
15	Li	0.653	0.002	0.003	-	-	-	-
16	B	1.202	0.121	0.011	2	2	1.0	0.5
17	Mo	0.231	0.002	0.003	-	-	No Relaxation	0.07
18	Ni	0.045	0.004	0.010	0.05	-	No Relaxation	0.02
19	Sc	0.180	0.013	0.0321	-	-	-	-
20	V	0.000	0.040	0.003	-	-	-	-
21	Co	0.010	0.006	0.001	-	-	-	-
22	Zn	0.132	0.325	0.284	5	-	15	5
23	Cu	0.036	0.066	0.027	3	-	1.5	0.05
24	Ga	0.018	0.006	0.028	-	-	-	-
25	Cd	0.754	0.001	0.000	2	-	No Relaxation	0.003
26	Sn	0.054	0.007	0.005	-	-	-	-
27	Hg	< 0.001	< 0.001	< 0.001	0.01	-	No Relaxation	0.001
28	As	< 0.001	< 0.001	< 0.001	0.2	0.2	0.05	0.01
29	Pb	< 0.001	< 0.001	< 0.001	0.1	-	No Relaxation	0.01
30	Se	< 0.001	< 0.001	< 0.001	0.05	-	No Relaxation	0.01
31	Ag	< 0.001	< 0.001	0.0117	-	-	-	-

Note: Concentration of elements in mg/l

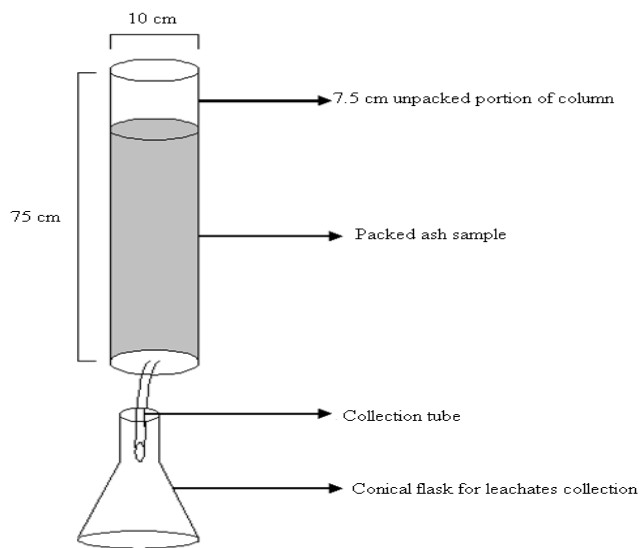


Fig.5.1 Experimental Set up for Open Column Percolation Leaching Experiments



Fig.5.2 Open Column Percolation Leaching Experiments

Comparative evaluation of leachate concentration levels from various leaching tests is summarized in **Table 7**, which reflects that TCLP concentration levels were considerably higher than those of other leaching tests, because of obvious reasons that leaching was carried out under acidic conditions in TCLP test. Leachate analysis results from ASTM, Modified SLP, generally were observed within the permissible/ desirable limits of RCRA, IS: 2490 Part I and IS: 10500 as elemental concentration were either observed within permissible limits or below detection limits.

Table 7: Elemental concentration from various Tests and its Comparison with concentration levels of Ash Dyke Leachate analysis

S.N	Parameter	ASTM 24 Hr Shake Test			Modified SLP			TCLP with pH- 4.93 ± 0.5			Open Column Leachate Analysis			Ash Dyke Leachate Analysis	IS: 2490 (1981)		IS: 10500 Drinking Water Quality Standard	
		Fly Ash	Ash Pond	Bottom Ash	Fly Ash	Ash Pond	Bottom Ash	Fly Ash	Ash Pond	Bottom Ash	Fly Ash	Ash Pond	Bottom Ash		Inland Surface Water	On Land for Irrigation	Permissible Limit	Desirable Limit
1.	Si	6.10	15.03	16.65	6.06	14.45	15.09	6.45	17.06	18.374	5.26	12.45	14.65	10.931	-	-	-	-
2.	Ti	80	0.047	0.034	74	0.038	0.029	85	0.056	0.040	66	0.024	0.023	0.027	-	-	-	-
3.	Al	40	11.896	9.67	35	10.43	8.88	47	13.54	11.456	30	9.85	7.76	8.734	-	-	0.2	0.03
4.	Fe	58.27	0.360	8.43	55	0.312	7.98	61.22	0.432	11.763	52	0.265	7.43	3.17	-	-	NR	0.3
5.	Cr	0.031	0.047	0.047	0.025	0.042	0.041	0.048	0.062	0.051	0.017	0.037	0.037	0.032	-	-	NR	
6.	Ca	62.34	44.530	27.23	60.56	41.55	25.43	65.421	47.77	31.418	54.13	36.52	22.65	22	-	-	200	75
7.	Mg	0.895	5.943	3.37	0.791	5.276	3.02	0.987	6.078	4.546	0.598	4.124	2.86	6	-	-	100	30
8.	Mn	0.075	0.335	0.615	0.068	0.312	0.532	0.087	0.365	0.790	0.057	0.242	0.456	0.08	-	-	0.3	0.1
9.	Na	64	48	58	58	42	52	70	55	64	51	38	47	32				
10.	K	9.314	2.978	2.32	6.52	2.865	2.13	11.27	3.43	2.532	5.925	2.578	1.87	1.15	-	-	-	-
11.	P	26.60	11.649	0.213	25.10	10.45	0.204	27.578	12.76	0.251	21.51	9.765	0.194	0.116	-	-	-	-
12.	Rb	0.744	0.801	0.777	0.654	0.732	0.654	0.812	0.913	0.813	0.576	0.654	0.578	0.522	-	-	-	-
13.	Sr	13.70	0.187	0.121	12.16	0.115	0.102	14.197	0.212	0.138	10.12	0.102	0.100	0.127	-	-	-	-
14.	Ba	0.959	0.366	0.278	0.876	0.265	0.245	0.976	0.458	0.313	0.754	0.189	0.216	0.231	-	-	NR	0.7
15.	Li	0.852	0.002	0.005	0.790	0.002	0.004	0.869	0.003	0.006	0.653	0.002	0.003	0.003	-	-	-	-
16.	B	1.502	0.165	0.018	1.342	0.147	0.013	1.664	0.232	0.023	1.202	0.121	0.011	0.031	2	2	1.0	0.5
17.	Mo	0.324	0.003	0.003	0.303	0.002	0.003	0.345	0.005	0.004	0.231	0.002	0.003	0.003	-	-	NR	0.07
18.	Ni	0.083	0.008	0.019	0.066	0.007	0.013	0.094	0.009	0.022	0.045	0.004	0.010	0.019	0.05	-	NR	0.02
19.	Sc	0.270	0.031	0.049	0.257	0.023	0.040	0.288	0.037	0.056	0.180	0.013	0.0321	0.048	-	-	-	-
20.	V	0.000	0.067	0.005	0.000	0.059	0.004	0.000	0.072	0.006	0.000	0.040	0.003	0.005	-	-	-	-
21.	Co	0.016	0.010	0.005	0.015	0.008	0.004	0.013	0.011	0.006	0.010	0.006	0.001	0.003	-	-	-	-
22.	Zn	0.199	0.422	0.308	0.144	0.413	0.294	0.210	0.434	0.324	0.132	0.325	0.284	0.434	5	-	15	5
23.	Cu	0.063	0.082	0.038	0.056	0.074	0.035	0.058	0.078	0.043	0.036	0.066	0.027	0.037	3	-	1.5	0.05
24.	Ga	0.027	0.012	0.040	0.022	0.008	0.031	0.025	0.015	0.045	0.018	0.006	0.028	0.042	-	-	-	-
25.	Cd	0.911	0.001	0.001	0.838	0.001	0.001	0.932	0.001	0.001	0.754	0.001	0.000	0.001	2	-	NR	0.003
26.	Sn	0.094	0.012	0.008	0.076	0.011	0.006	0.086	0.018	0.010	0.054	0.007	0.005	0.008	-	-	-	-
27.	Hg	0.004	0.193	< 0.001	0.003	0.167	< 0.001	0.005	0.210	< 0.001	0.002	0.124	< 0.001	< 0.001	0.01	-	NR	0.001
28.	As	0.37	0.043	< 0.001	0.034	0.040	< 0.001	0.041	0.048	< 0.001	0.030	0.038	< 0.001	< 0.001	0.2	0.2	0.05	0.01
29.	Pb	0.064	0.084	< 0.001	0.061	0.078	< 0.001	0.076	0.092	< 0.001	0.055	0.072	< 0.001	< 0.001	0.1	-	NR	0.01
30.	Se	0.41	0.47	< 0.001	0.39	0.43	< 0.001	0.45	0.52	< 0.001	0.33	0.39	< 0.001	< 0.001	0.05	-	NR	0.01
31.	Ag	< 0.001	< 0.001	0.0132	< 0.001	< 0.001	0.0126	< 0.001	< 0.001	0.0148	< 0.001	< 0.001	0.0117	< 0.001	-	-	-	-

A. Fly Ash

pH of the leachate sample varied from 6.3 to 8.44. Initially the pH of the samples was found to be alkaline but gradually the alkalinity decreases and a decreasing trend of pH were observed. However, pH was found to be within permissible limit. It is indicative of mildly alkaline ashes i.e. anhydrite dissolution dominates leaching, which can be attributed to moderately low Ca levels and balanced Ca/S ratios that give rise to mildly alkaline conditions (pH 8-9).

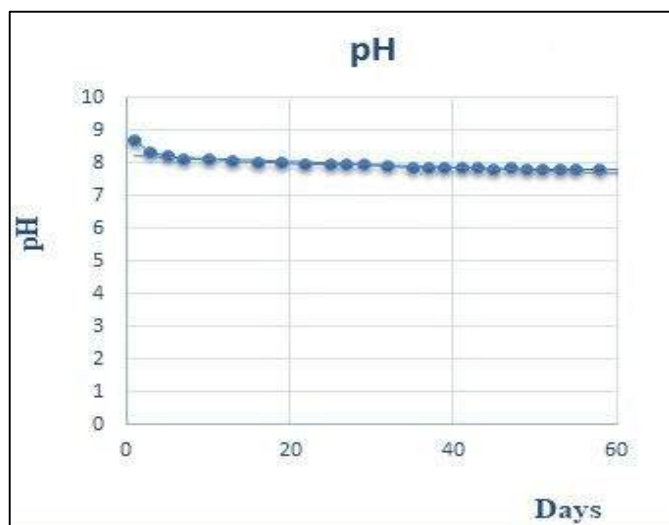


Fig. A.1 Variation of pH in Fly Ash Leachates over Time

Conductivity was found between from 40.2 to 167.8 $\mu\text{S}/\text{cm}$. Initially, the higher conductivity values were found which reduced suddenly after 10-20 days of leaching due to first flush phenomenon as surficial alkali metal ions such as Na^+ , K^+ etc. leached out within the initial leaching period of 10-20 days from about 162 $\mu\text{S}/\text{cm}$ to < 78 $\mu\text{S}/\text{cm}$. There after conductivity reduced gradually and almost stabilized. The similar trend can also be observed with TDS, Na^+ , K^+ , etc.

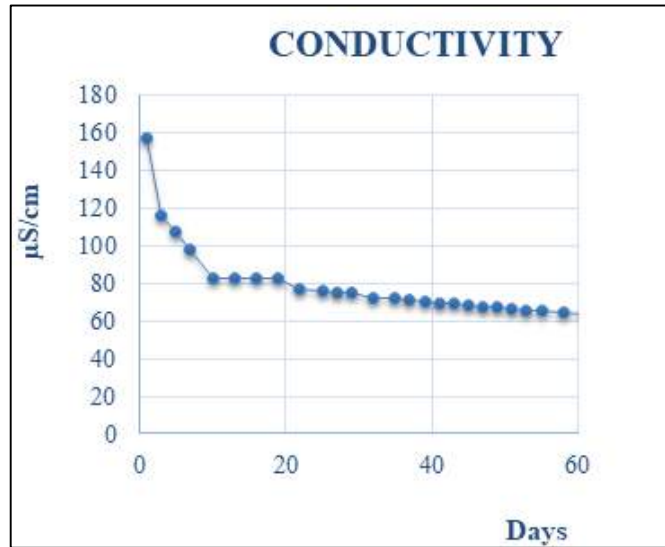


Fig.A.2 Variation of Conductivity in Fly Ash Leachates over Time

Sodium and Potassium were observed regularly in the leachates during the entire study period but their concentrations decreased significantly with leaching time. The concentration of K and Na was found to vary from 76 mg/l to BDL and 56 mg/l to BDL, respectively. As the leaching progresses, the leachate composition reflects rapid depletion of salts due to first flush phenomenon as Na^+ and K^+ ions which are surficial elements are washed out within 20 days or so.

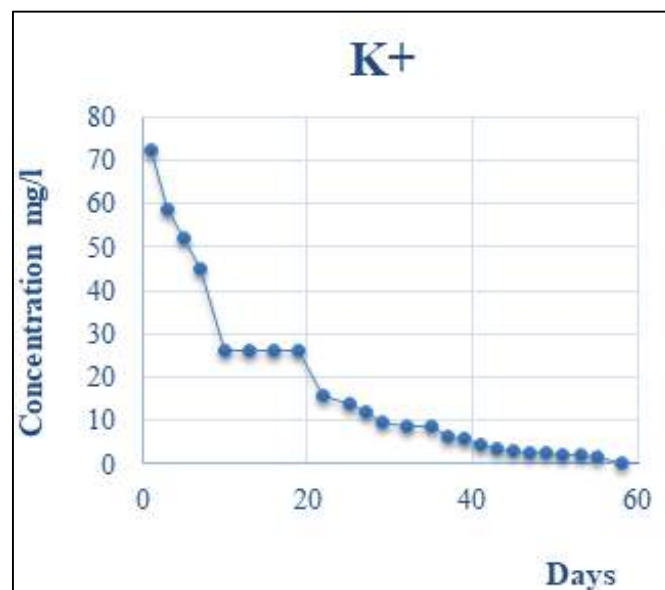


Fig. A.3 Variation of Potassium in Fly Ash Leachates over Time

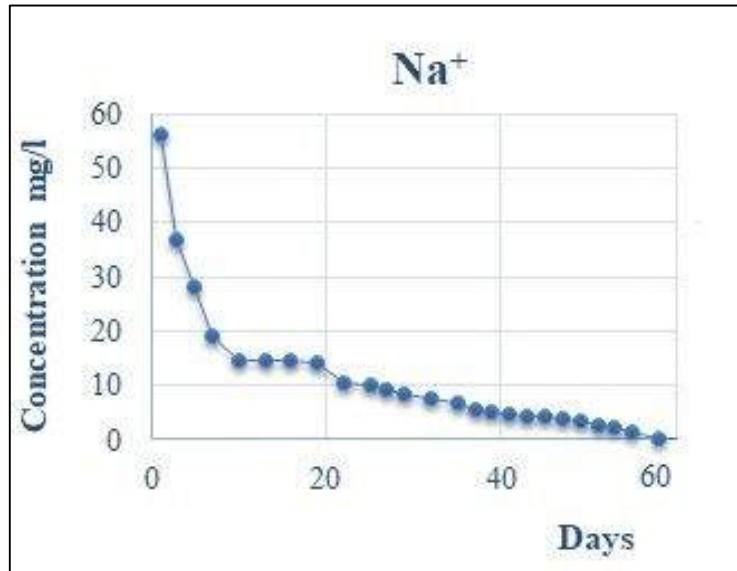


Fig. A.4 Variation of Sodium in Fly Ash Leachates over Time

TDS concentration of the leachate sample was found in the range of 250 mg/l to 57 mg/l with a gradual decrease in the concentration from earlier stage to later stage. During the early stage of leaching high values of conductivity, TDS was found in the leachates due to presence of various ions and finally they were reduced substantially with leaching time due to less availability of ions. Leachability of trace elements from ash particles is controlled by the number of extractions. Therefore, high values of conductivity, TDS were observed initially in the leachate due to high cation concentration.

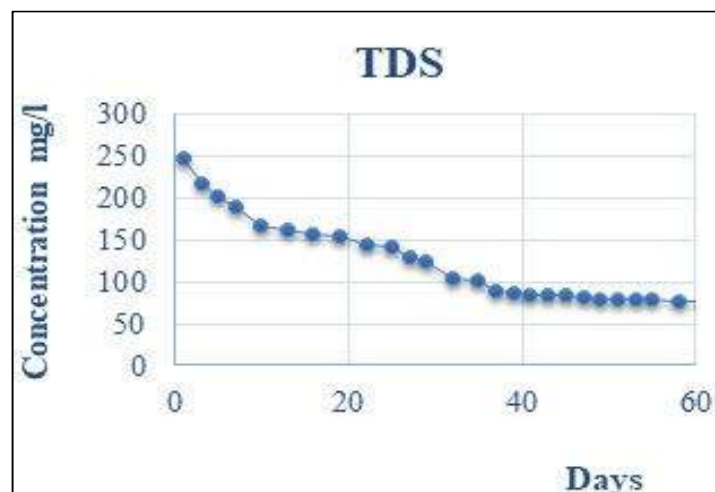


Fig. A.5 Variation of TDS in Fly Ash Leachates over Time

Trace elements/ heavy metals such as Al, As, Ba, Cd, Co, Cr, Cu, Fe, Hg, Mg, Mn, Ni, Pb, Se, Sr and Zn were analyzed for the leachate sample.

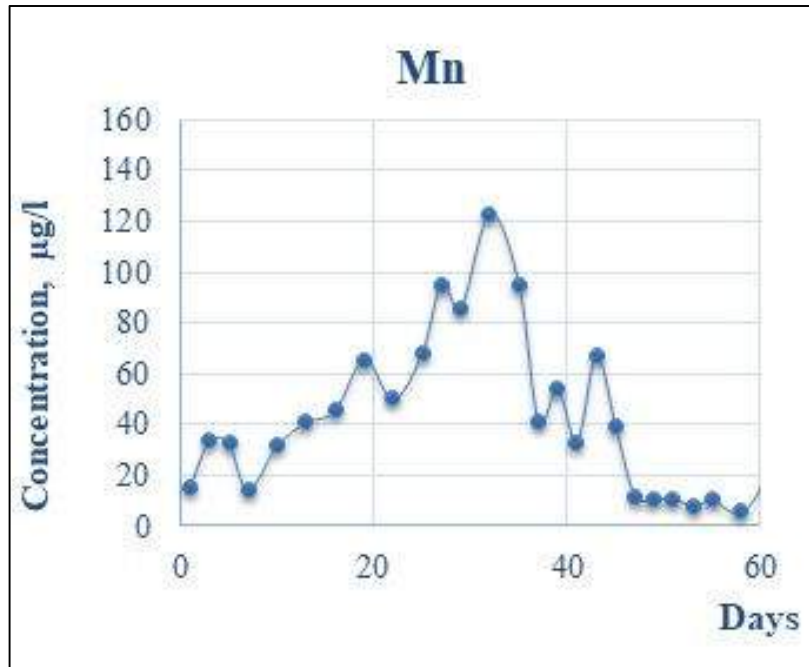


Fig. A.6 Variation of Manganese in Fly Ash Leachates over Time

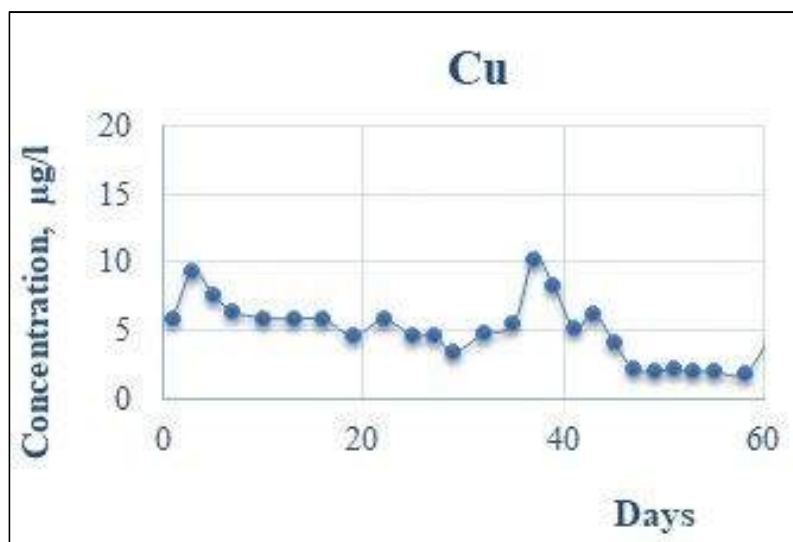


Fig. A.7 Variation of Copper in Fly Ash Leachates over Time

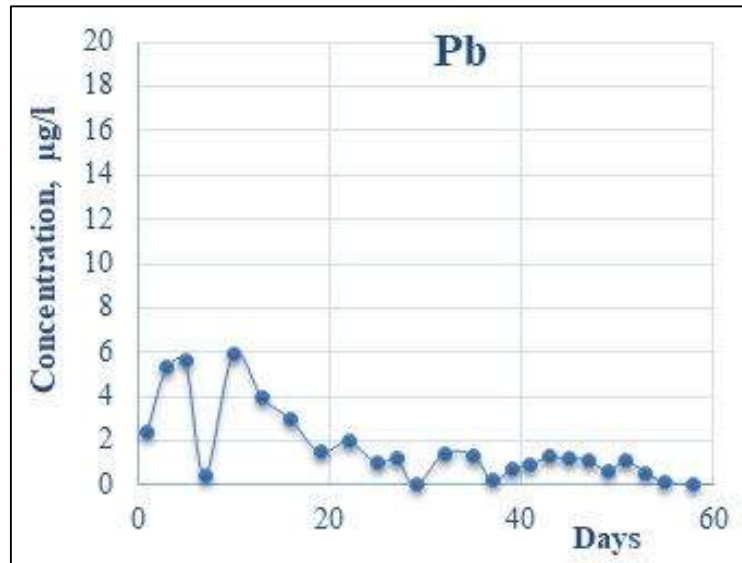


Fig. A.8 Variation of Lead in Fly Ash Leachates over Time

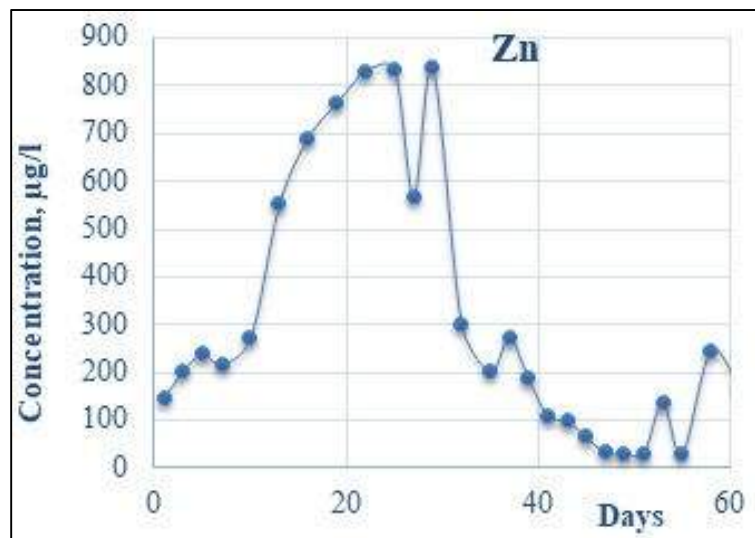


Fig. A.9 Variation of Zinc in Fly Ash Leachates over Time

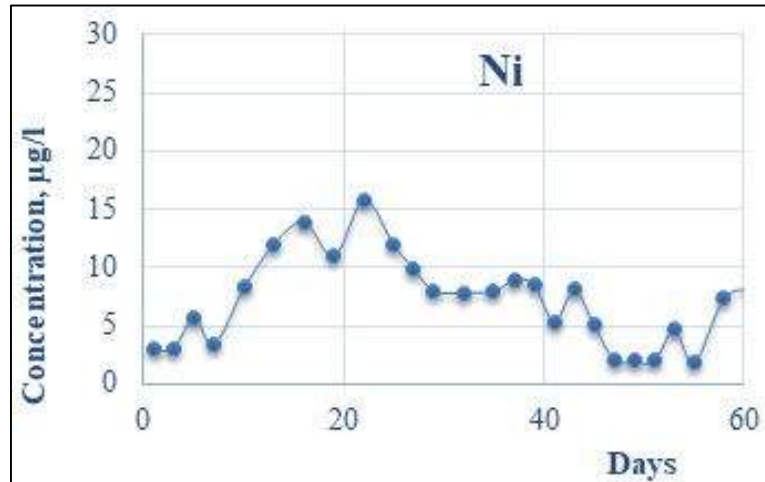


Fig. A.10 Variation of Nickel in Fly Ash Leachates over Time

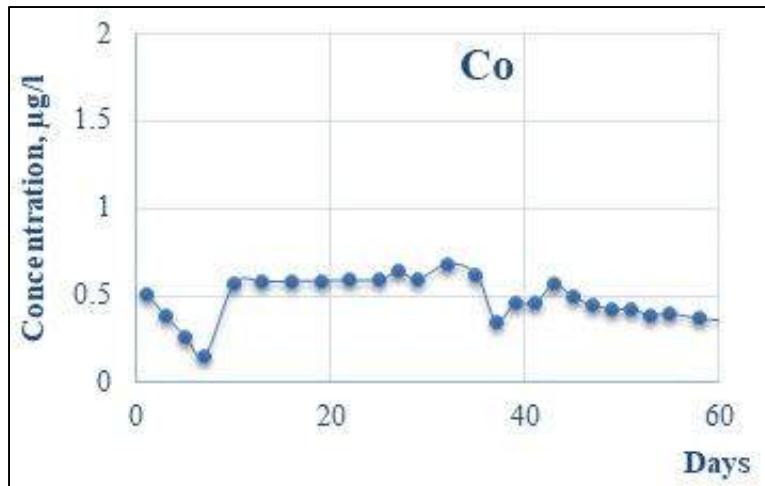


Fig. A.11 Variation of Cobalt in Fly Ash Leachates over Time

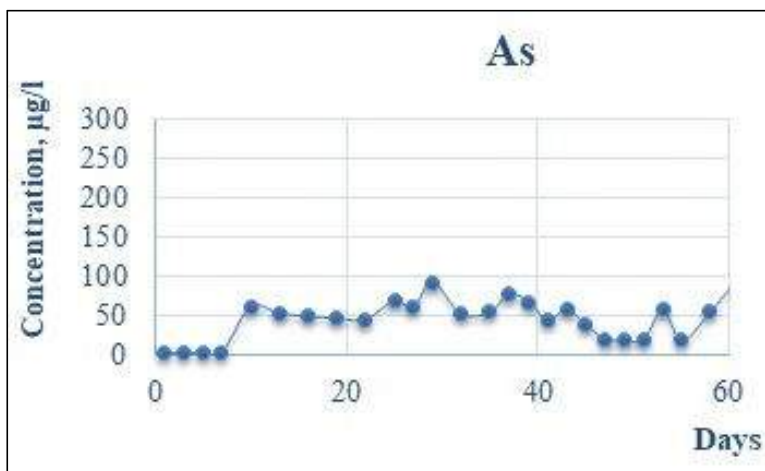


Fig. A.12 Variation of Arsenic in Fly Ash Leachates over Time

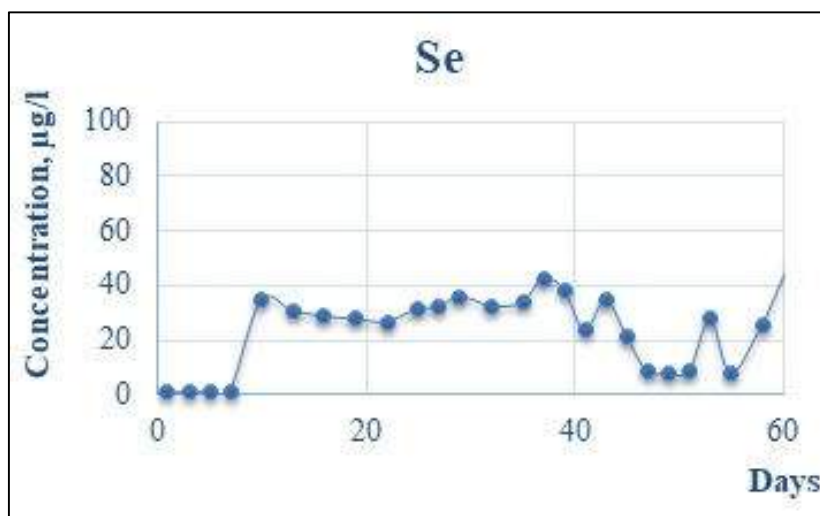


Fig. A.13 Variation of Selenium in Fly Ash Leachates over Time

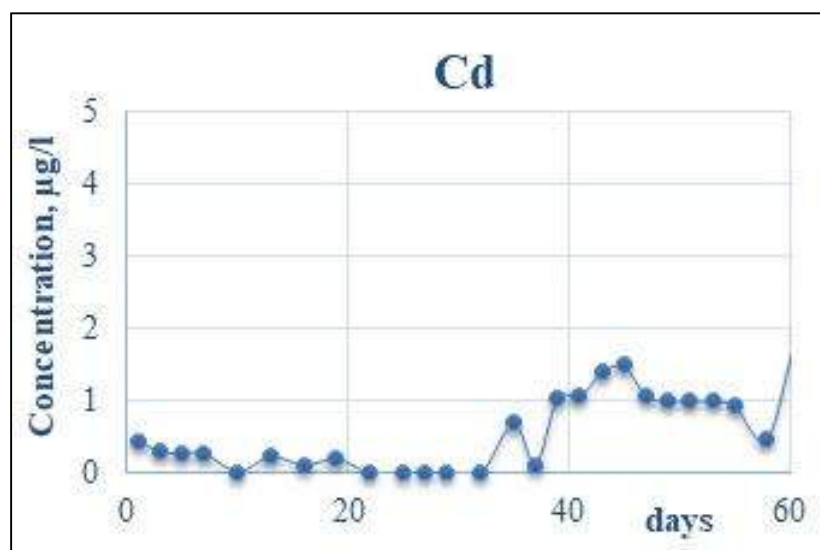


Fig. A.14 Variation of Cadmium in Fly Ash Leachates over Time

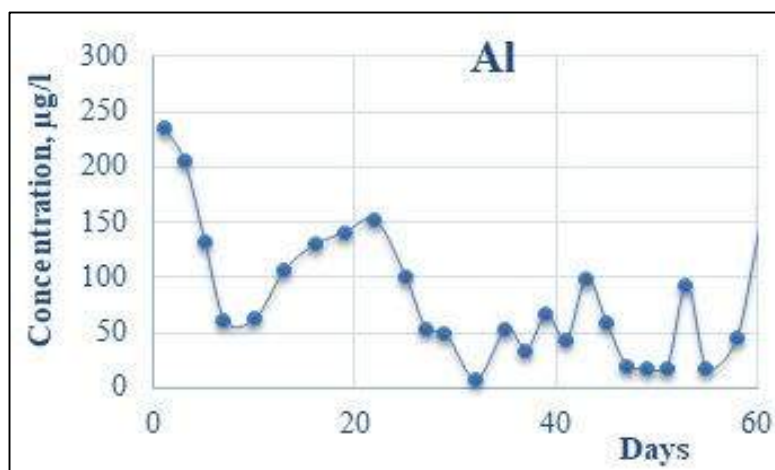


Fig. A.15 Variation of Aluminum Fly Ash Leachates over Time

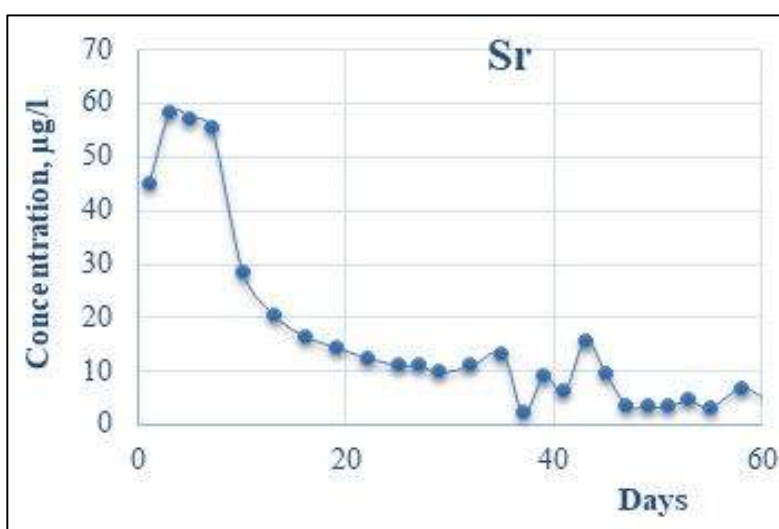


Fig. A.16 Variation of Strontium in Fly Ash Leachates over Time

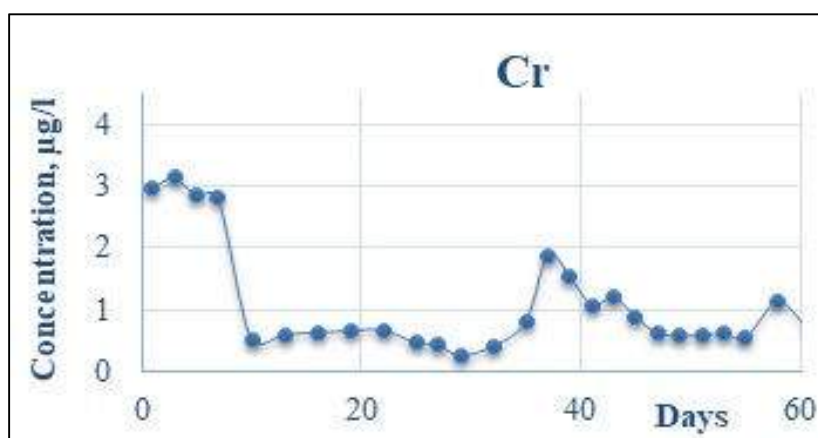


Fig. A.17 Variation of Chromium in Fly Ash Leachates over Time

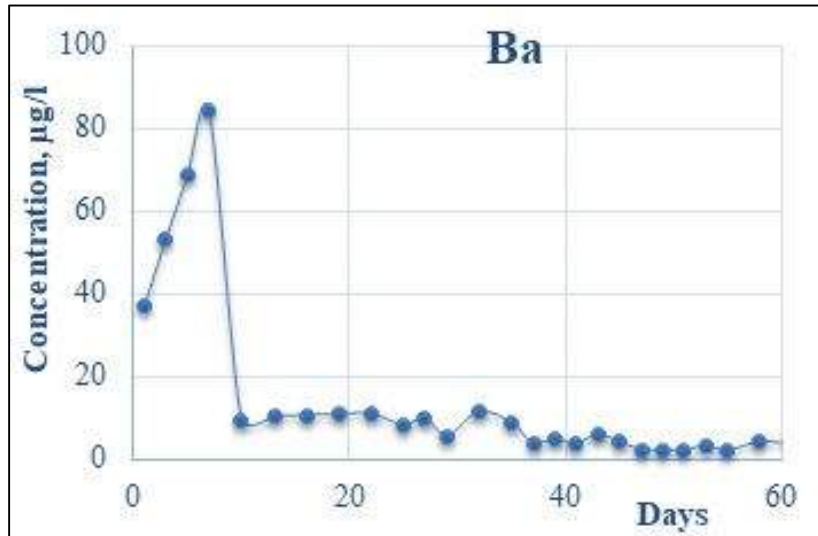


Fig. A.18 Variation of Barium in Fly Ash Leachates over Time

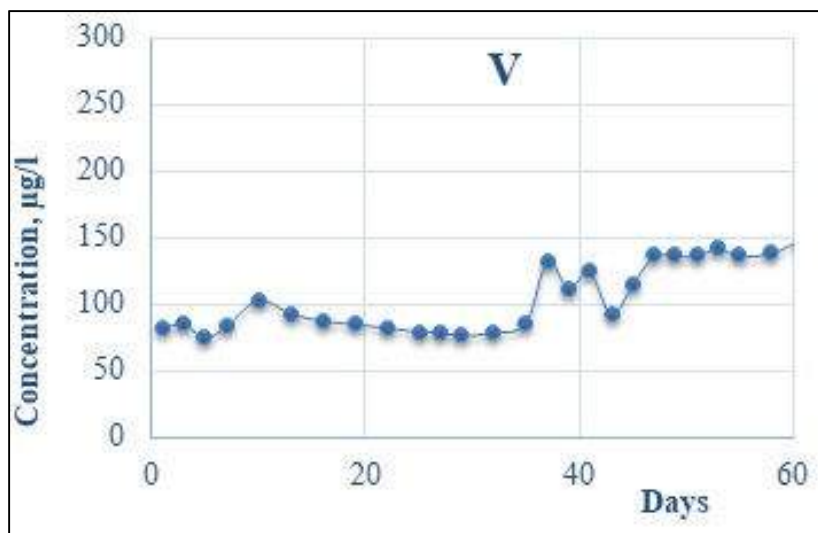


Fig. A.19 Variation of Vanadium in Fly Ash Leachates over Time

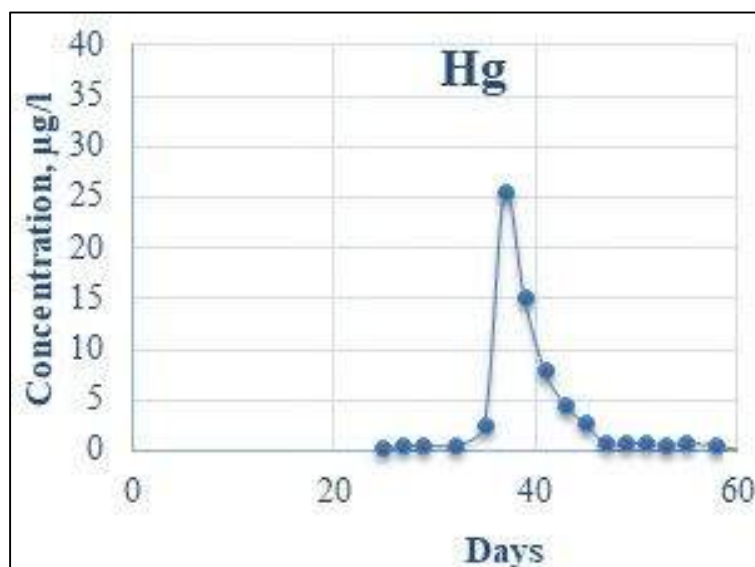


Fig. A.20 Variation of Mercury in Fly Ash Leachates over Time

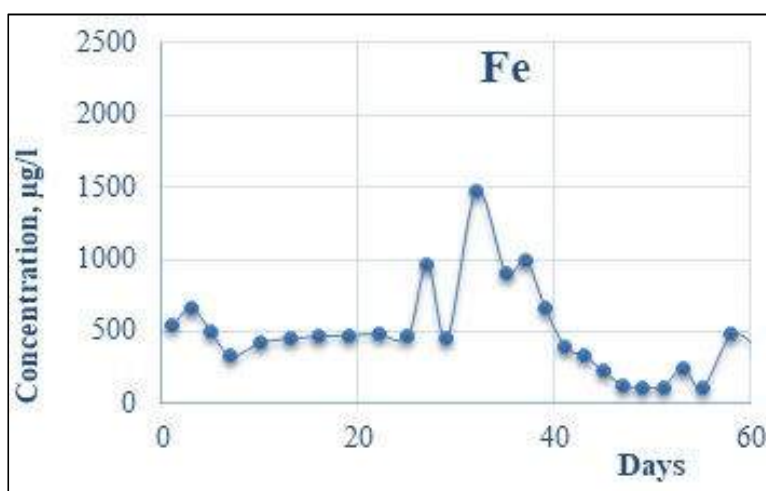


Fig. A.21 Variation of Iron in Fly Ash Leachates over Time

The concentration of Mn was initially 13.75 µg/l to BDL lately rising to higher value of 124.86 µg/l on the 32nd day and just later this reduced drastically to attain a constant value. Cu was found to be 5.91 µg/l initially attaining the higher value 10.48 µg/l and decreased in the later stage, but fluctuations were observed in concentration of Cu throughout the study period. The range of Cu was found 10.28 µg/l to 0.72 µg/l. Initially the concentration of lead was found 2.44 µg/l suddenly raised to the highest level of 6.00 µg/l and reduced to BDL in the later stage, but certain fluctuation was also observed. The initial concentration of Zn was 151.00 µg/l then raised drastically to 839.53 µg/l and attain lower concentration in the later stages. Zn was found to be in the range of

839.65 µg/l to 0.01 µg/l. Ni was in the range of 14.73 µg/l to BDL. Initially the concentration of Ni was found to be 4 µg/l raised to 16.76 µg/l little later and attain lower concentration in the later stages. The concentration of Co was found low ranging from 0.70 µg/l to BDL with an initial concentration of 0.54 µg/l, raised to 0.69 µg/l and attain lower concentration in the later stages. Arsenic (As) was in the range of 97.52 µg/l to 0.88 µg/l with an initial concentration of 2.875 µg/l, raised to the highest value of 95.51 µg/l and attain lower concentration in the later stages. Selenium (Se) was found in the range of 49.129 µg/l to 0.30 µg/l. The initially concentration of Se was 1.11 µg/l raised to the highest value of 49.137 µg/l and reduce drastically to attain lower concentration with time. Cd was found in the range of 1.98 µg/l to BDL with an initial concentration of 0.48 µg/l increased to 1.99 µg/l with a sharp rise and reduced drastically to lower concentration in the later stage. The concentration of Al was found 237.32 µg/l initially and then reduced gradually to 0.01 µg/l in the later stage. The concentration of Sr was found 59.43 µg/l initially and then reduced gradually to 0.01 µg/l with time. Cr was found in the range of 3.25 µg/l to BDL. The concentration of Cr was found high initially but decreased with time to attain a nearly constant lower concentration in the later stages. The same trend was also observed in Ba with the range of 86.22 µg/l to BDL. Vanadium was found in the range of 150.24 µg/l to 0.47 µg/l. Initially the concentration was found 85.13 µg/l raised to the highest level of 146.23 µg/l in the middle and reduced to lower concentration later. Mercury was in the range of 25.41 µg/l to BDL. Initially the concentration of Hg was found BDL, raised abruptly to the highest value of 25.17 µg/l then reduced drastically after another peak of 9.03 µg/l to attain nearly constant lower concentration value in the later stage. Fe was found in the range of 1473.47 µg/l to 0.01 µg/l. The initial concentration of iron (Fe) was found 545.56 µg/l, went up to the highest concentration of 145.83 µg/l then reduced drastically after another peak of 852.37 µg/l to attain nearly constant lower concentration values later. The concentration of Cr, Sr, Ba, Fe, Pb, Zn, Co, Mn and Al were found very low initially but were found higher or sometimes very higher in later period. The concentration of V, Hg, Cu, Ni, As, Se and Cd were found very low in the initial stage increased rapidly to a considerable strength and again decreased later.

B. Bottom Ash

pH of the leachate sample varied from 8.83 to 7.02. Initially the pH of the samples was found to be alkaline but gradually the alkalinity decreases and a decreasing trend of pH were observed. However pH was found to be within permissible limit.

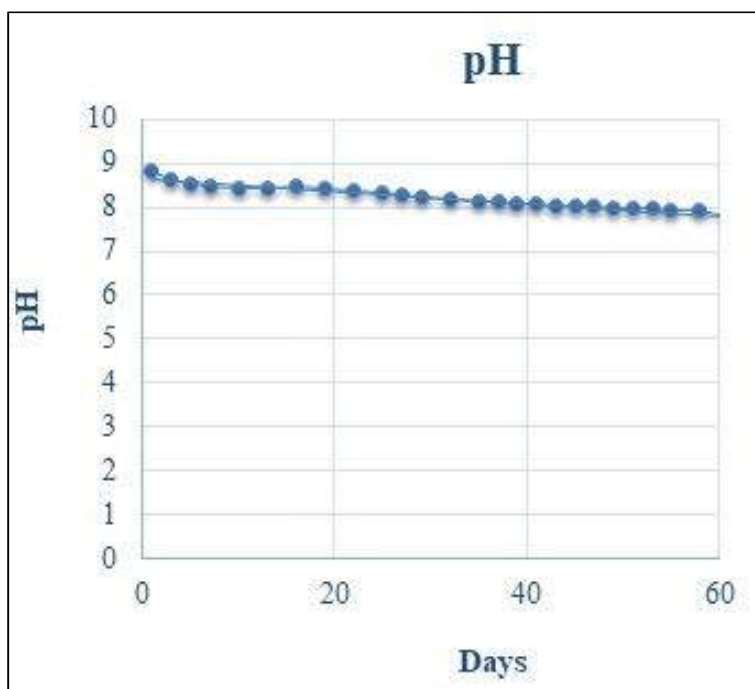


Fig. B.1 Variation of pH in Bottom Ash Leachates over Time

Conductivity was found in the range of 165.4 $\mu\text{S}/\text{cm}$ to 59.6 $\mu\text{S}/\text{cm}$. Initially the higher conductivity values were found which reduced suddenly after 10-20 days of leaching due to first flush phenomenon as surficial alkali metal ions such as Na^+ , K^+ etc. leached out within the initial leaching period of 10-20 days from about 171 $\mu\text{S}/\text{cm}$ to $< 84 \mu\text{S}/\text{cm}$. There after conductivity reduced gradually and almost stabilized. The similar trend can also be observed with TDS, Na^+ , K^+ , salinity etc.



Fig. B.2 Variation of Conductivity in Bottom Ash Leachates over Time

Sodium and Potassium were observed in the leachates during the early stage and their concentrations decreased significantly with leaching time to BDL in the later stage. The concentration of Na^+ and K^+ was found to vary from 59 mg/l to BDL and 68 mg/l to BDL, respectively.

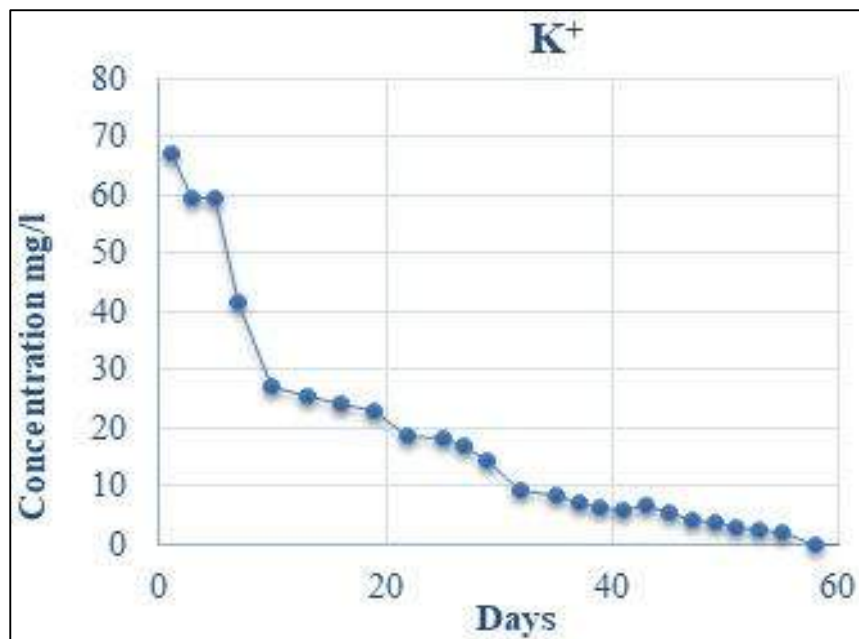


Fig. B.3 Variation of Potassium in Bottom Ash Leachates over Time

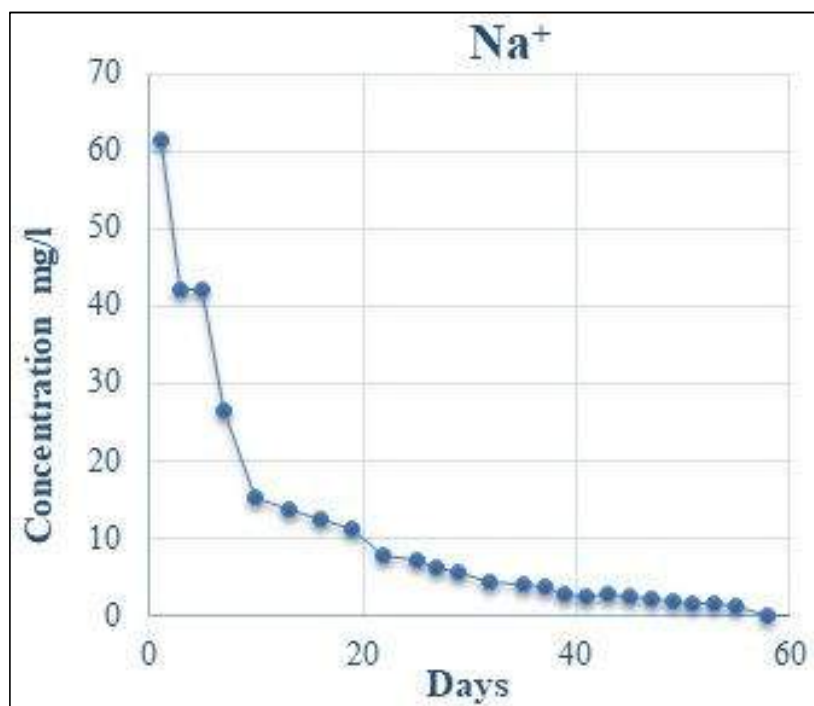


Fig. B.4 Variation of Sodium in Bottom Ash Leachates over Time

TDS concentration of the leachate sample was found in the range of 349 mg/l to 87 mg/l with a gradual decrease in the concentration from earlier stage to later stage. The same trend was also found for salinity which varied from 68 mg/l to 14 mg/l. During the early stage of leaching high values of conductivity, TDS and salinity were found in the leachates due to presence of various ions and finally they were reduced substantially with leaching time due to less availability of ions.

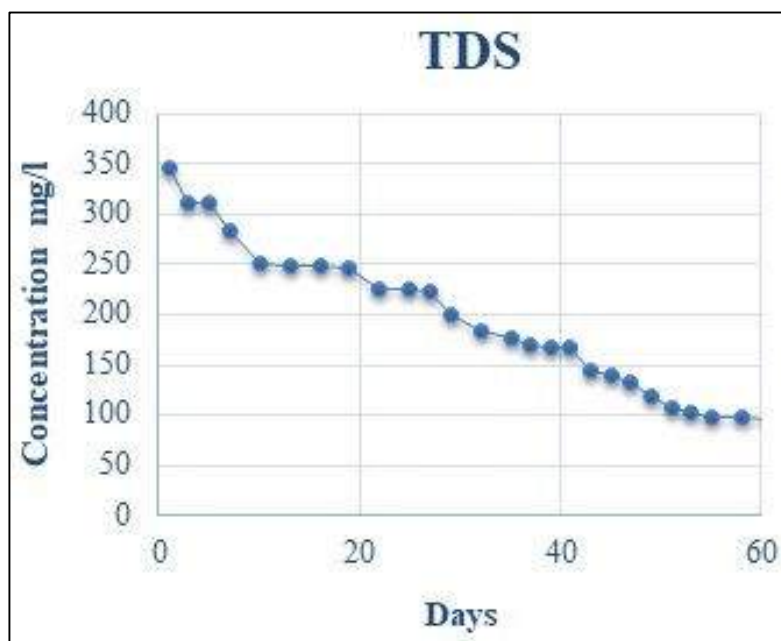


Fig. B.5 Variation of TDS in Bottom Ash Leachates over Time

Trace elements/ heavy metals such as Al, As, Ba, Cd, Co, Cr, Cu, Fe, Hg, Mg, Mn, Ni, Pb, Se, Sr and Zn were analyzed for the leachate sample.

The concentration of Mn was found in a range of 725.93 $\mu\text{g/l}$ to 0.039 $\mu\text{g/l}$. The concentration was initially low, reached to highest value in the middle then suddenly became low and attained constant value in the later stage. Cu was found in a range of 30.175 $\mu\text{g/l}$ to 0.819 $\mu\text{g/l}$. The concentration of Cu was found higher in initial stage and decreased gradually. Pb was in the range of 9.571 $\mu\text{g/l}$ to BDL with higher concentration in the initial stage to a gradual decrease towards the later stage. Zn was found in the range of 1552.27 $\mu\text{g/l}$ to BDL. The concentration of Zn was found 242.16 $\mu\text{g/l}$ initially, sharply reached up to 1551.33 $\mu\text{g/l}$ and decreased abruptly to a constant lower value with time. The concentration of Ni was found higher and fluctuating in the initial stage, decreased gradually and became constant in the later stage with the range of 27.93 $\mu\text{g/l}$ to BDL. Co was found in the range of 6.09 $\mu\text{g/l}$ to BDL. Its concentration was found lower initially, became high in middle and decreased gradually. Arsenic was found to be in the range of 194.75 $\mu\text{g/l}$ to 2.85 $\mu\text{g/l}$ with a higher concentration fluctuating in the initial and middle stage to constant lower concentration in the later stage. The same trend was also repeated for Selenium whose concentration was found in the range of 83.66 $\mu\text{g/l}$ to 0.95 $\mu\text{g/l}$. Cd was in the range of 30.21 $\mu\text{g/l}$ to BDL. Initially the concentration was low, increasing to the highest concentration and decreased

suddenly to become constant at lower concentration in the later stage. Al was found in the range of 18943.18 $\mu\text{g/l}$ to 0.024 $\mu\text{g/l}$. The concentration of Al was found highest initially and decreased gradually to lower level with time. Sr was in the range of 108.43 $\mu\text{g/l}$ to 0.006 $\mu\text{g/l}$ with a higher concentration fluctuating in the initial and middle stage to constant lower concentration in the later stage. Cr was found with the range of 16.214 $\mu\text{g/l}$ to BDL. The concentration of Cr was found higher in the initial stage and decreased gradually to lowest level with time and became constant. Ba was in the range of 323.285 $\mu\text{g/l}$ to BDL. The concentration of Ba was found higher in the initial stage and BDL in the later stage. V was found in the range of 195.424 $\mu\text{g/l}$ to 0.017 $\mu\text{g/l}$ with a higher concentration in the initial and middle stage to lowest later. Hg was in the range of 6.184 $\mu\text{g/l}$ to BDL. A sharp linear trend in the concentration of Hg was not found, but the concentration in the later stage was far lower than the initial stages. Fe was found in the range of 1372.79 $\mu\text{g/l}$ to BDL. The concentration of Fe was found higher in the initial and middle stages but decreased gradually to in the later stages.

The concentration of Cr, Sr, Ba, Fe, V, Pb, Zn, Ni and Al were found very low initially but were determined higher or sometimes very higher in later period. The concentration of Mn, Hg, Cu, Ni, Co, As, Se and Cd were showed irregular leaching trend.

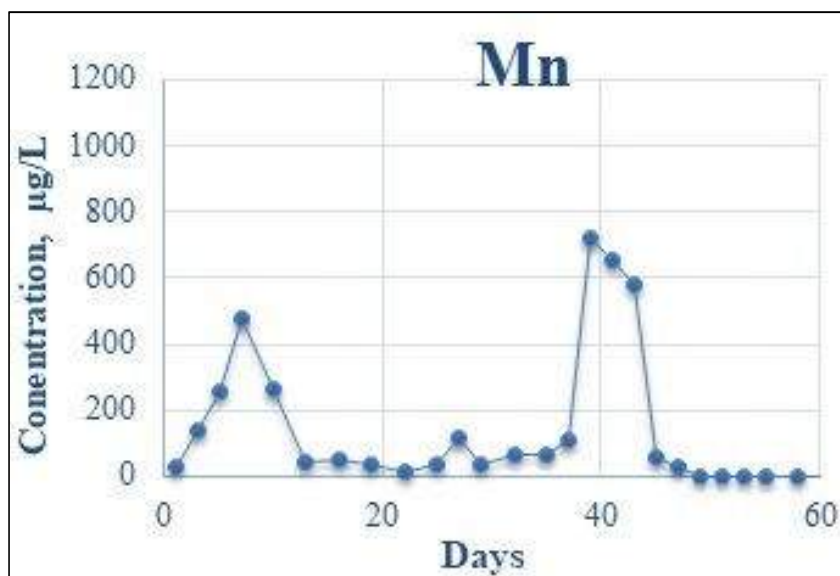


Fig. B.6 Variation of Manganese in Bottom Ash Leachates over Time

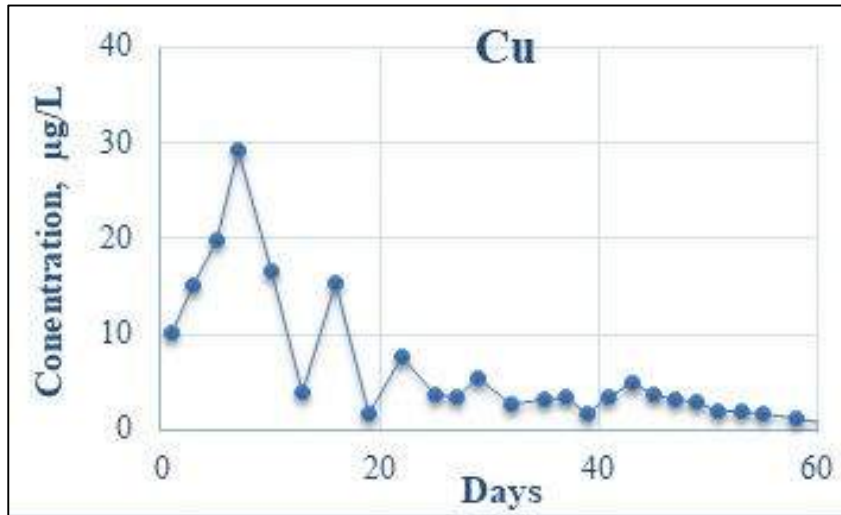


Fig. B.7 Variation of Cu in Bottom Ash Leachates over Time

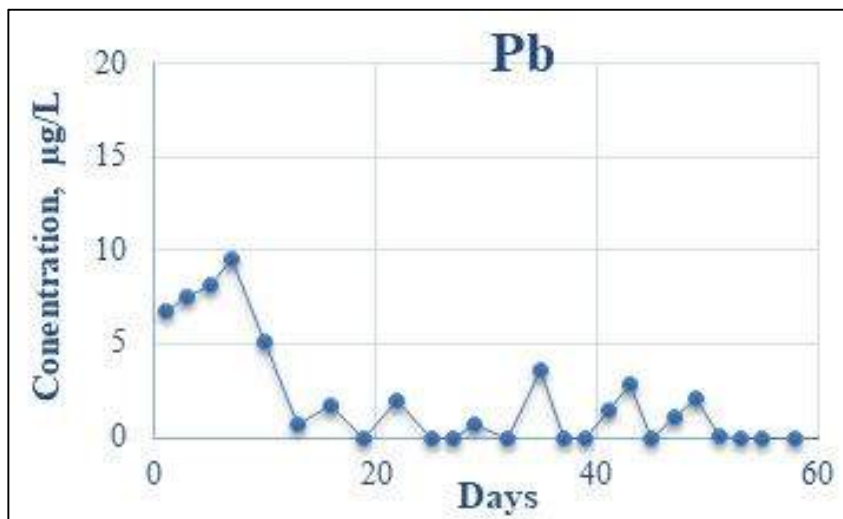


Fig. B.8 Variation of Lead in Bottom Ash Sample over Time

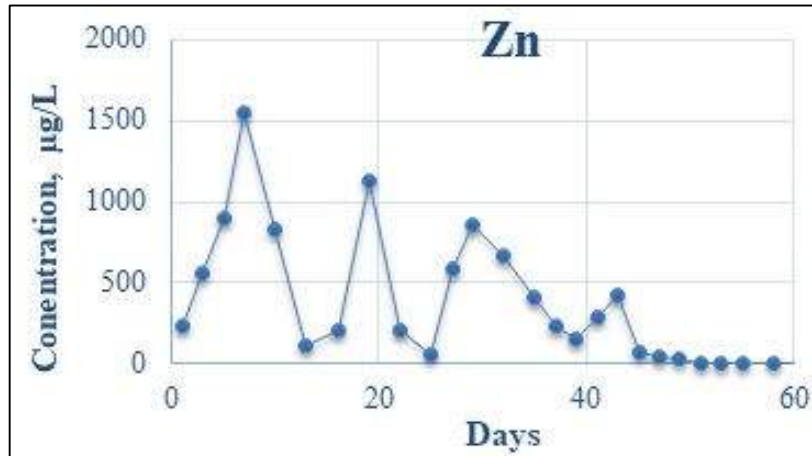


Fig. B.9 Variation of Zinc in Bottom Ash Leachates over Time

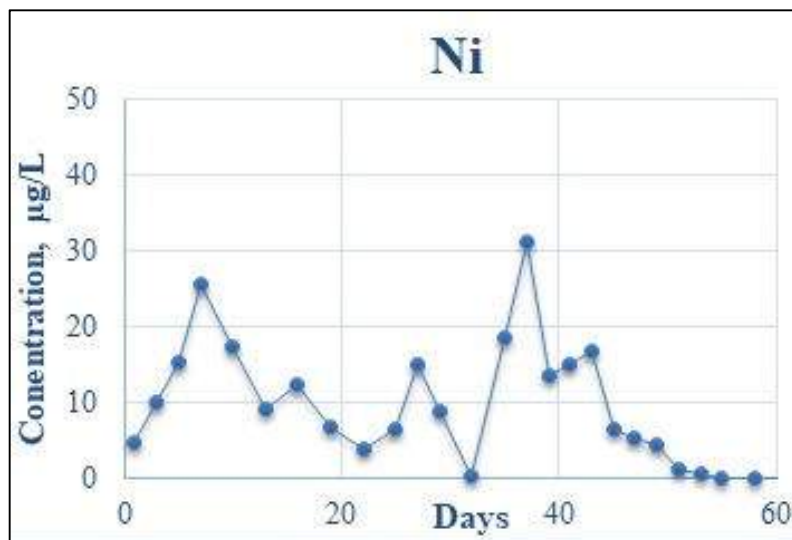


Fig. B.10 Variation of Nickel in Bottom Ash Leachates over Time

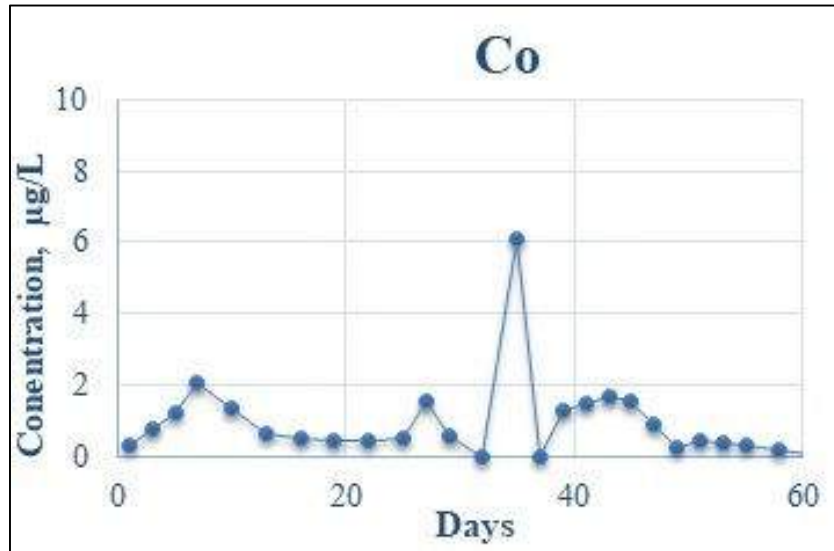


Fig. B.11 Variation of Cobalt in Bottom Ash Sample over Time

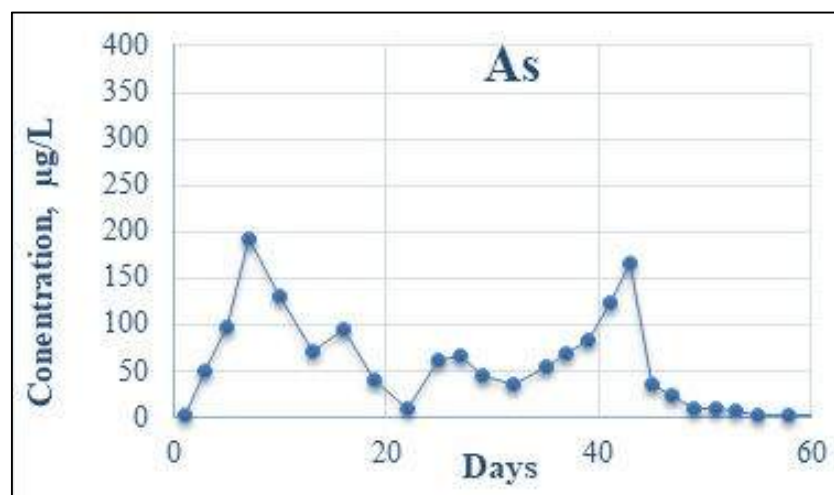


Fig. B.12 Variation of Arsenic in Bottom Ash Leachates over Time

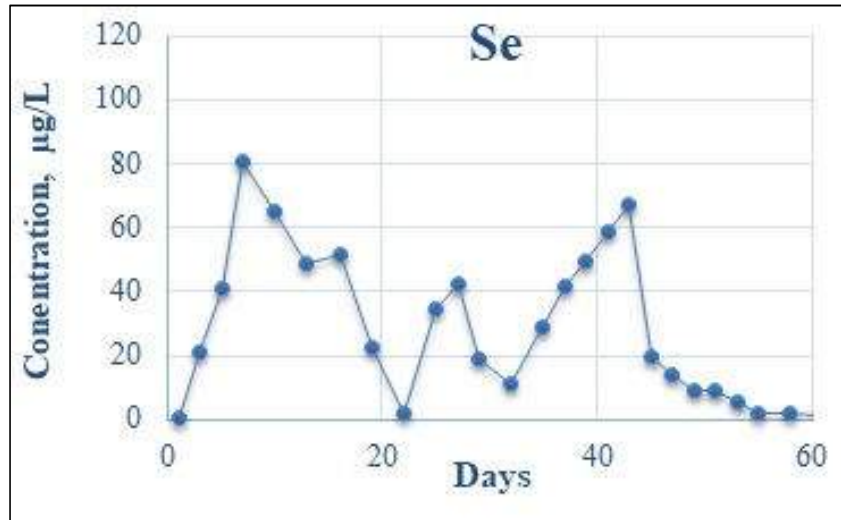


Fig. B.13 Variation of Selenium in Bottom Ash Leachates over Time

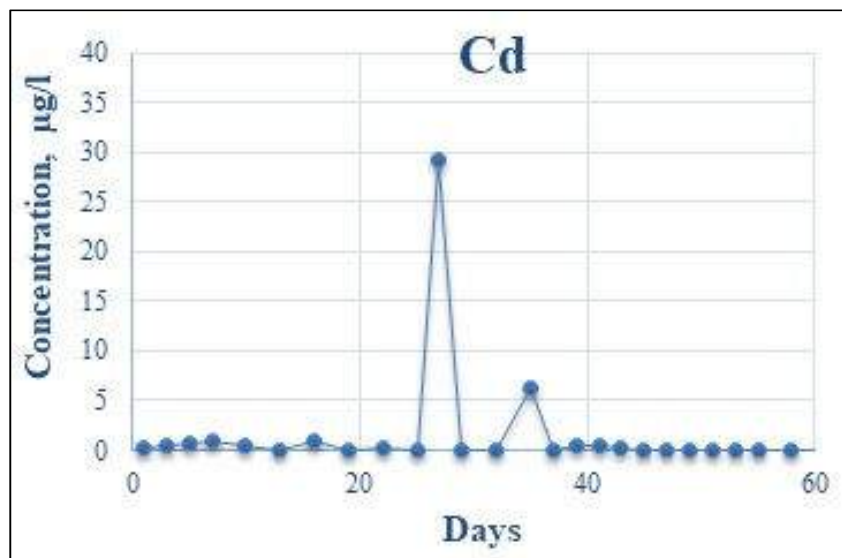


Fig. B.14 Variation of Cadmium in Bottom Ash Leachates over Time

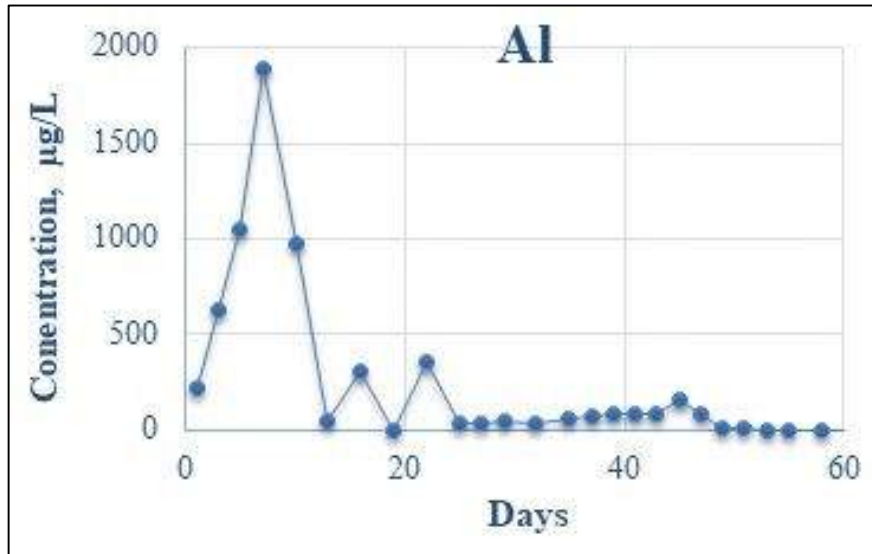


Fig. B.15 Variation of Aluminium in Bottom Ash Leachates over Time

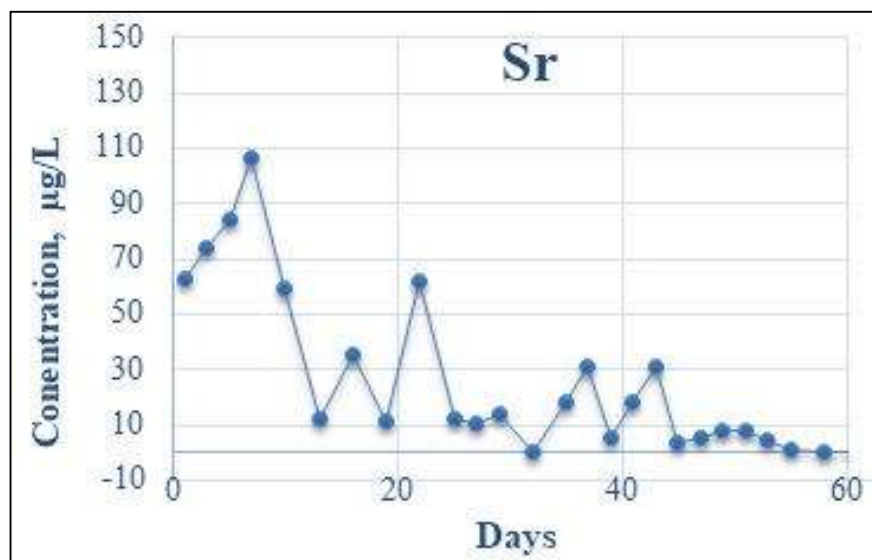


Fig. B.16 Variation of Strontium in Bottom Ash Leachates over Time

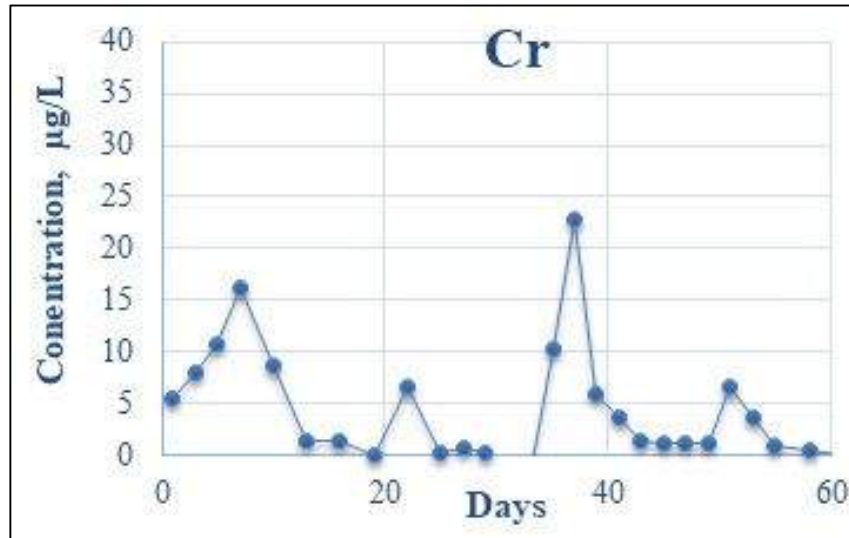


Fig. B.17 Variation of Chromium in Bottom Ash Leachates over Time

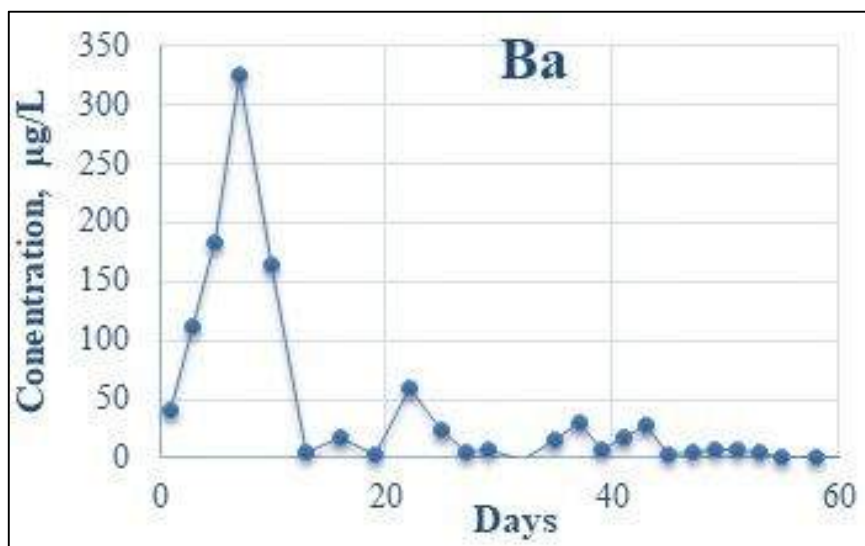


Fig. B.18 Variation of Barium in Bottom Ash Leachates over Time

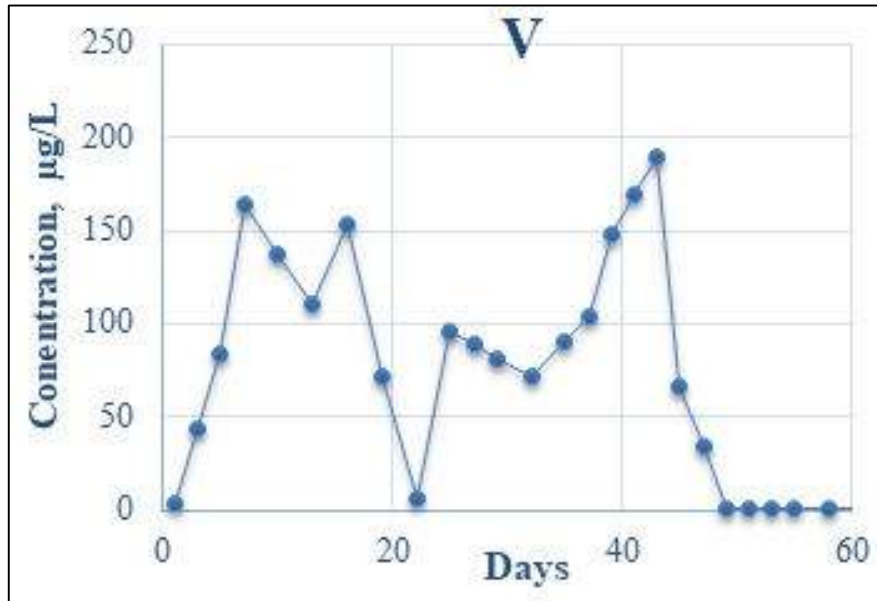


Fig. B.19 Variation of Vanadium in Bottom Ash Leachates over Time

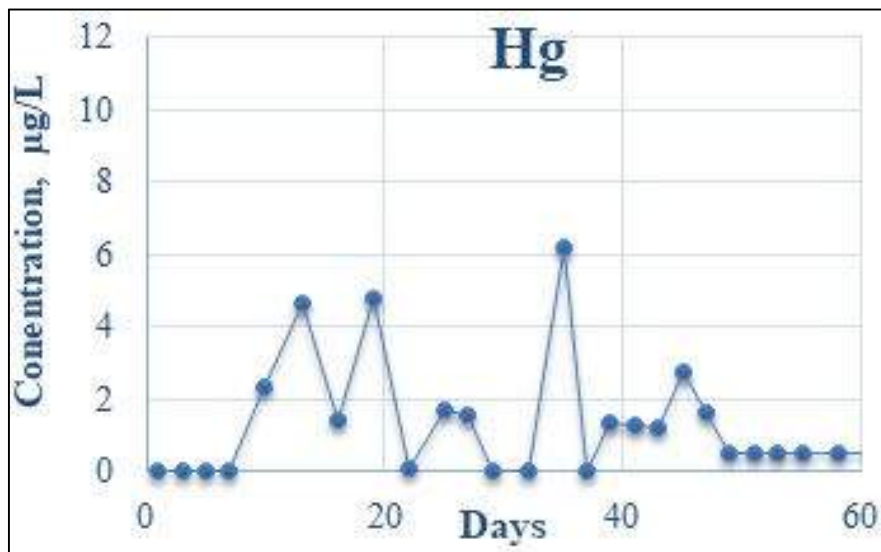


Fig. B.20 Variation of Mercury in Bottom Ash Leachates over Time

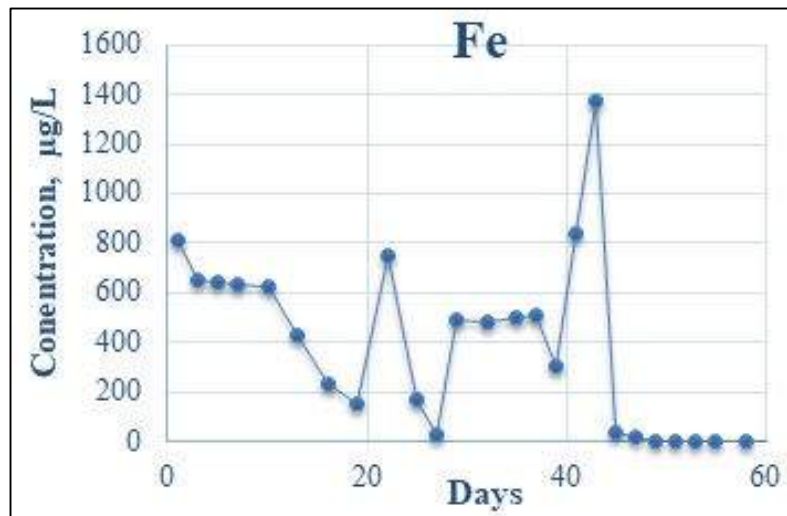


Fig. B.21 Variation of Iron in Bottom Ash Leachates over Time

Alkaline pH of leachate samples indicate that the fly ash can be utilized for amending the acidic soil. Alkaline ash also help to mitigate the problem of acid mine drainage. Conductivity of the ash sample indicates that the ash is enriched in various ions. Hence the samples can be used as additives in ameliorating poor soils.

The result of chemical analysis showed that ash samples are the potential source of various macro and micro nutrients. The samples are rich in Na and K. It was found that all ash samples are enriched in various trace elements such as Fe, Mn, Cu, Ni, Pb, Co and Zn which are very essential for the growth of the plants in agriculture fields. These samples may be used as a source of several nutrients in amending the nutrient deficient and poor agriculture soils.

Based on above findings it can be recommended that ash samples of the thermal power plants are suitable materials for effective utilization. There are many trace elements present in these ash samples which may be suitable for plant growth especially agricultural point of view. Ash samples may be utilized in several geotechnical applications such as making bricks, blocks, tiles, ash dykes etc. These are also useful materials for various applications such as mine void filling, reclamation of waste lands etc.

Comparative evaluation of elemental concentration levels from open column leaching analysis along with ash dyke leachate analysis is summarized in **Table 8**.

Table 8 Summary of Open Column Percolation Leaching Analysis of Fly Ash and Bottom Ash along with Ash Dyke Leachate Analysis

Parameter	Open Column Percolation test Leachates		Ash Dyke Leachate	IS:2490, 1981 Inland Surface Water
	Fly Ash	Bottom Ash		
pH	6.3-8.44	7.02-8.83	6.25	5.5-9
Conductivity	40.2-167.8	59.6-165.4	247	-
TDS	57-250	87-349	113	2100
Na ⁺	BDL-56	BDL-59	38	-
K ⁺	BDL-76	BDL-68	27	-
Fe	1473-0.02	BDL-1372.79	BDL	-
Mn	BDL-122.74	0.039-725.93	BDL	-
Al	235.12-0.01	0.027-1884.28	173	-
Cu	0.44-10.28	0.819-30.175	0.1	3
Pb	BDL-5.97	BDL-9.571	BDL	0.1
Zn	0.01-837.63	0.001-1548.38	BDL	5
Ni	BDL-15.83	BDL-31.409	BDL	3
Co	BDL-0.68	BDL-6.11	BDL	-
As	0.85-95.15	2.778-192.323	BDL	0.2
Se	0.28-47.13	0.916-81.059	BDL	0.05
Cd	BDL-1.97	BDL-29.233	BDL	2
Sr	58.24-0.01	0.007-106.423	BDL	-
Cr	BDL-3.14	BDL-16.133	BDL	2
Ba	BDL-82.12	BDL-325.283	BDL	-
V	148.33-0.382	0.017-195.424	BDL	-
Hg	27.53-0.02	BDL-6.184	BDL	-
BDL- Below Detection Limit Conductivity in $\mu\text{S}/\text{cm}$ TDS, salinity, Na and K in mg/l Heavy Metals and Trace Elements in $\mu\text{g}/\text{l}$				



FINAL REPORT OF THE CONSULTANCY PROJECT

on

Study of the Effect of Fly Ash Dumping on Ground Water Surrounding the Gare IV/2 & 3 Coal Mines

Consultants

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Dr. B Samanta, Department of Mining Engineering

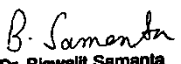
Submitted to

Jindal Power Limited, Tamnar



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PURPOSE OF THE REPORT

This report provides the combined of background of the study, objectives and scope of work. A brief description of the studied environmental parameter is also provided in this report. The geo-environmental parameters of ground water are highlighted. The methodology and sampling procedure for ground water is also provided. The outcome of the study in the form of ground water qualities are reported and the measured values are compared with the regulatory standards. Finally, recommendations of the study have been discussed in this study report.

1. OBJECTIVE OF THE STUDY

Conducting a scientific investigation to assess possible environmental impacts of fly-ash dumping at Gare IV/ 2 &3 mines. The study specifically aims at the following:

- Laboratory analysis of underground water samples collected from the surrounding area of Gare IV/ 2 &3 mines.

2. SCOPE OF WORK

As per the service order issued to IIT Kharagpur in regards with geo-environmental studies, following are the scope of work of the Geo-environmental study of environmental parameters in and around of Gare IV/ 2 &3 mines.

- Ten groundwater samples will be collected around the ash-dumping areas and the following water quality parameters (which form some of the indicated parameters in the regulatory norms of Government of India) will be analyzed for each of the samples. Parameters like pH, Turbidity, Odour, Total Dissolved Solids, Total Hardness (as CaCO₃), Alkalinity, Sulphate (SO₄), Chlorides (Cl), Iron(Fe), Manganese (Mn), Copper (Cu), Zinc (Zn), Nickel (Ni), Lead (Pb), Cadmium (Cd), Arsenic (As), Mercury

3. METHODOLOGY

The study team visited the plant site to look into the pertinent ash dumping activities related to the study. After a thorough study of site maps, design methodology of ash dumping, a detailed discussion was made with the plant management to chalk out the program for conducting geo-environmental study. At first, it was decided to select the appropriate sites for collection of ground-water samples. Finally, it was decided to collect ground water samples from borewell at Jharna, Libra, Kosampali & Dongamahua vilages, piezometer at CHP, Shavitri Nagar Colony and inside plant near WTP, openwell at Jharna village. The details of these have been presented below.

4 WATER SAMPLE PARAMETERS

The major contaminants which are responsible for causing water pollution and for which the quality of water is adjudged, as a standard practice, have been provided in Table 1. These water quality parameters include heavy metals contaminants along with pH, TDS, TSS, alkanity. The adverse impacts of these parameters are also provided in the same table. For groundwater, as it is directly used for drinking purpose, the standard (ANNEXURE 1, BIS 10500) as specific to drinking water quality has been used. It can be noted that permissible level of drinking water contamination is more stringent than affluent discharge, since the affluent mixed with other water bodies gets diluted.

Table 1: Water Quality parameter and their adverse impacts

Water Quality Parameter	Adverse consequences
pH	Water with high pH causes corrosion to pipelines and fittings, can lead to health effects if acid water causes leaching of lead and copper
Turbidity	Turbid water may contain microorganisms that cause diseases
Odour	Generally harmless, causes aesthetic effect only
Total Dissolved Solids	Concentration of TDS is an important indicator for usefulness of water. The higher TDS cannot be used for drinking purpose (recommended concentration upto 500 mg/L. Crops yield is substantially reduced in presence of excess concentration of TDS
Total Hardness (as CaCO ₃ equivalent) (Chemical Analysis)	Consumes more soap while washing, create scaling in pipeline and boiler, causes aesthetic effect in water, excessive consumption could lead to kidney/ bladder stones
TSS	TSS can include a wide variety of material such as silt, decaying plants, animal matter, industrial waste and sewage. High concentration of TSS can cause many problems for stream health and aquatic lives.
BOD	BOD is an important indicator of the organic matter presence in water. Excessive BOD causes reduced amount of dissolved oxygen content in water, which in turn creates problem of aquatic lives.
COD	The effect of COD is same as BOD.
Oil & Grease	Oil and grease may be toxic. The toxicity varies depending on the types of oil and greases. Various hydrocarbons can pose a wide range of health problems, affecting liver, kidney and blood to increasing risk of cancer. Low level of oil pollution can reduce aquatic organisms ability to reproduce and survive.
Alkalinity	Alkalinity measures the acid neutralization potentiality, less alkaline solution has reduced neutralization potentiality to acidity
Sulphate (SO ₄)	Drinking water containing excess sulphate concentration causes laxative effect
Chlorides (Cl)	Causes bad taste of water, excessive chloride concentration causes irrigation problem
Iron (Fe)	Elevated Iron levels in water can cause stain in plumbing, laundry and cooking utensils; and can impart objectionable tastes and colours to foods.
Calcium (Ca)	Calcium contributes to the total hardness of water.
Copper (Cu)	Excess amount of copper causes genetic disorder causing neurological, psychiatric, and liver diseases.
Zinc (Zn)	Some fish can accumulate zinc in their bodies. When zinc enters the bodies of these fish, it is able to bio-magnify up the food chain. Zinc also

	be a threat to cattle and plant species when present in excess quantity
Cobalt (Co)	Cobalt dust is flammable and is toxic by inhalation.
Nickel (Ni)	No perceived problems under controlled limits.
Chromium (Cr)	Hexavalent chromium is carcinogenic by inhalation, and are corrosive to tissue.
Manganese (Mn)	Elevated Manganese can cause stain in plumbing / laundry, and cooking utensils.

5. TESTING PROCEDURE

5.1 LABORATORY TESTING

Water samples collected from the field are tested in the laboratory for determining concentration levels of different pollutants. Testing methods vary depending upon the attribute to be measured. The metal concentration present in water has been tested using atomic absorption spectrophotometer. For testing other pollutant concentrations different methods have been used following standard procedure (APHA, 2005). Methods for testing different attributes are presented in Table 2. The different testing procedures by chemical analysis can be found in a number of text books (Masters, 2005). The testing of heavy metals by AAS procedure is briefly presented in next section for convenience of understanding the working principle of this method.

Table 2: Measuring methods for different water pollutants

Sl. No	Parameters	Measurement Method
1	pH	pH meter
2	Turbidity	Turbidity Meter
3	Odour	Physical
4	TSS	Filtration
5	COD	Chemical Analysis
6	BOD (5 days)	BOD Incubator
7	Oil and grease	Chemical Analysis
8	Total Dissolved Solids	Filtration
9	Total Hardness (as CaCO ₃ equivalent) (Chemical Analysis)	Chemical Analysis
10	Alkalinity	Chemical Analysis
11	Sulphate (as SO ₄)	Chemical Analysis
12	Chlorides (as Cl)	Chemical Analysis
13	Copper (as Cu)	AAS
14	Zinc (as Zn)	AAS
15	Lead (as Pb)	AAS
16	Cobalt (as Co)	AAS
17	Iron (as Fe)	AAS
18	Cadmium (as Cd)	AAS
19	Arsenic(as As)	AAS
20	Manganese (Mn)	AAS
21	Chromium (Cr)	AAS
22	Nickel (Ni)	AAS

5.2 TESTING USING AAS

Atomic absorption spectrometry is an analytical method for determination of metallic elements when present in both trace and major concentrations. This study used AAS for determining the heavy metal concentration in water samples as well as fly-ash samples. Figure 3 presents the photograph of an AAS instrument. As with other analytical techniques AAS requires calibration before testing can proceed. The calibration can be done through several steps including interferences check samples, calibration verification, calibration standard, bland control, and linear dynamic range. The idealised calibration curve is stated by Beer's law that the absorbance of an absorbing analyte is proportional to its concentration.

However, due to several reasons, such as unabsorbed radiation, stray light or disproportionate decomposition of molecules at high concentrations, deviation from linearity is usually observed. Figures 1 and 2 present the AAS instrument and a typical idealized and deviation curves of response respectively. It is desirable to work in the linearity response range. The rule of thumb is that a minimum of five standards and a blank should be prepared in order to have sufficient information to fit the standard curve appropriately. If the sample concentration is too high to permit accurate analysis in linearity response range, there are three alternatives that may help bring the absorbance into the optimum working range: (i) sample dilution, (ii) using an alternative wavelength having a lower absorptivity, (iii) reducing the path length by rotating the burner hand. The details operating principles can be found in (Haswell, S.J., 1991. and Reynolds, R.J. et al., 1970).



Figure 1: The photograph of the AAS instrument

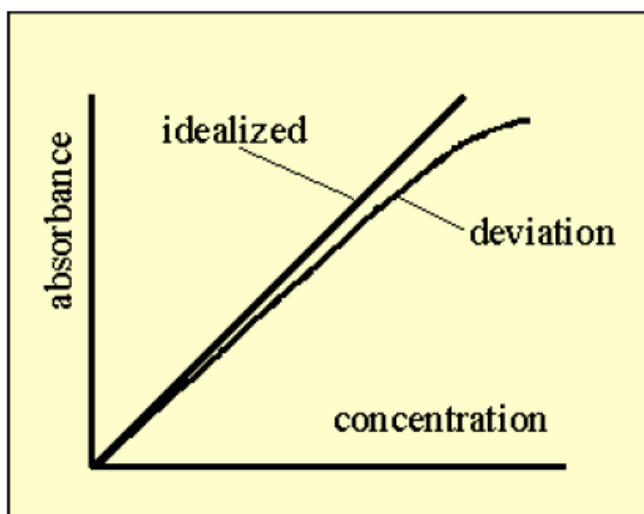


Figure 2: An idealized / deviation response curve

The water samples collected from the site have been analyzed for determination of heavy-metal concentrations. Initially, the calibration curves for each of the elements are prepared using standards. For few of the elements, when the concentration values have not matched in the linear response range, the samples have been diluted appropriately to get the precise measurements. For this purpose, different dilutions in range of 1:10, 1:50, and 1:100 have been tried. It is also important to note that while conducting heavy metal concentration testing using AAS five observations are taken to minimize the experimental error pertaining to AAS method. The results of heavy metal concentrations, hence, reflect the average of these five observations. However, no effort has been put for repeatability of the experiments which are done through chemical analysis in order to minimize the experimental efforts.

6. RESULT

The analysis results for the collected samples are provides in the Tables

ANALYSIS RESULTS

Table 3

Sample Location : **PIEZOMETER, CHP OFFICE**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.09.2021**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.50	6.5 – 8.5
2	Turbidity	NTU	4.2	5
3	Odour	-	Agreeable	Agreeable
4	Total Dissolved Solids	mg/l	430	2000
5	Total Hardness (as CaCO ₃)	mg/l	230	600
6	Alkalinity	mg/l	225	600
7	Sulphate (SO ₄)	mg/l	65.2	400
8	Chlorides (Cl)	mg/l	47.5	1000
9	Iron (Fe)	mg/l	0.10	0.3
10	Manganese (Mn)	mg/l	0.15	0.3
11	Copper (Cu)	mg/l	0.20	1.5
12	Zinc (Zn)	mg/l	1.5	15
13	Nickel (Ni)	mg/l	0.01	0.02
14	Lead (Pb)	mg/l	0.001	0.01
15	Cadmium (Cd)	mg/l	ND	0.003

16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 4

Sample Location : **JHARNA VILLAGE OPEN WELL**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.09.2021**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.4	6.5 – 8.5
2	Turbidity	NTU	3.5	5
3	Odour	-	Agreeable	Agreeable
4	Total Dissolved Solids	mg/l	750	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	440	600
6	Alkalinity	mg/l	200	600
7	Sulphate (SO ₄)	mg/l	70.0	400
8	Chlorides (Cl)	mg/l	41.0	1000
9	Iron (Fe)	mg/l	0.20	0.3
10	Manganese (Mn)	mg/l	0.05	0.3
11	Copper (Cu)	mg/l	ND	1.5
12	Zinc (Zn)	mg/l	0.020	15
13	Nickel (Ni)	mg/l	0.006	0.02
14	Lead (Pb)	mg/l	0.002	0.01
15	Cadmium (Cd)	mg/l	ND	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 5

Sample Location : **LIBRA VILLAGE**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.09.2021**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.1	6.5 – 8.5
2	Turbidity	NTU	3.80	5
3	Odour	-	Agreeable	Agreeable
4	Total Dissolved Solids	mg/l	402	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	160	600
6	Alkalinity	mg/l	122	600
7	Sulphate (SO ₄)	mg/l	12.0	400
8	Chlorides (Cl)	mg/l	27.0	1000
9	Iron (Fe)	mg/l	0.10	0.3
10	Manganese (Mn)	mg/l	0.021	0.3
11	Copper (Cu)	mg/l	0.201	1.5
12	Zinc (Zn)	mg/l	0.050	15
13	Nickel (Ni)	mg/l	0.010	0.02
14	Lead (Pb)	mg/l	0.004	0.01
15	Cadmium (Cd)	mg/l	ND	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 6

Sample Location : **KOSAMPALI VILLAGE**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.09.2021**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.3	6.5 – 8.5
2	Turbidity	NTU	4.0	5
3	Odour	-	Agreeable	Agreeable
4	Total Dissolved Solids	mg/l	450	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	310	600
6	Alkalinity	mg/l	90	600
7	Sulphate (SO ₄)	mg/l	50	400
8	Chlorides (Cl)	mg/l	10.0	1000
9	Iron (Fe)	mg/l	0.15	0.3
10	Manganese (Mn)	mg/l	0.010	0.3
11	Copper (Cu)	mg/l	0.12	1.5
12	Zinc (Zn)	mg/l	0.10	15
13	Nickel (Ni)	mg/l	0.010	0.02
14	Lead (Pb)	mg/l	0.002	0.01
15	Cadmium (Cd)	mg/l	ND	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 7

Sample Location : **DONGAMAHUA VILLAGE**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.09.2021**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.3	6.5 – 8.5
2	Turbidity	NTU	4.0	5
3	Odour	-	Agreeable	Agreeable
4	Total Dissolved Solids	mg/l	580	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	310	600
6	Alkalinity	mg/l	130	600
7	Sulphate (SO ₄)	mg/l	41.8	400
8	Chlorides (Cl)	mg/l	70.5	1000
9	Iron (Fe)	mg/l	0.06	0.3
10	Manganese (Mn)	mg/l	0.006	0.3
11	Copper (Cu)	mg/l	0.06	1.5
12	Zinc (Zn)	mg/l	0.012	15
13	Nickel (Ni)	mg/l	0.004	0.02
14	Lead (Pb)	mg/l	0.001	0.01
15	Cadmium (Cd)	mg/l	ND	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 8

Sample Location : **PIEZOMETER INSIDE PLANT WTP**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.09.2021**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.40	6.5 – 8.5
2	Turbidity	NTU	3.1	5
3	Odour	-	UO	Agreeable
4	Total Dissolved Solids	mg/l	550	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	340	600
6	Alkalinity	mg/l	290	600
7	Sulphate (SO ₄)	mg/l	60	400
8	Chlorides (Cl)	mg/l	55	1000
9	Iron (Fe)	mg/l	0.03	0.3
10	Manganese (Mn)	mg/l	0.007	0.3
11	Copper (Cu)	mg/l	0.02	1.5
12	Zinc (Zn)	mg/l	0.010	15
13	Nickel (Ni)	mg/l	0.011	0.02
14	Lead (Pb)	mg/l	0.003	0.01
15	Cadmium (Cd)	mg/l	ND	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 9

Sample Location : **PIEZOMETER INSIDE SAVITRINAGAR COLONY**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.09.2021**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.30	6.5 – 8.5
2	Turbidity	NTU	3.80	5
3	Odour	-	UO	Agreeable
4	Total Dissolved Solids	mg/l	610	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	440	600
6	Alkalinity	mg/l	310	600
7	Sulphate (SO ₄)	mg/l	70	400
8	Chlorides (Cl)	mg/l	90	1000
9	Iron (Fe)	mg/l	0.02	0.3
10	Manganese (Mn)	mg/l	0.014	0.3
11	Copper (Cu)	mg/l	0.020	1.5
12	Zinc (Zn)	mg/l	0.040	15
13	Nickel (Ni)	mg/l	0.014	0.02
14	Lead (Pb)	mg/l	0.002	0.01
15	Cadmium (Cd)	mg/l	ND	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 10

Sample Location : **SHAKTI VEHAR – II PIEZOMETER**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.09.2021**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.50	6.5 – 8.5
2	Turbidity	NTU	4.8	5
3	Odour	-	UO	Agreeable
4	Total Dissolved Solids	mg/l	590	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	430	600
6	Alkalinity	mg/l	25	600
7	Sulphate (SO ₄)	mg/l	60	400
8	Chlorides (Cl)	mg/l	70	1000
9	Iron (Fe)	mg/l	0.02	0.3
10	Manganese (Mn)	mg/l	0.018	0.3
11	Copper (Cu)	mg/l	0.016	1.5
12	Zinc (Zn)	mg/l	0.06	15
13	Nickel (Ni)	mg/l	0.008	0.02
14	Lead (Pb)	mg/l	0.002	0.01
15	Cadmium (Cd)	mg/l	ND	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 11

Sample Location : **JPL II GATE– III PIEZOMETER**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.09.2021**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.10	6.5 – 8.5
2	Turbidity	NTU	2.80	5
3	Odour	-	UO	Agreeable
4	Total Dissolved Solids	mg/l	540	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	420	600
6	Alkalinity	mg/l	390	600
7	Sulphate (SO ₄)	mg/l	80	400
8	Chlorides (Cl)	mg/l	80	1000
9	Iron (Fe)	mg/l	0.020	0.3
10	Manganese (Mn)	mg/l	0.004	0.3
11	Copper (Cu)	mg/l	0.09	1.5
12	Zinc (Zn)	mg/l	0.09	15
13	Nickel (Ni)	mg/l	0.002	0.02
14	Lead (Pb)	mg/l	0.005	0.01
15	Cadmium (Cd)	mg/l	ND	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

*Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 12**Sample Particulars** : ASSESSMENT OF SURFACE WATER QUALITY PARAMETERS**Date of Sampling** : 10.09.2021

S. No	Parameters	Unit	Bendra Nallah Upstream	Bendra Nallah Down stream	Kelo River Upstream	Kelo River Downstream	Effluent discharge limit for inland surface water as per G.S.R.422
1	pH	pH Unit	7.4	7.6	7.6	7.7	5.5-9.0
2	TSS	mg/l	38	42	45	43	100
3	COD	mg/l	68	69	56	60	250
4	BOD (5 days)	mg/l	13.5	14.0	15.0	14.5	30
5	Oil and grease	mg/l	0.6	0.7	0.3	0.4	10
6	Copper (Cu)	mg/l	0.006	0.004	0.008	0.006	3.0
7	Zinc (Zn)	mg/l	0.056	0.004	0.008	0.011	5.0
8	Lead (Pb)	mg/l	0.004	0.006	0.034	0.043	0.1
9	Iron (Fe)	mg/l	0.018	0.025	0.021	0.019	3.0
10	Cadmium (Cd)	mg/l	0.0031	0.003	0.005	0.006	2.0
11	Arsenic (As)	mg/l	ND	ND	ND	ND	0.2
12	Manganese (Mn)	mg/l	0.06	0.007	0.005	0.006	2.0
13	Mercury	mg/l	ND	ND	ND	ND	0.01
14	Nickel (Ni)	mg/l	0.11	0.03	0.025	0.08	3.0

*Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table: 13

Sample Particulars : ANALYSIS RESULTS OF SOIL SAMPLES

Date of Sampling : 10.09.2021

S. No	Parameters	Unit	Kosumpalli Village	Libra Village	Dongamahua Village	Mining OB
1.	pH	-	7.10	7.70	7.30	7.30
2.	Zinc (Zn)	ppm	2.60	2.42	2.50	2.70
3.	Copper (Cu)	ppm	1.70	1.68	1.47	1.70
4.	Lead (Pb)	ppm	0.40	0.55	0.34	0.58
5.	Cadmium (Cd)	ppm	0.15	0.13	0.12	0.20
6.	Selenium (Se)	ppm	0.022	0.016	0.018	0.014
7.	Nickel (Ni)	ppm	0.23	0.25	0.46	0.38
8.	Chromium (Cr)	ppm	0.35	1.01	1.30	1.43
9.	Arsenic (As)	ppm	0.03	0.06	0.03	0.05
10.	Mercury (Hg)	ppm	0.003	0.005	0.007	0.008

*Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicate

Table: 14**Sample Particulars : ANALYSIS RESULTS OF FLY ASH SAMPLES****Date of Sampling : 10.09.2021**

Sl. No.	Parameters	Unit	Mine Dump	4 x 600 MW	4 x 250 MW
1.	Silica (SiO ₂)	% by mass	62.4	60.8	61.4
2.	Chloride (Cl)	% by mass	4.20	4.80	4.60
3.	Zinc (Zn)	ppm	59.5	54.9	53.8
4.	Copper (Cu)	ppm	66.4	68.8	65.0
5.	Manganese (Mn)	ppm	172.0	174.2	174.0
6.	Cobalt (Co)	ppm	43.0	41.1	47.8
7.	Lead (Pb)	ppm	8.6	9.2	9.5
8.	Cadmium (Cd)	ppm	0.03	0.01	0.04
9.	Selenium (Se)	ppm	0.01	0.01	0.01
10.	Nickel (Ni)	ppm	36.8	33.3	31.2
11.	Arsenic (As)	ppm	0.01	0.03	0.04
12.	Mercury (Hg)	ppm	0.03	0.02	0.03
13.	Chromium (Cr)	ppm	0.21	0.22	0.24

*Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table: 15

Sample Particulars : ANALYSIS RESULTS OF AAQM PARAMETER

Sample Particulars: Ambient Air Quality Monitoring
Parameter Date of Sampling: 10.09.2021 & 11.09.2021

Sl. No.	Parameters	Unit	Near CHP office	Near CHP office Canteen	Near Kosampalli Gate	Near Mine switch yard
1.	PM 10	$\mu\text{g}/\text{m}^3$	70.2	73.5	71.2	80.0
2.	PM 2.5	$\mu\text{g}/\text{m}^3$	32.4	38.0	37.4	42.1
3.	SO ₂	$\mu\text{g}/\text{m}^3$	15.9	16.0	15.6	15.7
4.	NO _x	$\mu\text{g}/\text{m}^3$	23.1	23.0	24.5	24.8
5.	CO	mg/m^3	0.43	0.41	0.45	0.45

- First two samples are collected on 10th and last two samples collected on 11st September 2021.

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ANALYSIS RESULTS for Second Six Months

Table 16

Sample Location : **PIEZOMETER, CHP OFFICE**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.03.2022**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.30	6.5 – 8.5
2	Turbidity	NTU	4.5	5
3	Odour	-	Agreeable	Agreeable
4	Total Dissolved Solids	mg/l	540	2000
5	Total Hardness (as CaCO ₃)	mg/l	350	600
6	Alkalinity	mg/l	210	600
7	Sulphate (SO ₄)	mg/l	70.0	400
8	Chlorides (Cl)	mg/l	48.2	1000
9	Iron (Fe)	mg/l	0.06	0.3
10	Manganese (Mn)	mg/l	0.07	0.3
11	Copper (Cu)	mg/l	0.11	1.5
12	Zinc (Zn)	mg/l	1.05	15
13	Nickel (Ni)	mg/l	0.02	0.02
14	Lead (Pb)	mg/l	0.001	0.01
15	Cadmium (Cd)	mg/l	0.003	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 17

Sample Location : **JHARNA VILLAGE OPEN WELL**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.03.2022**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.3	6.5 – 8.5
2	Turbidity	NTU	3.8	5
3	Odour	-	Agreeable	Agreeable
4	Total Dissolved Solids	mg/l	750	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	440	600
6	Alkalinity	mg/l	190	600
7	Sulphate (SO ₄)	mg/l	85.0	400
8	Chlorides (Cl)	mg/l	45.0	1000
9	Iron (Fe)	mg/l	0.12	0.3
10	Manganese (Mn)	mg/l	0.11	0.3
11	Copper (Cu)	mg/l	0.003	1.5
12	Zinc (Zn)	mg/l	0.09	15
13	Nickel (Ni)	mg/l	0.03	0.02
14	Lead (Pb)	mg/l	0.001	0.01
15	Cadmium (Cd)	mg/l	0.003	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 18

Sample Location : **LIBRA VILLAGE**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.03.2022**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.4	6.5 – 8.5
2	Turbidity	NTU	4.20	5
3	Odour	-	Agreeable	Agreeable
4	Total Dissolved Solids	mg/l	390	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	165	600
6	Alkalinity	mg/l	120	600
7	Sulphate (SO ₄)	mg/l	13.0	400
8	Chlorides (Cl)	mg/l	35.0	1000
9	Iron (Fe)	mg/l	0.12	0.3
10	Manganese (Mn)	mg/l	0.079	0.3
11	Copper (Cu)	mg/l	0.08	1.5
12	Zinc (Zn)	mg/l	0.02	15
13	Nickel (Ni)	mg/l	0.03	0.02
14	Lead (Pb)	mg/l	0.002	0.01
15	Cadmium (Cd)	mg/l	0.003	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 19

Sample Location : **KOSAMPALI VILLAGE**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.03.2022**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.3	6.5 – 8.5
2	Turbidity	NTU	4.2	5
3	Odour	-	Agreeable	Agreeable
4	Total Dissolved Solids	mg/l	467	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	310	600
6	Alkalinity	mg/l	90	600
7	Sulphate (SO ₄)	mg/l	48	400
8	Chlorides (Cl)	mg/l	14.0	1000
9	Iron (Fe)	mg/l	0.11	0.3
10	Manganese (Mn)	mg/l	0.034	0.3
11	Copper (Cu)	mg/l	0.011	1.5
12	Zinc (Zn)	mg/l	0.07	15
13	Nickel (Ni)	mg/l	0.017	0.02
14	Lead (Pb)	mg/l	0.003	0.01
15	Cadmium (Cd)	mg/l	0.003	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 20

Sample Location : **DONGAMAHUA VILLAGE**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.03.2022**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.2	6.5 – 8.5
2	Turbidity	NTU	4.6	5
3	Odour	-	Agreeable	Agreeable
4	Total Dissolved Solids	mg/l	580	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	310	600
6	Alkalinity	mg/l	150	600
7	Sulphate (SO ₄)	mg/l	41.0	400
8	Chlorides (Cl)	mg/l	72.0	1000
9	Iron (Fe)	mg/l	0.02	0.3
10	Manganese (Mn)	mg/l	0.006	0.3
11	Copper (Cu)	mg/l	0.005	1.5
12	Zinc (Zn)	mg/l	0.02	15
13	Nickel (Ni)	mg/l	0.015	0.02
14	Lead (Pb)	mg/l	0.001	0.01
15	Cadmium (Cd)	mg/l	0.003	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 21

Sample Location : **PIEZOMETER INSIDE PLANT WTP**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.03.2022**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.30	6.5 – 8.5
2	Turbidity	NTU	4.0	5
3	Odour	-	UO	Agreeable
4	Total Dissolved Solids	mg/l	570	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	360	600
6	Alkalinity	mg/l	310	600
7	Sulphate (SO ₄)	mg/l	50	400
8	Chlorides (Cl)	mg/l	51	1000
9	Iron (Fe)	mg/l	0.012	0.3
10	Manganese (Mn)	mg/l	0.011	0.3
11	Copper (Cu)	mg/l	0.01	1.5
12	Zinc (Zn)	mg/l	0.029	15
13	Nickel (Ni)	mg/l	0.018	0.02
14	Lead (Pb)	mg/l	0.001	0.01
15	Cadmium (Cd)	mg/l	0.003	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 22

Sample Location : **PIEZOMETER INSIDE SAVITRINAGAR COLONY**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.03.2022**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.20	6.5 – 8.5
2	Turbidity	NTU	3.9	5
3	Odour	-	UO	Agreeable
4	Total Dissolved Solids	mg/l	640	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	440	600
6	Alkalinity	mg/l	310	600
7	Sulphate (SO ₄)	mg/l	70	400
8	Chlorides (Cl)	mg/l	85	1000
9	Iron (Fe)	mg/l	0.028	0.3
10	Manganese (Mn)	mg/l	0.012	0.3
11	Copper (Cu)	mg/l	0.011	1.5
12	Zinc (Zn)	mg/l	0.031	15
13	Nickel (Ni)	mg/l	0.018	0.02
14	Lead (Pb)	mg/l	0.001	0.01
15	Cadmium (Cd)	mg/l	0.003	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 23

Sample Location : **SHAKTI VEHAR – II PIEZOMETER**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.03.2022**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.10	6.5 – 8.5
2	Turbidity	NTU	1.2	5
3	Odour	-	UO	Agreeable
4	Total Dissolved Solids	mg/l	490	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	210	600
6	Alkalinity	mg/l	35	600
7	Sulphate (SO ₄)	mg/l	60	400
8	Chlorides (Cl)	mg/l	62	1000
9	Iron (Fe)	mg/l	0.04	0.3
10	Manganese (Mn)	mg/l	0.201	0.3
11	Copper (Cu)	mg/l	0.011	1.5
12	Zinc (Zn)	mg/l	0.012	15
13	Nickel (Ni)	mg/l	0.009	0.02
14	Lead (Pb)	mg/l	0.002	0.01
15	Cadmium (Cd)	mg/l	ND	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

* Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 24

Sample Location : **JPL II GATE– III PIEZOMETER**

Sample Particulars : **ASSESSMENT OF GROUND WATER QUALITY PARAMETERS**

Date of Sampling : **10.03.2022**

Sl. No	Parameters	Unit	Result	Permissible limit for drinking as per IS: 10500
1	pH	pH Unit	7.10	6.5 – 8.5
2	Turbidity	NTU	1.50	5
3	Odour	-	UO	Agreeable
4	Total Dissolved Solids	mg/l	400	2000
5	Total Hardness (as CaCO ₃ equiv.)	mg/l	410	600
6	Alkalinity	mg/l	320	600
7	Sulphate (SO ₄)	mg/l	80	400
8	Chlorides (Cl)	mg/l	76	1000
9	Iron (Fe)	mg/l	0.014	0.3
10	Manganese (Mn)	mg/l	0.012	0.3
11	Copper (Cu)	mg/l	0.08	1.5
12	Zinc (Zn)	mg/l	0.036	15
13	Nickel (Ni)	mg/l	0.011	0.02
14	Lead (Pb)	mg/l	0.004	0.01
15	Cadmium (Cd)	mg/l	ND	0.003
16	Arsenic (As)	mg/l	ND	0.05
17	Mercury	mg/l	ND	0.001

*Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table 25**Sample Particulars : ASSESSMENT OF SURFACE WATER QUALITY PARAMETERS****Date of Sampling : 10.03.2022**

S. No	Parameters	Unit	Bendra Nallah Upstream	Bendra Nallah Down stream	Mine Sump	Kelo River Upstream	Kelo River Downstream	Effluent discharge limit for inland surface water as per G.S.R.422
1	pH	pH Unit	7.4	7.6	7.1	7.5	7.6	5.5-9.0
2	TSS	mg/l	42	45	60	47	45	100
3	COD	mg/l	70	65	67	60	58	250
4	BOD (5 days)	mg/l	12.2	13.1	13.5	12.5	13.5	30
5	Oil and grease	mg/l	0.6	0.5	0.7	0.5	0.4	10
6	Copper (Cu)	mg/l	0.006	0.004	0.12	0.007	0.008	3.0
7	Zinc (Zn)	mg/l	0.04	0.02	0.03	0.04	0.03	5.0
8	Lead (Pb)	mg/l	0.004	0.006	0.007	0.09	0.03	0.1
9	Iron (Fe)	mg/l	0.700	0.65	0.12	1.30	1.90	3.0
10	Cadmium (Cd)	mg/l	0.003	0.006	0.010	0.003	0.005	2.0
11	Arsenic (As)	mg/l	0.03	0.011	0.012	0.011	0.018	0.2
12	Manganese (Mn)	mg/l	0.05	0.019	0.54	0.023	0.019	2.0
13	Mercury	mg/l	ND	ND	0.003	ND	ND	0.01
14	Nickel (Ni)	mg/l	0.145	0.032	0.03	0.050	0.020	3.0

*Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table: 26

Sample Particulars : ANALYSIS RESULTS OF SOIL SAMPLES

Date of Sampling : 10.03.2022

S. No	Parameters	Unit	Kosumpalli Village	Libra Village	Dongamahua Village	Mining OB
1.	pH	-	7.20	7.50	7.40	7.50
2.	Zinc (Zn)	ppm	2.80	2.32	2.40	3.70
3.	Copper (Cu)	ppm	1.90	1.80	1.60	1.80
4.	Lead (Pb)	ppm	0.30	0.50	0.39	0.68
5.	Cadmium (Cd)	ppm	0.16	0.14	0.18	0.21
6.	Selenium (Se)	ppm	0.025	0.019	0.016	0.013
7.	Nickel (Ni)	ppm	0.20	0.24	0.48	0.39
8.	Chromium (Cr)	ppm	0.50	1.20	1.10	1.30
9.	Arsenic (As)	ppm	0.04	0.05	0.04	0.06
10.	Mercury (Hg)	ppm	0.004	0.004	0.006	0.007

*Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicate

Table: 27

Sample Particulars : ANALYSIS RESULTS OF FLY ASH SAMPLES

Date of Sampling : 10.03.2022

Sl. No.	Parameters	Unit	Mine Dump	4 x 600 MW	4 x 250 MW
1.	Silica (SiO ₂)	% by mass	62.4	64.8	63.8
2.	Chloride (Cl)	% by mass	5.60	5.80	5.60
3.	Zinc (Zn)	ppm	60.5	62.8	60.7
4.	Copper (Cu)	ppm	63.4	69.8	68.0
5.	Manganese (Mn)	ppm	180.0	170.2	178.0
6.	Cobalt (Co)	ppm	47.0	45.2	49.7
7.	Lead (Pb)	ppm	7.9	9.5	10.0
8.	Cadmium (Cd)	ppm	0.02	0.03	0.02
9.	Selenium (Se)	ppm	0.01	0.01	0.01
10.	Nickel (Ni)	ppm	38.8	35.3	36.2
11.	Arsenic (As)	ppm	0.01	0.03	0.02
12.	Mercury (Hg)	ppm	0.02	0.02	0.01
13.	Chromium (Cr)	ppm	0.26	0.28	0.27

*Heavy Metal concentration has been determined by Atomic Absorption Spectrometry (AAS) using 5 numbers of replicates of the samples and the value reported above is the average of 5 such replicates.

Table: 28

Sample Particulars : ANALYSIS RESULTS OF AAQM PARAMETER

Sample Particulars: Ambient Air Quality Monitoring
Parameter Date of Sampling: 09.03.2022 & 10.03.2022

Sl. No.	Parameters	Unit	Near CHP office	Near CHP office Canteen	Near Kosampalli Gate	Near Mine switch yard
1.	PM 10	$\mu\text{g}/\text{m}^3$	75.2	78.0	76.3	76.5
2.	PM 2.5	$\mu\text{g}/\text{m}^3$	32.1	35.4	34.4	42.2
3.	SO ₂	$\mu\text{g}/\text{m}^3$	15.6	16.7	14.2	17.8
4.	NO _x	$\mu\text{g}/\text{m}^3$	24.0	23.0	21.5	22.8
5.	CO	mg/m^3	0.45	0.40	0.46	0.42

- First two samples are collected on 09th and last two samples collected on 10th March 2022.

7.0 GEO-ENVIRONMENTAL IMPACT ON FLORA & FAUNA

A global perspective of mining activities suggests that mining of coal and minerals and other fossil fuels can cause air, water, noise, and soil pollutions which can in turn adversely affect ecosystems of surrounding area including lives of the flora and fauna, and other aquatic lives prevailing thereof. The adverse impacts of mining on flora and fauna are case specific and very challenging to assess.

The possible harmful effect of fly-ash dumping would be, potentiality the formation of air borne particulate matters. The air-borne respiratory particles may pose threat to workers health. The heavy metal may be migrated to water due to fly-ash leaching from dumping areas. These may potentiality cause adverse effect on flora and fauna. In this case specific mine, the analysis of air samples, water samples, and fly-ash samples indicate that environment pollution is not in an alarming degree to pose substantial threat on flora and fauna, based on the following observations.

a) The average ambient air quality parameter values, i.e., SO₂, NO_x, CO, observed in the mining area, are below the critical values of NAAQS. Even though, fly-ash dust gets airborne, during the observation period the concentrations of PM_{2.5} and PM₁₀ are observed to be below the permissible limits.

b) The concentrations of different pollutants as observed in the surface water and ground water samples did not exceed the maximum permissible limits and most of the cases fall below the specified limits with respect to heavy metal concentrations as well as other water quality attributes / pollutants.

Therefore, the fly-ash mixed dumping may not be a serious concern from environmental point of view and may not cause significant impact on the flora, fauna and other aquatic lives in and around the mining area studied. However, period monitoring is required on these parameters from time to time.

8. CONCLUSIONS AND RECOMMENDATION

The test report of the groundwater, surface water, soil, fly-ash and air samples reflect that the environmental parameters are within the threshold limits of safe working as per the regulatory guidelines. There is no trend of either increasing or decreasing nature of the environmental parameters as observed based on these studies, although there are certain fluctuations of these parameters. Therefore, adverse impact of fly-ash mixed dumping is not quite apparent from these studies.

However, the periodic study should be continued for proper monitoring of the environmental parameters.

9. Acknowledgements

The study team is grateful to the sponsoring authorities for funding the present study. The study team also acknowledges the authorities of IIT Kharagpur for allowing the investigators to carry out the present study. They also wish to thank all the officials involved from JPL for all their help during the study.

References

1. Standard methods for the examination of water and waste water, Vol. I & II, Publisher: American Public Health Association, eds. 2005.
2. Masters, G. M., 2005, Introduction to environmental engineering and science, 2nd edition, Printice Hall of India Pvt Ltd., New Delhi, 649 p.
3. Haswell, S.J., 1991, Atomic Absorption Spectrometry; Theory, Design and Applications. Elsevier, Amsterdam.
4. Reynolds, R.J. et al., 1970. Atomic Absorption Spectroscopy. Barnes & Noble Inc., New York

ANNEXURE - A1 DRINKING WATER SPECIFICATION: IS: 10500

TOLERANCE LIMITS

S.No	Parameter	IS: 10500 Requirement (Desirable limit)	Undesirable effect outside the desirable limit	IS: 10500 Permissible limit in the absence of alternate source
Essential Characteristics				
1.	pH	6.5 – 8.5	Beyond this range the water will effect the mucous membrane and / or water supply system	No relaxation
2.	Colour (Hazen Units), Maximum	5	Above 5, consumer acceptance decreases	25
3.	Odour	Unobjectio nable	--	--
4.	Taste	Agreeable	--	--
5.	Turbidity, NTU, Max	5	Above 5, consumer acceptance decreases	10
Following Results are expressed in mg/1 :				
6.	Total hardness as CaCO ₃ , Max	300	Encrustation in water supply structure and adverse effects on domestic use	600
7.	Iron as Fe, Max	0.30	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.	1.0
8.	Chlorides as Cl, Max	250	Beyond this limit tast, corrosion and palatability are effected	1000
9.	Residual, Free Chlorine, Min	0.20	--	--
Desirable Characteristics				
10.	Dissolved solids, Max	500	Beyond this palatability decreases and may cause gastro intentional irritation	2000
11.	Calcium as Ca,	75	Encrustation in water supply structure and adverse effects	200


	Max		on domestic use	
12.	Magnesium as Mg, Max	30	--	100
13.	Copper as Cu, Max	0.05	Astringent taste, discoloration and corrosion of pipes, fitting and utensils will be caused beyond this	1.5
14.	Manganese as Mn, Max	0.1	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures	0.3
15.	Sulphate as SO ₄ Max	200	Beyond this causes gastro intentional irritation when magnesium or sodium are present	400
16.	Nitrates as NO ₃	45	Beyond this methanemoglobinemia takes place	100
17.	Fluoride, Max	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5
18.	Phenolic compounds as C ₆ H ₅ OH, Max	0.001	Beyond this, it may cause objectionable taste and odour	0.002
19.	Mercury as Hg, Max	0.001	Beyond this, the water becomes toxic	No relaxation
20.	Cadmium as Cd, Max	0.01	Beyond this, the water becomes toxic	No relaxation
21.	Selenium as Se, Max	0.01	Beyond this, the water becomes toxic	No relaxation
22.	Arsenic as As, Max	0.05	Beyond this, the water becomes toxic	No relaxation
23.	Cyanide as CN, Max	0.05	Beyond this, the water becomes toxic	No relaxation
24.	Lead as Pb, Max	0.05	Beyond this, the water becomes toxic	No relaxation
25.	Zinc as Zn, Max	5	Beyond this limit it can cause astringent taste and an opalescence in water	15
26.	Anionic detergents as MBAS, Max	0.2	Beyond this limit it can cause a light froth in water	1.0
27.	Chromium as Cr ⁶⁺ , Max	0.05	May be carcinogenic above this limit	No relaxation
28.	Ploynuclear aromatic hydrocarbons as	--	May be carcinogenic	--

	PAH, Max			
29.	Mineral Oil, Max	0.01	Beyond this limit undesirable	
			taste and odour after chlorination take place	0.03
30.	Pesticides, Max	Absent	Toxic	0.001
31.	Radioactive materials	--	--	0.1
	a) α emitters Bq/1, Max	--	--	1
	b) β emitters Pci/1, Max			
32.	Alkalinity, Max	200	Beyond this limit taste becomes unpleasant	600
33.	Aluminum as Al, Max	0.03	Cumulative effect is reported to cause dementia	0.2
34.	Boron, Max	1	--	5

ENVIRONMENTAL AUDIT REPORT OF THE
ENVIRONMENTAL IMPACT ASSESSMENT

ENVIRONMENTAL AUDIT		
Audit Team:	IIT Kharagpur	
	Department of Mining Engineering IIT Kharagpur Kharagpur, West Bengal, 721302	
Audit date:	27 April, 2022	
Report finalised:	27 April, 2022	


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1. **INTRODUCTION**

- 1.1 JPL is the first power plant to achieve 'Mega Power' project status in the private sector in India. This plant has also been certified by ISO 9001:2015, ISO 14001:2015 , ISO 45001:2018 and ISO 50001:2018 (Energy Management System) Standards. The power plant site is located near the village Tamnar in Raigarh District of Chhattisgarh State. The site is situated at about 25 km (aerial) North of Raigarh town and falls under Toposheet Nos. 64(N) and 64(0) of Government Survey of India. Location of the plant site is shown in Fig 1. The site is approachable from Raigarh by the State Highway which branches off at Punjipathra, about 12 km from the site and 35 km from the Raigarh town. The nearest Railway Station is Raigarh at about 50 km (by road) from the site. The nearest Airport is at Jharsuguda, which is about 90 km and the nearest seaport is Haldia at Kolkata, which is about 550 km from the site.
- 1.2 The JPL authority approached IIT Kharagpur for conducting an audit study regarding the fly ash utilization in and around the plant areas. This includes the fly ash backfilling sites in the Gare IV/2 & 3 mine area, low-lying areas, brick plants etc. The proposed study focuses mainly on the examination of fly-ash management on the utilization sites with due consideration to environmental and geotechnical aspects. In this regard, two members of IIT study team visited and inspected all the sites including plant and ash filling areas.

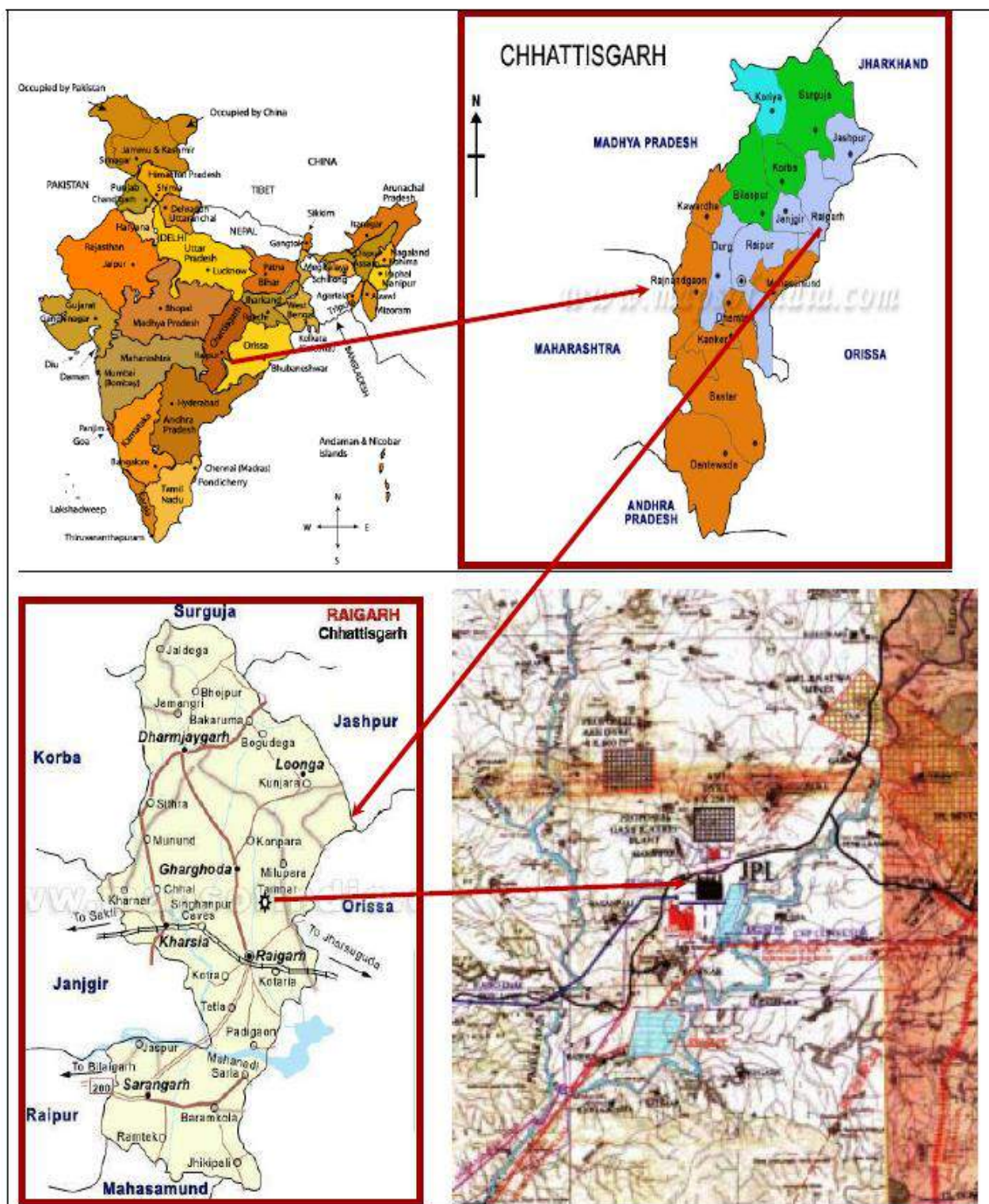


Figure 1: Location Map of the Study Area

2. PURPOSE OF THE STUDY

To conduct a comprehensive audit for fly ash management 4x250 MW TPP and 4x600 MW thermal power plant to assess the compliance of various environmental permissions, CPCB guidelines and fly ash notifications and other initiatives undertaken for the abatement of environmental pollution and upliftment of the society.

According to the Notification issued by the Ministry of Environment, Forest and Climate Change (MoEFCC) of India a detailed stock of disposal and utilization of ash (fly and bottom) in coal or lignite based thermal power plants, has to be provided on a regular basis. The provisions specify for the utilization of 100% of ash, in an eco-friendly manner for specified purposes such as the manufacture of cement, building materials or mine void filling, filling of low-lying areas etc. Additionally, unutilized ash (accumulated) stored before the publication of this Notification must also be completely utilized within 10 years, and if this is not achieved, environmental compensation will be imposed based on the quantity to the particular organization. The government authority monitors ash utilization on a quarterly basis, and thermal power plants are required to upload monthly information on the generation and utilization of ash on the portal within the 1st week of the following month.

Responsibilities of thermal power plants in the disposal of fly ash and bottom ash:

- (1) Every coal or lignite based thermal power plant (including captive or co-generating stations or both) shall be primarily responsible to ensure 100 percent utilisation of ash (fly ash, and bottom ash) generated by it in an eco-friendly manner as given in sub-paragraph (2);
- (2) The ash generated from coal or lignite based thermal power plants shall be utilised only for the following eco-friendly purposes, namely: -
 - (i) Fly ash based products viz. bricks, blocks, tiles, fibre cement sheets, pipes, boards, panels;
 - (ii) Cement manufacturing, ready mix concrete;
 - (iii) Construction of road and fly over embankment, Ash and Geo-polymer based construction material;
 - (iv) Construction of dam;
 - (v) Filling up of low lying area;
 - (vi) Filling of mine voids;
 - (vii) Manufacturing of sintered or cold bonded ash aggregate;
 - (viii) Agriculture in a controlled manner based on soil testing;

- (ix) Construction of shoreline protection structures in coastal districts;
- (x) Export of ash to other countries;
- (xi) Any other eco-friendly purpose as notified from time to time.

(3) A committee shall be constituted under the chairmanship of Chairman, Central Pollution Control Board (CPCB) and having representatives from Ministry of Environment, Forest and Climate Change (MoEFCC), Ministry of Power, Ministry of Mines, Ministry of Coal, Ministry of Road Transport and Highways, Department of Agricultural Research and Education, Institute of Road Congress, National Council for Cement and Building Materials, to examine and review and recommend the eco-friendly ways of utilisation of ash and make inclusion or exclusion or modification in the list of such ways as mentioned in Sub-paragraph (2) based on technological developments and requests received from stakeholders. The committee may invite the State Pollution Control Board or Pollution Control Committee, operators of thermal power plants and mines, cement plants and other stakeholders as and when required for this purpose. Based on the recommendations of the Committee, Ministry of Environment, Forest and Climate Change (MoEFCC) may publish such eco-friendly purpose.

(4) Every coal or lignite based thermal power plant shall be responsible to utilise 100 percent ash (fly ash and bottom ash) generated during that year, however, in no case shall utilisation fall below 80 per cent in any year, and the thermal power plant shall achieve average ash utilisation of 100 per cent in a three years cycle:

Provided that the three years cycle applicable for the first time is extendable by one year for the thermal power plants where ash utilisation is in the range of 60-80 per cent, and two years where ash utilisation is below 60 per cent and for the purpose of calculation of percentage of ash utilisation, the percentage quantity of utilisation in the year 2021- 2022 shall be taken into account as per the table below:

Utilisation percentages of thermal power plants	First compliance Cycle to meet 100 per cent utilisation	Second compliance cycle onwards, to meet 100 per cent utilisation
>80 per cent	3 years	3 years
60-80 per cent	4 years	3 years
<60 per cent	5 years	3 years

Provided further that the minimum utilisation percentage of 80 per cent shall not be applicable to the first year and first two years of the first compliance cycle for the thermal power plants under the utilisation category of 60-80 per cent and <60 per cent, respectively.

Provided also that 20 percent of ash generated in the final year of compliance cycle may be carried forward to the next cycle which shall be utilised in the next three years cycle along with the ash generated during that cycle.

- (5) The unutilised accumulated ash i.e. legacy ash, which is stored before the publication of this notification, shall be utilised progressively by the thermal power plants in such a manner that the utilization of legacy ash shall be completed fully within ten years from the date of publication of this notification and this will be over and above the utilisation targets prescribed for ash generation through current operations of that particular year:

Provided that the minimum quantity of legacy ash in percentages as mentioned below shall be utilised during the corresponding year and the minimum quantity of legacy ash is to be calculated based on the annual ash generation as per installed capacity of thermal power plant.

Year from date of publication	1 st	2 nd	3 rd -10 th
Utilisation of legacy ash (in percentage of Annual ash)	At least 20 per cent	At least 35 per cent	At least 50 per cent

Provided further that the legacy ash utilisation shall not be required where ash pond or dyke has stabilised and the reclamation has taken place with greenbelt or plantation and the concerned State Pollution Control Board shall certify in this regard. Stabilisation and reclamation of an ash pond or dyke including certification by the Central Pollution Control Board (CPCB) or State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) shall be carried out within a year from the date of publication of this notification. The ash remaining in all other ash ponds or dykes shall be utilised in progressive manner as per the above mentioned timelines.

Note: The obligations under sub-paragraph (4) and (5) above for achieving the ash utilisation targets shall be applicable from 1st April, 2022.

- (6) Any new as well as operational thermal power plant may be permitted an emergency or temporary ash pond with an area of 0.1 hectare per Mega Watt (MW). Technical specifications of ash ponds or dykes shall be as per the guidelines of Central Pollution Control Board (CPCB) made in consultation with Central Electricity Authority (CEA) and these guidelines shall also lay down a procedure for annual certification of the ash pond or dyke on its safety,

environmental pollution, available volume, mode of disposal, water consumption or conservation in disposal, ash water recycling and greenbelt, etc., and shall be put in place within three months from the date of publication of this notification.

- (7) Every coal or lignite based thermal power plant shall ensure that loading, unloading, transport, storage and disposal of ash is done in an environmentally sound manner and that all precautions to prevent air and water pollution are taken and status in this regard shall be reported to the concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) in Annexure attached to this notification.
- (8) Every coal or lignite based thermal power plant shall install dedicated silos for storage of dry fly ash silos for at least sixteen hours of ash based on installed capacity and it shall be reported upon to the concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) in the Annexure and shall be inspected by Central Pollution Control Board (CPCB) or State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) from time to time.
- (9) Every coal or lignite based thermal power plant (including captive or co-generating stations or both) shall provide real time data on daily basis of availability of ash with Thermal Power Plant (TPP), by providing link to Central Pollution Control Board's web portal or mobile phone App for the benefit of actual user(s).
- (10) Statutory obligation of 100 percent utilisation of ash shall be treated as a change in law, wherever applicable.

Thermal power plants are responsible for utilizing 100% of ash generated in a given year, however, in no case may the utilization rate fall below 80% and must achieve an average ash utilization rate of 100% in a three years cycle. It may be noted that for the first applicable three years cycle, there are mitigation measures as shown in the table below (effective from April 1, 2022).

3. METHODOLOGY

The IIT KGP study team visited the sites and followed the following methodology for the fly-ash utilization auditing study.

1. The study team visited the Jindal Power Plant for inspection/audit of various fly ash utilization sites like low lying areas, mine back filling area and ash dyke area, ash siloes etc.
2. During the visit the discussion were also made on various fly ash management practices adopted in the plant and planning for future also.
3. Enlisting the parameters and preparations of the documentation
4. Filling up of the required documents/forms as per the list /notification

5. Site visit and discussions with the concerned officials
6. Understanding the level of compliance based on field-based observations during the site visit and review of the documentation provided.
7. The major component of the study included the review of documentation/data for last 24 months i.e. from April, 2020 to March, 2021 and April, 2021 to March, 2022.

4. FLY ASH MANAGEMENT AT JINDAL POWER LIMITED-

A large number of technologies have been developed for productive utilization and safe and sound management of fly ash under the concerted efforts made by MOEF &CC and CPCB Fly Ash Mission, Government of India. Fly ash utilization has taken considerable strides over the past few years. JPL is constantly exploring innovative and new ways to utilize the ash generated at 4X250 MW and 4X600 MW TPP, so as to ensure its utilization on long term basis. Few common modes of fly ash utilization that are presently followed at JPL are as follows:

4.1 BACK FILLING/STOWING OF MINES:

JPL is utilizing fly ash along with Overburden for backfilling of the coal mines at Gare Pelma IV/2 & IV/3 which is at a distance of 10 Kms from the power plant in Raigarh as per the guidelines of Director General of Mines safety (“DGMS”).

An MoU has been signed between SECL and JPL on 07.04.2018 for back filling of fly ash in Gare Pelma IV/2 & IV/3 Open Cast coal Mines. JPL has already started back filling of fly ash in Gare IV/2 & 3 as per MoU & in line with Ash Utilization Notification.

Recently, Jindal Power Limited, Tamnar has started the production from Gare IV/1 Coal Mines. JPL, Tamnar plans to use fly ash generated from its power plant in back filling with over burden in Gare Palma IV/1 very soon.

4.2 FLY ASH BASED BRICKS:

Fly ash is being used in manufacturing of fly ash based building products like bricks, blocks, tiles etc which results in saving of fertile top soil. Fly ash based bricks/blocks/tiles are as good as clay based conventional building products. It has substantial potential of fly ash utilization especially for thermal power stations. JPL has installed brick plants with capacity of 1,50,000 bricks per day nearby its Power plant. Also, JPL has signed agreement with Fly ash brick manufacturing units with a total approx. capacity of 1,80,000 Nos. bricks per day for supplying of ash to brick plants .

4.3 CEMENT PLANT:-

Fly ash is being currently used by Cement Industries as a pozzolanic material for manufacturing of Portland Pozzolana Cement (PPC). It saves both precious lime stone and coal. The utilization of fly ash in manufacturing of cement is highly value added use. JPL has signed agreement with Ultratech cement, Shree Cement and NVL/NVCL Cement for supplying of fly ash. However, the cement plants are located at more than 200 kms distance from the Power Plant and there is no rail connectivity to transport ash to these cements plants from the TPP.

4.4 LOW LYING AREA FILLING

Fly ash is being currently used for filling of low lying area located nearby the plant premises under strict supervision / guidelines of CPCB & CECB which results in saving of fertile top soil.

4.5 OTHER AVENUES:

Ash from the power plant is also being utilized for development of land for sericulture, Road construction, underground mine filling in nearby mines, etc.

5. ASSUMPTION AND LIMITATIONS

This auditing study report is limited to the field observations, the documents received, and other relevant information provided by the concerned officials at the time of field visit.

6. ACKNOWLEDGEMENTS


The study team extends its appreciation to all the individuals who provided verbal, visual or documentary assistance during the assessment study.

7. FINDINGS

In this section of the report the study team sets out the commitments and/or management objectives as provided and the findings following the assessment of compliance in respect of the aforesaid commitments and/or management objectives. In the Table below reference is made to general observations made during the documentation review/assessment as well as site specific observations made during the site visit.

8. CONCLUSION

It is noted that the activities undertaken by JPL authority in regards with fly-ash management are adequately addressed. The pertinent rules/ regulations issued by MoEFCC, CPCB & CECB for fly ash utilization are adhered. The same practice should be continued and effectively implemented.


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TABLE A

4X250 MW TPP FY 2020-21

For FY 2020-21		
Sl. No.	Details	
1	Name of Power Plant	M/s O.P.Jindal Super Thermal Power Plant
2	Name of the company	Jindal Power Limited, Tamnar
3	District	Raigarh
4	State	Chhattisgarh
5	Postal address for communication:	Village & Post- Tamnar, District-Raigarh (C.G) Pin Code-496107
6	E-mail:	Jpl.emd@jindalpower.com
7	Power Plant installed capacity (MW):	1000 MW (4x250 MW)
8	Plant Load Factor (PLF):	50.308
9	No. of units generated (MWh):	4407005000
10	Total area under power plant (ha): (including area under ash ponds)	Power Plant-360 Ha (for 4X250 MW & 4X600 MW TPPs)
		Ash pond- 198 Ha
11	Quantity of coal consumption during reporting period (Metric Tons per Annum):	3498075
12	Average ash content in percentage (per cent):	45.23
13	Quantity of current ash generation during reporting period (Metric Tons per Annum):	1582074
	Fly ash (Metric Tons per Annum):	1265659
	Bottom ash (Metric Tons per Annum):	316415
14	Capacity of dry fly ash storage silo(s) (Metric Tons) :	3200 MT(2X1600 MT)
15	Details of utilisation of current ash generated during reporting period	
	(a) Total quantity of current ash utilised (MTPA) during reporting period:	246699
	(b) Quantity of fly ash utilised (MTPA):	246699
	(i) Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels)	0
	(ii) Cement manufacturing:	0
	(iii) Ready mix concrete:	0
	(iv) Ash and Geo-polymer based construction material:	0
	(v) Manufacturing of sintered or cold bonded ash aggregate:	0
	(vi) Construction of roads, road and fly over embankment:	8011
	(vii) Construction of dams:	0
	(viii) Filling up of low lying area:	59005
	(ix) Filling of mine voids:	179683
	(x) Use in overburden dumps:	0

	(xi) Agriculture:	0
	(xii) Construction of shoreline protection structures in coastal districts;	0
	(xiii) Export of ash to other countries:	0
	(xiv) Others (please specify):	0
	(c) Quantity of bottom ash utilised (MTPA):	
	(i) Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels):	0
	(ii) Cement manufacturing:	0
	(iii) Ready mix concrete:	0
	(iv) Ash and Geo-polymer based construction material:	0
	(v) Manufacturing of sintered or cold bonded ash aggregate:	0
	(vi) Construction of roads, road and flyover embankment:	0
	(vii) Construction of dams:	0
	(viii) Filling up of low lying area:	0
	(ix) Filling of mine voids:	0
	(x) Use in overburden dumps:	0
	(xi) Agriculture:	0
	(xii) Construction of shoreline protection structures in coastal districts:	0
	(xiii) Export of ash to other countries:	0
	(xiv) Others (please specify):	0
	Total quantity of current ash unutilised (MTPA) during reporting period:	1335375
16	Percentage utilisation of current ash generated during reporting period (per cent):	15.6
	Details of disposal of ash in ash ponds	,
	(a) Total quantity of ash disposed in ash pond(s) (Metric Tons) as on 31st March 2020 (excluding reporting period):	8807000.0
	(b) Quantity of ash disposed in ash pond(s) during reporting period (Metric Tons):	1335375
17	(c) Total quantity of water consumption for slurry discharge into ash ponds during reporting period (m3):	7849276.8
	(d) Total number of ash ponds:	1
	(i) Active:	1
	(ii) Exhausted (yet to be reclaimed):	0
	(iii) Reclaimed:	0
	(e) total area under ash ponds (ha):	198
18	Individual ash pond details Ash pond-1,2, etc (please provide below mentioned details separately, if number of ash ponds is more than one)	NA
	(a) Status: Under construction or Active or Exhausted or Reclaimed	Active
	(b) Date of start of ash disposal in ash pond (DD/MM/YYYY or MMYYYY):	Dec, 2007

	(c) Date of stoppage of ash disposal in ash pond after completing its capacity (DD/MM/YYYY or MM/YYYY): (Not applicable for active ash ponds)	NA
	(c) area (hectares):	198
	(d) dyke height (m):	14 m
	(d) volume (m3):	26612955
	(e) quantity of ash disposed as on 31st March 2021 (Metric Tons):	10142375
	(f) available volume in percentage (per cent) and quantity of ash can be further disposed (Metric Tons):	347198.44 m3 (01.30%), 312478 MT
	(g) expected life of ash pond (number of years and months):	01 month and 10 days
	(e) co-ordinates (Lat and Long): (please specify minimum 4 co-ordinates)	SN Latitude Longitude 1 22.12279 83.44879 2 22.13349 83.45347 3 22.12592 83.46450 4 22.11995 83.46389
	(f) type of lining carried in ash pond: HDPE lining or LDPE lining or clay lining or No lining	Clay, LEPE and PCC lining
	g) mode of disposal: Dry disposal or wet slurry (in case of wet slurry please specify whether HCSD or MCSD or LCSD)	LCDS
	(h) Ratio of ash: water in slurry mix (1:___):	1:03
	(i) Ash water recycling system (AWRS) installed and functioning: Yes or No	Yes
	(j) Quantity of wastewater from ash pond discharged into land or water body (m3):	Nil
	(k) Last date when the dyke stability study was conducted and name of the organisation who conducted the study:	28.04.2021, L&T-S&L
	(l) Last date when the audit was conducted and name of the organisation who conducted the audit:	
19	Quantity of legacy ash utilised (MTPA):	0
	i. Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels):	0
	ii. Cement manufacturing:	0
	iii. Ready mix concrete:	0
	iv. Ash and Geo-polymer based construction material:	0
	v. Manufacturing of sintered or cold bonded ash aggregate:	0
	vi. Construction of roads, road and flyover embankment:	0
	vii. Construction of dams:	0
	viii. Filling up of low lying area:	0
	ix. Filling of mine voids:	0
	x. Use in overburden dumps:	0
	xi. Agriculture:	0
	xii. Construction of shoreline protection structures in coastal districts;	0



	xiii. Export of ash to other countries:	0		
	xiv. Others (please specify):	0		
	Summary: FY 2020-21			
	Details	Quantity generated (MTP)	Quantity utilised (MTP) and (per cent)	Balance quantity (MTP)
20	Current ash during reporting period	1582074	246699	1335375
			15.6	
	Legacy ash	8807000.0	0	8807000.0
	Total	10389074	246714.5934	10142375
21	Any other information: Soft copy of the annual compliance report, and shape files of power plant and ash ponds may be e-mailed to:- moefcccoalash@gov.in			
22	Signature of Authorised Signatory		   Dr. Biswajit Samanta Professor Department of Mining Engineering Indian Institute of Technology Kharagpur Kharagpur-721302, West Bengal, India	

4X250 MW TPP FY21-22

For FY 2021-22		
Sl. No.	Details	
1	Name of Power Plant	M/s O.P.Jindal Super Thermal Power Plant
2	Name of the company	Jindal Power Limited, Tamnar
3	District	Raigarh
4	State	Chhattisgarh
5	Postal address for communication:	Village & Post- Tamnar, District-Raigarh (C.G) Pin Code-496107
6	E-mail:	Jpl.emd@jindalpower.com
7	Power Plant installed capacity (MW):	1000 MW (4x250 MW)
8	Plant Load Factor (PLF):	59.65%
9	No. of units generated (KWh):	5226000
10	Total area under power plant (ha): (including area under ash ponds)	Power Plant-360 Ha (for 4X250 MW & 4X600 MW TPPs)
		Ash pond- 198 Ha
11	Quantity of coal consumption during reporting period (Metric Tons per Annum):	4145023
12	Average ash content in percentage (per cent):	44.27%
13	Quantity of current ash generation during reporting period (Metric Tons per Annum):	1834909
	Fly ash (Metric Tons per Annum):	1467927.2
	Bottom ash (Metric Tons per Annum):	366981.8
14	Capacity of dry fly ash storage silo(s) (Metric Tons) :	3200 MT(2X1600 MT)
15	Details of utilisation of current ash generated during reporting period	
	(a) Total quantity of current ash utilised (MTPA) during reporting period:	1554303.74
	(b) Quantity of fly ash utilised (MTPA):	1439103.74
	(i) Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels)	0
	(ii) Cement manufacturing:	189173.06
	(iii) Ready mix concrete:	0
	(iv) Ash and Geo-polymer based construction material:	0
	(v) Manufacturing of sintered or cold bonded ash aggregate:	0
	(vi) Construction of roads, road and fly over embankment:	0
	(vii) Construction of dams:	0
	(viii) Filling up of low lying area:	624952.99
	(ix) Filling of mine voids:	624977.69
	(x) Use in overburden dumps:	0
	(xi) Agriculture:	0

	(xii) Construction of shoreline protection structures in coastal districts;	0
	(xiii) Export of ash to other countries:	0
	(xiv) Others (please specify):	0
	(c) Quantity of bottom ash utilised (MTPA):	115200
	(i) Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels):	0
	(ii) Cement manufacturing:	0
	(iii) Ready mix concrete:	0
	(iv) Ash and Geo-polymer based construction material:	0
	(v) Manufacturing of sintered or cold bonded ash aggregate:	0
	(vi) Construction of roads, road and flyover embankment:	0
	(vii) Construction of dams:	0
	(viii) Filling up of low lying area:	0
	(ix) Filling of mine voids:	115200
	(x) Use in overburden dumps:	0
	(xi) Agriculture:	0
	(xii) Construction of shoreline protection structures in coastal districts:	0
	(xiii) Export of ash to other countries:	0
	(xiv) Others (please specify):	0
	Total quantity of current ash unutilised (MTPA) during reporting period:	280605.26
16	Percentage utilisation of current ash generated during reporting period (per cent):	84.7
	Details of disposal of ash in ash ponds	,
	(a) Total quantity of ash disposed in ash pond(s) (Metric Tons) as on 31st March (excluding reporting period):	10142375
	(b) Quantity of ash disposed in ash pond(s) during reporting period (Metric Tons):	280605.26
17	(c) Total quantity of water consumption for slurry discharge into ash ponds during reporting period (m3):	8356518
	(d) Total number of ash ponds:	1
	(i) Active:	1
	(ii) Exhausted (yet to be reclaimed):	0
	(iii) Reclaimed:	0
	(e) total area under ash ponds (ha):	198
18	Individual ash pond details Ash pond-1,2, etc (please provide below mentioned details separately, if number of ash ponds is more than one)	
	(a) Status: Under construction or Active or Exhausted or Reclaimed	Active
	(b) Date of start of ash disposal in ash pond (DD/MM/YYYY or MMYYYY):	Dec, 2007

	(c) Date of stoppage of ash disposal in ash pond after completing its capacity (DD/MM/YYYY or MM/YYYY): (Not applicable for active ash ponds)	NA
	(c) area (hectares):	198
	(d) dyke height (m):	18 m
	(d) volume (m3):	32107355
	(e) quantity of ash disposed as on 31st March (Metric Tons):	10422980.26
	(f) available volume in percentage (per cent) and quantity of ash can be further disposed (Metric Tons):	5207980 m3 (16.22%), 4687182 MT
	(g) expected life of ash pond (number of years and months):	01 year and 08 months
	(e) co-ordinates (Lat and Long): (please specify minimum 4 co-ordinates)	SN Latitude Longitude 1 22.12279 83.44879 2 22.13349 83.45347 3 22.12592 83.46450 4 22.11995 83.46389
	(f) type of lining carried in ash pond: HDPE lining or LDPE lining or clay lining or No lining	Clay, LEPE and PCC lining
	g) mode of disposal: Dry disposal or wet slurry (in case of wet slurry please specify whether HCSD or MCSD or LCSD)	LCDS
	(h) Ratio of ash: water in slurry mix (1:___):	1:03
	(i) Ash water recycling system (AWRS) installed and functioning: Yes or No	Yes
	(j) Quantity of wastewater from ash pond discharged into land or water body (m3):	Nil
	(k) Last date when the dyke stability study was conducted and name of the organisation who conducted the study:	28.04.2021, L&T-S&L
	(l) Last date when the audit was conducted and name of the organisation who conducted the audit:	We are in process to conduct audit of fly ash through national reputed institute.
19	Quantity of legacy ash utilised (MTPA):	0
	i. Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels):	0
	ii. Cement manufacturing:	0
	iii. Ready mix concrete:	0
	iv. Ash and Geo-polymer based construction material:	0
	v. Manufacturing of sintered or cold bonded ash aggregate:	0
	vi. Construction of roads, road and flyover embankment:	0
	vii. Construction of dams:	0
	viii. Filling up of low lying area:	0
	ix. Filling of mine voids:	0
	x. Use in overburden dumps:	0
	xi. Agriculture:	0
	xii. Construction of shoreline protection structures in coastal districts;	0

	xiii. Export of ash to other countries:	0		
	xiv. Others (please specify):	0		
	Summary:			
	Details	Quantity generated (MTP)	Quantity utilised (MTP) and (per cent)	Balance quantity (MTP)
20	Current ash during reporting period	1834909	1554303.74	280605.26
			84.7	
	Legacy ash	10142375	0	10142000
	Total	11977284	1554388.447	10422980.26
21	Any other information: Soft copy of the annual compliance report, and shape files of power plant and ash ponds may be e-mailed to:- moefcccoalash@gov.in			
22	Signature of Authorised Signatory		  Dr. Biswajit Samanta Professor Department of Mining Engineering Indian Institute of Technology Kharagpur Kharagpur - 721302, India	



4X600 MW TPP FY20-21

For FY 2020-21		
Sl. No.	Details	
1	Name of Power Plant	M/s O.P.Jindal Super Thermal Power Plant
2	Name of the company	Jindal Power Limited, Tamnar
3	District	Raigarh
4	State	Chhattisgarh
5	Postal address for communication:	Village & Post- Tamnar, District-Raigarh (C.G) Pin Code-496107
6	E-mail:	Jpl.emd@jindalpower.com
7	Power Plant installed capacity (MW):	2400 MW (4X600 MW)
8	Plant Load Factor (PLF):	41.228
9	No. of units generated (MWh):	8667672000
10	Total area under power plant (ha): (including area under ash ponds)	Power Plant-360 Ha (for 4X250 MW & 4X600 MW TPPs)

		Ash pond- 198 Ha (Existing Ash Dyke of 4X250 MW is being used after getting required clearances)
11	Quantity of coal consumption during reporting period (Metric Tons per Annum):	6798548
12	Average ash content in percentage (per cent):	45.06
13	Quantity of current ash generation during reporting period (Metric Tons per Annum):	3063582
	Fly ash (Metric Tons per Annum):	2450865.6
	Bottom ash (Metric Tons per Annum):	612716.4
14	Capacity of dry fly ash storage silo(s) (Metric Tons) :	9200 MT(4X2300 MT)
15	Details of utilisation of current ash generated during reporting period	
	(a) Total quantity of current ash utilised (MTPA) during reporting period:	556019
	(b) Quantity of fly ash utilised (MTPA):	556019
	(i) Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels)	14588
	(ii) Cement manufacturing:	17524
	(iii) Ready mix concrete:	0
	(iv) Ash and Geo-polymer based construction material:	0
	(v) Manufacturing of sintered or cold bonded ash aggregate:	0
	(vi) Construction of roads, road and fly over embankment:	0
	(vii) Construction of dams:	0
	(viii) Filling up of low lying area:	70552
	(ix) Filling of mine voids:	453355
	(x) Use in overburden dumps:	0
	(xi) Agriculture:	0
	(xii) Construction of shoreline protection structures in coastal districts;	0
	(xiii) Export of ash to other countries:	0
	(xiv) Others (please specify):	0
	(c) Quantity of bottom ash utilised (MTPA):	0
	(i) Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels):	0
	(ii) Cement manufacturing:	0
	(iii) Ready mix concrete:	0
	(iv) Ash and Geo-polymer based construction material:	0
	(v) Manufacturing of sintered or cold bonded ash aggregate:	0
	(vi) Construction of roads, road and flyover embankment:	0
	(vii) Construction of dams:	0
	(viii) Filling up of low lying area:	0
	(ix) Filling of mine voids:	0

	(x) Use in overburden dumps:	0
	(xi) Agriculture:	0
	(xii) Construction of shoreline protection structures in coastal districts:	0
	(xiii) Export of ash to other countries:	0
	(xiv) Others (please specify):	0
	Total quantity of current ash unutilised (MTPA) during reporting period:	2507563
16	Percentage utilisation of current ash generated during reporting period (per cent):	18.1
17	Details of disposal of ash in ash ponds	,
	(a) Total quantity of ash disposed in ash pond(s) (Metric Tons) as on 31st March 2020 (excluding reporting period):	2849000
	(b) Quantity of ash disposed in ash pond(s) during reporting period (Metric Tons):	2507563
	(c) Total quantity of water consumption for slurry discharge into ash ponds during reporting period (m3):	11136490
	(d) Total number of ash ponds:	1
	(i) Active:	1
	(ii) Exhausted (yet to be reclaimed):	0
	(iii) Reclaimed:	0
	(e) total area under ash ponds (ha):	198 (Existing Ash Dyke of 4X250 MW is being used after getting required clearances)
18	Individual ash pond details Ash pond-1,2, etc (please provide below mentioned details separately, if number of ash ponds is more than one)	
	(a) Status: Under construction or Active or Exhausted or Reclaimed	Active (Existing Ash Dyke of 4X250 MW is being used after getting required clearances)
	(b) Date of start of ash disposal in ash pond (DD/MM/YYYY or MM/YYYY):	Mar, 2014
	(c) Date of stoppage of ash disposal in ash pond after completing its capacity (DD/MM/YYYY or MM/YYYY): (Not applicable for active ash ponds)	NA
	(c) area (hectares):	198
	(d) dyke height (m):	14 m
	(d) volume (m3):	26612955
	(e) quantity of ash disposed as on 31st March 2021 (Metric Tons):	5356563
	(f) available volume in percentage (per cent) and quantity of ash can be further disposed (Metric Tons): (as on 31.03.2022)	347198.44 m3 (01.30%), 312478 MT
	(g) expected life of ash pond (number of years and months):	01 month and 10 days

	(e) co-ordinates (Lat and Long): (please specify minimum 4 co-ordinates)	SN Latitude Longitude 1 22.12279 83.44879 2 22.13349 83.45347 3 22.12592 83.46450 4 22.11995 83.46389		
	(f) type of lining carried in ash pond: HDPE lining or LDPE lining or clay lining or No lining	Clay, LEPE and PCC lining		
	(g) mode of disposal: Dry disposal or wet slurry (in case of wet slurry please specify whether HCSD or MCSD or LCSD)	HCDS		
	(h) Ratio of ash: water in slurry mix (1:___):	3:01		
	(i) Ash water recycling system (AWRS) installed and functioning: Yes or No	Yes		
	(j) Quantity of wastewater from ash pond discharged into land or water body (m3):	Nil		
	(k) Last date when the dyke stability study was conducted and name of the organisation who conducted the study:	28.04.2021, L&T-S&L		
	(l) Last date when the audit was conducted and name of the organisation who conducted the audit:			
19	Quantity of legacy ash utilised (MTPA):	0		
	i. Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels):	0		
	ii. Cement manufacturing:	0		
	iii. Ready mix concrete:	0		
	iv. Ash and Geo-polymer based construction material:	0		
	v. Manufacturing of sintered or cold bonded ash aggregate:	0		
	vi. Construction of roads, road and flyover embankment:	0		
	vii. Construction of dams:	0		
	viii. Filling up of low lying area:	0		
	ix. Filling of mine voids:	0		
	x. Use in overburden dumps:	0		
	xi. Agriculture:	0		
	xii. Construction of shoreline protection structures in coastal districts;	0		
	xiii. Export of ash to other countries:	0		
	xiv. Others (please specify):	0		
20	Summary:			
	Details	Quantity generated (MTP)	Quantity utilised (MTP) and (per cent)	Balance quantity (MTP)
	Current ash during reporting period	3063582	556019	2507563
			18.1	
	Legacy ash	2849000	0	2849000
	Total	5912582	556037.1493	5356563

21	Any other information: Soft copy of the annual compliance report, and shape files of power plant and ash ponds may be e-mailed to:- moefcccoalash@gov.in	
22	Signature of Authorised Signatory	  Associate Professor Department of Mining Engineering Indian Institute of Technology Kharagpur Kharagpur - 721302, India





4X600 MW TPP FY21-22

For FY 2021-22		
Sl. No.	Details	
1	Name of Power Plant	M/s O.P.Jindal Super Thermal Power Plant
2	Name of the company	Jindal Power Limited, Tamnar
3	District	Raigarh
4	State	Chhattisgarh
5	Postal address for communication:	Village & Post- Tamnar, District-Raigarh (C.G) Pin Code-496107
6	E-mail:	Jpl.emd@jindalpower.com
7	Power Plant installed capacity (MW):	2400 MW (4X600 MW)
8	Plant Load Factor (PLF):	45.60%
9	No. of units generated (KWh):	9588000
10	Total area under power plant (ha): (including area under ash ponds)	Power Plant-360 Ha (for 4X250 MW & 4X600 MW TPPs) Ash pond- 198 Ha (Existing Ash Dyke of 4X250 MW is being used after getting required clearances)

11	Quantity of coal consumption during reporting period (Metric Tons per Annum):	7862032
12	Average ash content in percentage (per cent):	45.39%
13	Quantity of current ash generation during reporting period (Metric Tons per Annum):	3568815.98
	Fly ash (Metric Tons per Annum):	2855052.784
	Bottom ash (Metric Tons per Annum):	713763.196
14	Capacity of dry fly ash storage silo(s) (Metric Tons) :	9200 MT(4X2300 MT)
15	Details of utilisation of current ash generated during reporting period	
	(a) Total quantity of current ash utilised (MTPA) during reporting period:	3198220.19
	(b) Quantity of fly ash utilised (MTPA):	2855377.2
	(i) Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels)	2654.46
	(ii) Cement manufacturing:	879
	(iii) Ready mix concrete:	0
	(iv) Ash and Geo-polymer based construction material:	0
	(v) Manufacturing of sintered or cold bonded ash aggregate:	0
	(vi) Construction of roads, road and fly over embankment:	0
	(vii) Construction of dams:	0
	(viii) Filling up of low lying area:	401829.03
	(ix) Filling of mine voids:	2450014.71
	(x) Use in overburden dumps:	0
	(xi) Agriculture:	0
	(xii) Construction of shoreline protection structures in coastal districts;	0
	(xiii) Export of ash to other countries:	0
	(xiv) Others (please specify):	0
	(c) Quantity of bottom ash utilised (MTPA):	342842.99
	(i) Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels):	0
	(ii) Cement manufacturing:	0
	(iii) Ready mix concrete:	0
	(iv) Ash and Geo-polymer based construction material:	0
	(v) Manufacturing of sintered or cold bonded ash aggregate:	0
	(vi) Construction of roads, road and flyover embankment:	0
	(vii) Construction of dams:	0
	(viii) Filling up of low lying area:	0
	(ix) Filling of mine voids:	342842.99
	(x) Use in overburden dumps:	0
	(xi) Agriculture:	0

	(xii) Construction of shoreline protection structures in coastal districts:	0
	(xiii) Export of ash to other countries:	0
	(xiv) Others (please specify):	0
	Total quantity of current ash unutilised (MTPA) during reporting period:	370595.79
16	Percentage utilisation of current ash generated during reporting period (per cent):	89.6
	Details of disposal of ash in ash ponds	,
	(a) Total quantity of ash disposed in ash pond(s) (Metric Tons) as on 31st March (excluding reporting period):	5356563
	(b) Quantity of ash disposed in ash pond(s) during reporting period (Metric Tons):	370595.79
	(c) Total quantity of water consumption for slurry discharge into ash ponds during reporting period (m3):	10956168
17	(d) Total number of ash ponds:	1
	(i) Active:	1
	(ii) Exhausted (yet to be reclaimed):	0
	(iii) Reclaimed:	0
	(e) total area under ash ponds (ha):	198 (Existing Ash Dyke of 4X250 MW is being used after getting required clearances)
	Individual ash pond details Ash pond-1,2, etc (please provide below mentioned details separately, if number of ash ponds is more than one)	
	(a) Status: Under construction or Active or Exhausted or Reclaimed	Active (Existing Ash Dyke of 4X250 MW is being used after getting required clearances)
	(b) Date of start of ash disposal in ash pond (DD/MM/YYYY or MM/YYYY):	Mar, 2014
	(c) Date of stoppage of ash disposal in ash pond after completing its capacity (DD/MM/YYYY or MM/YYYY): (Not applicable for active ash ponds)	NA
18	(c) area (hectares):	198
	(d) dyke height (m):	18 m
	(d) volume (m3):	32107355
	(e) quantity of ash disposed as on 31st March (Metric Tons):	5727158.79
	(f) available volume in percentage (per cent) and quantity of ash can be further disposed (Metric Tons):	5207980 m3 (16.22%), 4687182 MT
	(g) expected life of ash pond (number of years and months):	01 year and 08 months

	(e) co-ordinates (Lat and Long): (please specify minimum 4 co-ordinates)	SN Latitude Longitude 1 22.12279 83.44879 2 22.13349 83.45347 3 22.12592 83.46450 4 22.11995 83.46389		
	(f) type of lining carried in ash pond: HDPE lining or LDPE lining or clay lining or No lining	Clay, LEPE and PCC lining		
	(g) mode of disposal: Dry disposal or wet slurry (in case of wet slurry please specify whether HCSD or MCSD or LCSD)	HCDS		
	(h) Ratio of ash: water in slurry mix (1:___):	3:01		
	(i) Ash water recycling system (AWRS) installed and functioning: Yes or No	Yes		
	(j) Quantity of wastewater from ash pond discharged into land or water body (m3):	Nil		
	(k) Last date when the dyke stability study was conducted and name of the organisation who conducted the study:	28.04.2021, L&T-S&L		
	(l) Last date when the audit was conducted and name of the organisation who conducted the audit:	We are in process to conduct audit of fly ash through national reputed institute.		
19	Quantity of legacy ash utilised (MTPA):	0		
	i. Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels):	0		
	ii. Cement manufacturing:	0		
	iii. Ready mix concrete:	0		
	iv. Ash and Geo-polymer based construction material:	0		
	v. Manufacturing of sintered or cold bonded ash aggregate:	0		
	vi. Construction of roads, road and flyover embankment:	0		
	vii. Construction of dams:	0		
	viii. Filling up of low lying area:	0		
	ix. Filling of mine voids:	0		
	x. Use in overburden dumps:	0		
	xi. Agriculture:	0		
	xii. Construction of shoreline protection structures in coastal districts;	0		
	xiii. Export of ash to other countries:	0		
	xiv. Others (please specify):	0		
20	Summary:			
	Details	Quantity generated (MTP)	Quantity utilised (MTP) and (per cent)	Balance quantity (MTP)
	Current ash during reporting period	3568815.98	3198220.19	370595.79
			89.6	
	Legacy ash	5356563	0	5357000
	Total	8925378.98	3198309.806	5727158.79

21	Any other information: Soft copy of the annual compliance report, and shape files of power plant and ash ponds may be e-mailed to:- moefcccoalash@gov.in	
22	Signature of Authorised Signatory	  <p> <small>অধ্যাপক/Professor</small> <small>খনিজ অভিযন্তা বিভাগ</small> <small>Department of Mining Engineering</small> <small>খনিজ, খনিজ, খনিজ-১১১-১, খারগুড়</small> <small>I.I.T. Kharagpur - 721302, India</small> </p>   <p> <small>Dr. B. Samanta</small> <small>Professor</small> <small>Department of Mining Engineering</small> <small>Indian Institute of Technology Kharagpur</small> <small>Kharagpur-721302, West Bengal, India</small> </p>

ANNEXURE OF FIELD PICTURES DURING THE VISIT



Figure 2: Mobile tanker for water sprinkling on roads





Figure 3 & 4: Fly Ash loading in bulkers for Cement











Figure 5 to 12: Savitri Nagar Colony (Vill-Tehlrampur) low lying area filled





Figure 3 to 15: Shakti Vihar -2 (Vill- Saliabhata low lying area filled with fly ash







Figure 17 to 21 : Mine Back filling



Figure 22: Water sprinkling at Mines roads



REGIONAL OFFICE
CHHATTISGARH ENVIRONMENT CONSERVATION BOARD,
T.V. TOWER ROAD, RAIGARH (C.G.)

No. 802 /RO/TS/CECB/2021

Raigarh, Date 12/08/2021

To,

M/s Jindal Power Limited,
 Tamnar, District- Raigarh (C.G.)

- Subject :- No Objection Certificate for ash filling in low lying area with pond ash.
- Ref. :- 1. Suggestion made by committee in O.A. NO. 104/2018 pending under Hon'ble NGT.
2. CPCB Guidelines for disposal/utilization of fly ash for reclamation of Low lying Areas and in stowing of Abandoned mines/Quarries.
3. MoEF & CC GOI O.M. No. 22-13/2019-IA.III dated 28.08.2019.
4. Head Office, Nawa Raipur Atal Nagar Raipur, letter no. 8332 dated 12.12.2020
5. Collector order letter dated 22.07.2021.
6. Your application no. JPL/EMD/F-18/3400MW/ 2020/109 dated 23.07.2021.

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With reference to the above, committee formed by Collector Raigarh has examined the proposal in details submitted by you having areas Khasra No. 197/1k, 197/1kh, 197/1g, 197/1jh, 197/1chh, 197/1j, Total Rakba- 4.271 Hect. in village- Budia, Khasra No. 253/1k, 252/2, 254, 258, 259, 253/1kh, 253/2, 255/1, 252/3, Total Rakba- 5.155 Hect. in village- Tamnar, Khasra No. 584, 427/1ad, 427/2k, 427/2kh, 418, Total Rakba- 4.03 Hect. in village- Saliabhata and Khasra No. 398, 399, 400, 401, Part of Khasra No. 406 (2.023 Hect.), 393, 394, 395, 396, 397, Total Rakba- 9.913 Hect. in village- Tehlirampur Proposal submitted by you for ash filling in Private land having approximate quantity of 2,00,000 MT. The Regional Office, Raigarh has No Objection for ash filling work in the low-lying areas Situted in Khasra no. 253/1k, 252/2, 254, 258, 259, 253/1kh, 253/2, 255/1, 252/3, Total Rakba- 5.155 Hect. in village- Tamnar, Khasra No. 584, 427/1ad, 427/2k, 427/2kh, 418, Total Rakba- 4.03 Hect. in village- Saliabhata and Part of Khasra No. 406 (2.023 Hect.), 398, 399, 400, 401, 393, 394, 395, 396, 397, Total Rakba- 9.913 Hect. in village- Tehlirampur District-Raigarh (C.G.) subject to the following terms & conditions.

Terms & Conditions :-

1. M/s Jindal Power Limited, 3400 MW Power Plant at Tamnar, District-Raigarh (C.G.), shall have to abide by the CPCB Guidelines for disposal/utilization of fly ash for reclamation of Low Lying areas industry shall ensure compliance of MoEF & CC GOI O.M. No. 22-13/2019-IA. III Dated 28.08.2019.
2. Vehicle used for transportaion of FlyAsh/Bottom Ash will be equipped with GPS system.

3. The Power Plant shall ensure that fly ash/bottom ash will be filled in areas Khasra no. 253/1k, 252/2, 254, 258, 259, 253/1kh, 253/2, 255/1, 252/3, Total Rakba- 5.155 Hect. in village- Tamnar, Khasra No. 584, 427/1ad, 427/2k, 427/2kh, 418, Total Rakba- 4.03 Hect. in village- Saliabhata and part of Khasra No. 406 (2.023 Hec.), 398, 399, 400, 401, 393, 394, 395, 396, 397, Total Rakba- 9.913 Hect. in village- Tehlirampur, District-Raigarh (C.G.).
4. The transportation of fly ash/Bottom ash shall be fully covered vehicle or by tarpaulin, during lifting of ash from the ash pond to low lying areas of the concerned village.
5. Industry shall dispose off fly ash/bottom ash only upto current ground level, If found above ground level EC will be imposed to the industry.
6. Proper water sprinkling activities shall be done on haul road and transportation road by dumping of fly ash in the aforesaid areas for mitigation of air pollution.
7. After filling fly ash the low-lying areas shall be covered by 500 mm topsoil.
8. Industry shall not cut/damage the tree in the land of Khasra no. 584, village- Saliabhata, District-Raigarh (C.G.).
9. After completion of fly ash filling work in low lying area, Industry shall submit Work-Completion Certificate to Chhattigarh Environment Conservation Board, Raigarh.
10. M/s Jindal Power Limited, 3400 MW Power Plant at Tamnar, District-Raigarh (C.G.) Shall have to abide by the guidelines of the Central Coverment/State Government regarding fly ash utilization issued from time to time.
11. The issuance of this NOC does not convey and property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Central/State laws or regulations.
12. The above NOC shall be revoke, if any conditions are violated by the M/s Jindal Power Limited, 3400 MW Power Plant at Tamnar, District-Raigarh (C.G.) with immediate effect.


This "No Objection Certificate" is being issued only for the purpose of ash filling in low-lying areas of aforesaid Khasra Nos. mentones in above and this shall not be treated as consent under Water (Prevention and Contorl of Pollution) Act, 1974 and Air (Prevention and Contorl of Pollution) Act 1981.


Regional Officer
Raigarh, Date

Endt. No. /RO/TS/CECB/2021

Copy To :-

1. The Member Secretary, C.G. Envirment Conservation Board, Raipur for information please.
2. Collector, Raigarh, District - Raigarh for information please.


Regional Officer
C.G. Envirment Conservation Board,
Raigarh (C.G.)



REGIONAL OFFICE
CHHATTISGARH ENVIRONMENT CONSERVATION BOARD,
T.V. TOWER ROAD, RAIGARH (C.G.)

No /RO/TS/CECB/2021

Raigarh, Date

To,

M/s Jindal Power Ltd.,
Tamnar, District- Raigarh (C.G.)

- Subject :-** No Objection Certificate for ash filling in low lying area/in stowing of Abandoned mines/Quarries with pond ash/Fly Ash.
- Ref.:-**
1. CPCB Guidelines for disposal/utilization of fly ash for reclamation of Low lying Areas and in stowing of Abandoned mines/Quarries.
 2. MoEF & CC GOI O.M. No. 22-13/2019-IA.III dated 28.08.2019.
 3. Head Office, Nawa Raipur Atal Nagar Raipur, letter no. 8332 dated 12.12.2020.
 4. Collector order letter dated 22.07.2021.
 5. Your application dated 28.09.2021.

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With reference to the above, committee formed by Collector Raigarh has examined the proposal in details submitted by you having areas Khasra No. 274, 276, 277, 279, 291, 293, 294, 295, 296 & 278, Total Rakba- 4.680 Hect. in Village-Tehlirampur, Tamnar. Proposal submitted by you for ash filling in Private land the Regional Office, Raigarh has No Objection for ash filling work in the low-lying areas/ Abandoned mines/Quarries situated in Khasra No. 274, 276, 277, 279, 291, 293, 294, 295, 296 & 278, Total Rakba- 4.680 Hect. in Village-Tehlirampur, Tamnar, District- Raigarh (C.G.) for quantity 1,00,000 MT subject to the following terms & conditions.

Terms & Conditions :-

1. M/s Jindal Power Ltd. 3400 MW Power Plant at Tamnar, District- Raigarh (C.G.) shall have to abide by the CPCB Guidelines for disposal/utilization of fly ash for reclamation of Low Lying areas industry shall ensure compliance of MoEF & CC GOI O.M. No. 22-13/2019-IA. III Dated 28.08.2019 in case of violation, EC will be imposed to the industry.
2. Vehicle used for transportaion of FlyAsh/Bottom Ash will be equipped with GPS system.
3. The Power Plant shall ensure that fly ash/bottom ash will be filled in areas Khasra No. 274, 276, 277, 279, 291, 293, 294, 295, 296 & 278, Total Rakba- 4.680 Hect. in Village-Tehlirampur, Tamnar, District-Raigarh (C.G.).
4. The transportation of fly ash/Bottom ash shall be fully covered vehicle or by tarpaulin, during lifting of ash from the ash pond to low lying areas/Abandoned mines/Quarries of the concerned village.

5. Industry shall dispose off fly ash/bottom ash only upto current ground level, in case of violation, EC will be imposed to the industry.
6. Proper water sprinkling activities shall be done on haul road and transportation road by dumping of fly ash in the aforesaid areas for mitigation of air pollution.
7. After filling fly ash the low-lying areas shall be covered by 500 mm topsoil.
8. After completion of fly ash filling work in low lying area, Industry shall submit Work-Completion Certificate to Chhattigarh Environment Conservation Board, Raigarh.
9. Industry shall install appropriate No. of piezometers in the proposed fly ash disposal area.
10. Industry shall not cut/damage the tree in the proposed land of village- Tehlirampur, Tamnar, District-Raigarh (C.G.)
11. Industry shall submit details (Quantity of fly ash & Bill T of transportaion) of fly ash transported to Khasra No. 274, 276, 277, 279, 291, 293, 294, 295, 296 & 278, Total Rakba- 4.680 Hect. in Village-Tehlirampur, Tamnar, District-Raigarh (C.G.) every 15 days.
12. M/s Jindal Power Ltd. at Tamnar, District- Raigarh (C.G.) shall have to abide by the guidelines of the Central Government/State Government regarding fly ash utilization issued from time to time.
13. The issuance of this NOC does not convey and property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Central/State laws or regulations.
14. The above NOC shall be revoke, if any conditions are violated by the M/s Jindal Power Ltd. at Tamnar, District- Raigarh (C.G.) with immediate effect.

This "No Objection Certificate" is being issued only for the purpose of ash filling in low-lying areas of aforesaid Khasra Nos. mentones in above and this shall not be treated as consent under Water (Prevention and Control of Pollution) Act, 1974 and Air (Prevention and Control of Pollution) Act 1981.


Regional Officer


C.G. Environment Conservation Board,
& Raigarh (C.G.)

Raigarh, Date

Endt. No. /RO/TS/CECB/2021

Copy To :-

1. The Member Secretary, C.G. Environment Conservation Board, Raipur for information please.
2. Collector District – Raigarh for information please.


Regional Officer

C.G. Environment Conservation Board,
Raigarh (C.G.)