Ref No. EOGEPL/CBM-RG (E)/MoEF&CC/2020/3114

Date: 23rd November, 2020

ESSAR
OIL & GAS

Essar Oil and Gas Exploration and Production Ltd.
AN 81 B, Sector 2B
Martin Luther King Road
Bidhan Nagar
Durgapur - 713 212
India

CIN : U11203GJ2016PLC091903

T +91 343 253 2202
F +91 343 253 2201
E eogepl@essarenp.co.in
www.essar.com

To
The Director
Ministry of Environment and Forests
Eastern Regional Office
A/3 Chandrasekharpur
Bhubaneswar-751 023
Orissa

Sub: Submission Half-yearly Compliance Report of the Environmental Clearance (Phase-II and Amendment) by Essar Oil and Gas Exploration and Production Limited reg.

Ref: Environmental Clearance of Phase-II granted by MoEF vide letter no. J-11011/351/2009- IA II (I) dated 23.09.2011; Amendment dated 18.06.2012; Transfer of EC from EOL to EOGEPL dated 06.11.2017

Dear Sir

We are enclosing herewith the half-yearly compliance report in respect of the stipulated prior environmental clearance terms and conditions for the Pilot cum Production Phase (Phase-II) and its amendment of CBM project activities for the period of April, 2020 to September, 2020.

Thanking you for your continued support,

With Best Regards,

For Essar Oil and Gas Exploration and Production Limited

Kannan Rajendran
Chief Operating Officer
Raniganj East, CBM Project Durgapur

Enclosed: Phase-II and Amendment Compliance Report

Copy to:

1. Member Secretary (Industry), MoEF, CGO Complex, Paryavan Bhavan, New Delhi-110003
2. The Environmental Engineer, Durgapur Regional Office, WBPCB, Durgapur-713216

Essar Oil and Gas Exploration and Production Limited
RG (East)-CBM-2001/1 (Phase-II) Half Yearly Environment Clearance Compliance Report
(April'20 to September'20)
Ref: Environment Clearance no. F. No. J-11011/351/2009- IA II (I) dated 23.09.2011

S. No.	EC Conditions	Compliance Status
	A. Specific Conditions	
i.	As proposed, Only 58 pilot-cum-production wells shall be drilled up to a depth of 1000 m. No additional wells shall be drilled without prior permission from this Ministry.	Number of pilot-cum-production wells has been drilled are as per the permission. Amendment in Environmental Clearance has been granted by MoEF & CC for drilling 4 additional supporting wells at each pilot cum production site to augment the production.
ii	As proposed, no drilling of well and any construction work shall be carried out in forest land. No forest land shall be used for installation of Group Gathering Stations (GGSs) and pipeline laying in the proposed location.	All the facilities including well sites & Gas Gathering Stations are located outside the forest area.
iii	Recommendations of the State Forest Department shall be obtained regarding likely impact of the proposed plant on the surrounding protected forests viz. Durgapur PF & Ukhra PF and implemented.	The Conservator of Forests (South East Circle), Forest Department, West Bengal has carried out site inspection on 19th Dec'12 to assess the probable impacts & suggested suitable recommendations. The Additional PCCF, West Bengal forwarded his recommendations to the Additional PCCF, MoEF (Eastern Regional Office). (A copy of the letter has already been submitted along with compliance report after that).
iv	Compensation for the land acquisition to the land oustees, if any, and also for standing crop shall be paid as per the National Resettlement and Rehabilitation Policy (NRRP) 2007 or State Government norms. It may be ensured that compensation provided shall not be less than the norms of the NRRP, 2007.	Land acquisition is being directly done with the land owners and the compensation is paid as per the prevailing market rate. There is no involvement of Rehabilitation and Resettlement.

S. No.	EC Conditions	Compliance Status
v	Prior permission from the Ministry of Defense shall be obtained regarding impact of proposed plant on Panagarh air base, if any.	Four (4) nos. of Gas Gathering Station (GGS) and One Main Compressor Station (MCS) was constructed as per the condition of the NOC of Ministry of Defense (MoD).
vi	The surface facilities shall be installed as per the applicable codes and standards, international practices and applicable local regulations.	Surface facilities have been designed as per applicable Code and Standard.
vii	Ambient air quality shall be monitored near the closest human settlements as per the National Ambient Air Quality Emission Standards (NAAQES) issued by the Ministry vide G.S.R. No. 826(E) dated 16th November, 2009 for PM_{1O}, $PM_{2.5}$, S02, NOx, CO, CH4, VOCs, HC, Non-methane HC etc. Efforts shall be made to improve the ambient air quality of the area.	Ambient Air Quality Monitoring has been carried out at well sites near to the closest human settlements as per the Ambient Air Quality Emission Standards (NAAQES) issued by the Ministry vide G.S.R No. 826(E) dated 16th November, 2009 for PM10, PM2.5, SO2, NOX, CO, CH4, VOCs, HC, Non-methane HC. Monitoring activity has been carried out from Jul'20 to Sep'20 through a recognized laboratory based in Kolkata. However, monitoring could not be carried out due to the restrictions imposed by GoI due to the ongoing COVID 19 pandemic, and also the laboratory was closed from Apr'20 to Jun'20. Please find the ambient air quality monitoring results from Jul'20 to Sep' 20 and also monitoring report of Mar' 20 attached with this report as **Annexure I.**
viii	The company shall monitor data on methane and non-methane hydrocarbon at the drilling site, GGS, CGS and at the SV station from where the gas is supplied to the customers.	Methane hydrocarbons are monitored as part of Ambient Air Quality Monitoring plan at major facilities (GGS, MCS) and villages. Monitoring activity has been carried out from Jul'20 to Sep'20 through a recognized laboratory based in Kolkata. However, monitoring could not be carried out due to the restrictions imposed by GoI due to the ongoing COVID 19 pandemic and, also the laboratory was closed from Apr'20 to Jun'20. Please find the ambient air quality monitoring results from

S. No.	EC Conditions	Compliance Status
		Jul'20 to Sep'20 and also monitoring report of Mar' 20 attached with this report as **Annexure I.**
ix	Mercury shall also be analyzed in air, water and drill cuttings twice during drilling period.	The drilling operation has been temporarily suspended from April, 2017 till date.
x	The flare system shall be designed as per good oil field practices and Oil Industry Safety Directorate (OISD) guidelines. The company shall take necessary measures to prevent fire hazards and soil remediation as needed. At the place of ground flaring, the flare pit shall be lined with refractory bricks and efficient burning system. In case of overhead flare stacks, the stack height shall be provided as per the regulatory requirements and emissions from stacks shall meet the MOEF/CPCB guidelines.	Elevated flare system has been designed as per OISD guidelines. Measures delineated in the EIA/EMP have been taken to prevent fire hazards. The overhead flaring has been installed at a height of 30 m. The following measures have been implemented to prevent fire hazards: • Installation of electrical equipment as per approved hazardous zone classification as communicated to DGMS. • Dry chemical fire extinguishers are available at site. • Online methane gas analyzers (CH4) are available. • Flame proof type lighting fixtures, push buttons and switches at the drill site facilities are used.
xi	The company shall make the arrangement for control of noise from the drilling activity and DG sets by providing necessary mitigation measures such as proper acoustic enclosures to DG sets and meet the norms notified by the MoEF. Height of all the stacks/vents shall be as per the CPCB guidelines.	CPCB approved models of silent generator sets have been installed with acoustic enclosures. Noise monitoring has been carried out in the activity area and surrounding habitat. Please find the results of noise monitoring attached with this report as **Annexure II**.
xii	The company shall comply with the guidelines for disposal of solid waste, drill cutting and drilling fluids for onshore drilling operation notified vide GSR. 546(E) dated 30'August, 2005.	The drilling operation has been temporarily suspended from April, 2017 till date.
xiii	Total fresh water requirement from local approved water suppliers shall not exceed 75 m3/day/well and prior permission shall be obtained from the	The drilling operation has been temporarily suspended from April, 2017 till date. However, The treated RO water is reused in work

S. No.	EC Conditions	Compliance Status
	concerned Authority and a copy submitted to the Ministry's Regional Office at Bhubaneswar. No ground water shall be used without permission of CGWA.	over operations and other utilities. Ground water is not used & withdrawn for Industrial water consumption.
xiv	The produced water during drilling operations shall be collected in HDPE lined waste pit to prevent ground water contamination. Effluent shall be properly treated and treated effluent shall conform to CPCB standards. As proposed, produced water may also be used in operational coal mines of Eastern Coal Fields for dust suppression, slurry activities and post-mining restoration efforts etc. Domestic effluent shall be disposed through septic tank followed by soak pit. No effluent shall be discharged outside the premises and 'zero' discharge shall be adopted	Produced water is collected & stored in over surface Zn-Al tanks installed at all sites. In case of excess water volume, the extra water is stored HDPE lined pits. Produced water is then transported by pipelines to Reverse Osmosis (RO) plant for treatment. Currently RO treatment plants of total capacity 5100 m3/ day have been installed. The treated water is used for the projects internal operations (work over & site preparation activities). Excess treated water is discharged to nearby stream only after complying with the discharge standards. Domestic effluent is treated in septic tank followed by soak pits. There is no discharge of effluent from the facilities.
xv	Water produced during drilling shall be reused in drilling of other core/test wells.	Produced water has been collected & stored in over surface Zn-Al tanks installed at all sites. In case of excess water volume, the extra water is stored HDPE lined pits. If water does not meet the standards then it is passed through suitable treatment system. Water meeting the standards set by CPCB is reused in the construction & work over activities of adjoining wells. Excess water is discharged only after meeting the discharge standards.
xvi	Reverse Osmosis plant shall be installed for further treatment of the wastewater in case the TDS is > 2000 mg/l and treated wastewater shall be reused or discharge on the land after meeting the norms.	Currently, Reverse Osmosis (RO) plants with total capacity of 5100 m3/ day are installed to treat the produced water generated from production wells. Please find the produced water analysis result attached with this report as **Annexure III**.

S. No.	EC Conditions	Compliance Status
		Please find the RO water quality monitoring results attached with this report as **Annexure IV.** The treated water is reused in HF, work over and other construction activities. Excess water is discharged to nearby streams only after meeting the discharges standards. Please find the analysis results of surface water monitoring attached with this report as **Annexure IV A**. Monitoring activity has been carried out from Jul'20 to Sep'20 through a recognized laboratory based in Kolkata. However, monitoring could not be carried out due to the restrictions imposed by GoI due to the ongoing COVID 19 pandemic from Apr'20 to Jun'20, and also the laboratory was closed. Reports from Mar'20 and Jul' 20 to Sep' 20 are attached.
xvii	Ground water quality monitoring shall be done to assess if produced water storage or disposal has any effect.	The ground water monitoring is plan in pre-monsoon (May) and Post-Monsoon (November) month. However, monitoring could not be carried out due to the restrictions imposed by GoI due to the ongoing COVID 19 pandemic from Apr'20 to Jun'20, and also the laboratory was closed.
xviii	Drilling wastewater including drill cuttings wash water shall be collected in disposal pit lined with HDPE lining and evaporated or treated and shall comply with the notified standards for on-shore disposal. The treated waste water should be reused in other wells during drilling operations. The membership of common TSDF shall be obtained for the disposal of drill cuttings and hazardous waste. Otherwise secured land fill shall be created at the site as per the design of the secured shall be approved by the CPCB and obtain the authorization of the WBPCB. Copy of authorization or	The drilling operation has been temporarily suspended from April 2017 till date.

S. No.	EC Conditions	Compliance Status
	membership of TSDF shall be submitted to Ministry's Regional Office at Bhubaneswar.	
xix	Only water based drilling mud shall be used. The drilling mud shall be recycled. Hazardous waste shall be disposed of as per Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules, 2008. The recyclable waste (oily sludge) and spent oil shall be disposed of to the authorized recyclers/re-processors.	The drilling operation has been temporarily suspended from April 2017 till date. Oil contaminated waste & waste filters are sent to TSDF facility, Haldia. We had arranged disposal of hazardous waste by July' 20 end. The copy of the FORM 10 is enclosed as **Annexure V**.
xx	The Company shall carry out long term subsidence study by collecting base line data before initiating drilling operation till the project lasts. The data so collected shall be submitted six monthly to the Ministry and its Regional Office at Bhubaneswar.	Land Subsidence Study is carried has been started from year 2012 and has been carried out regularly as condition Amendment 4 (viii). In the last 7 years, no significant land subsidence have been observed. The last report of September' 2020 is attached with this report as **Annexure VI**. There is no active subsidence observed in the study.
xxi	The Company shall take necessary measures to prevent fire hazards, containing oil spill and soil remediation as needed. At place of ground flaring, the overhead flaring stack with knockout drums shall be installed to minimize gaseous emissions during operation.	The necessary measures have been taken to prevent fire hazards and soil remediation as follows. • Installation of electrical equipment as per approved hazardous zone classification as communicated to DGMS • Dry chemical fire extinguishers are available at all well site. • Portable methane gas analyzers (CH4) are available. • Flame proof type lighting fixtures, push buttons and switches in the drill site facilities are used. • Impervious surface, secondary containment and spill kits are provided whenever there is a possibility of soil contamination.
xxii	The project authorities shall install SCADA system with dedicated optical fiber based	SCADA System is installed for monitoring of wells and Gas Gathering Station. Safe Operation of the

S. No.	EC Conditions	Compliance Status
	telecommunication link for safe operation of pipeline and Leak Detection System. Additional sectionalizing valves in the residential area and sensitive installations shall be provided to prevent the amount of gas going to the atmosphere in the event of pipeline failure. Intelligent pigging facility shall be provided for the entire pipeline system for internal corrosion monitoring. Coating and impressed current cathodic protection system shall be provided to prevent external corrosion.	pipeline is ensured through continuous motoring of parameter at the Control Room and through regular patrolling. Sectionalizing valves are in Place. Cathodic Ray Protection system has been installed along the length of pipeline to prevent the corrosion. The design and laying of surface facilities have been confirmed to the standards of OISD 141.
xxiii	All the surface facilities including GGS, CGS and SV station shall be as per applicable codes and standards, international practices and applicable local regulations.	All the surface facilities including GGS, CGS and SV stations have been laid as per applicable code and standards.
xxiv	The design, material of construction, assembly, inspection, testing and safety recommendations of operation and maintenance of pipeline and transporting the natural gas/oil shall be governed by ASME/ANSI B 31.8/B31.4 and OISD standard 141. Pipeline wall thickness and minimum depth of burial at river crossing and casings at rails, major road crossings should be in conformity with ANSI/ASME requirements.	All surface facilities have been installed as per the ASME/ANSI B 31.8 standards. Pipelines design and laying is also confirms to the ANSI/ASME standards.
xxv	Annual safety audit should be carried out for the initial three years by an independent agency and report submitted to this Ministry for ensuring the strict compliance of safety regulations on operations and maintenance.	Safety audits are conducted by third party to maintain the safety standards.
xxvi	The project authorities shall patrol and inspect the pipeline regularly for detection of faults as per OISD guidelines and continuous monitoring of pipeline operation by adopting non-destructive method (s) of testing as envisaged in the EMP. Pearson survey	Regular patrolling and inspection of laid pipeline has been carried out for detection of faults as per OISD guidelines. Pipeline operations shall be continuously monitored by adopting non-destructive methods of testing as envisaged in the EIA/EMP. Pearson

S. No.	EC Conditions	Compliance Status
	and continuous potential survey should be carried out at regular intervals to ensure the adequacy of cathodic protection system.	survey and continuous potential survey shall be carried out at regular intervals to ensure the adequacy of cathodic protection system.
xxvii	The company shall develop a contingency plan for H_2S release including all necessary recommendations from evacuation to resumption of normal operations. The workers shall be provided with personal H_2S detectors in locations of high risk of exposure along with self-containing breathing apparatus.	H_2S is not present as per the analysis of gas tapped from the test wells. However all the necessary safety measures are delineated as per the emergency response plan. Gas detectors are kept at the drilling and production sites to check any presence of gases which are beyond threshold values. All workers have been provided with standard PPEs according to the job requirement.
xxviii	Adequate well protection system shall be provided like BoP or diverter systems as required based on the geological formation of the blocks.	Adequate well control measures along with BOP have been adopted to ensure necessary level of safety.
xxix	Blow Out Preventor (BOP) system shall be installed to prevent well blowouts during drilling operations. BOP measures during drilling shall focus on maintaining well bore hydrostatic pressure by proper pre-well planning and drilling fluid logging etc.	CBM well hydrostatic pressures are normally less than 2psi. However considering the hydrostatic pressures and sensitivity of well, Blow Out Preventers or diverter systems have been provided at the well head during drilling along with other well control measures such as proper pre-well planning and drilling fluid logging to maintain the hydrostatic pressure.
xxx	The top soil removed shall be stacked separately for reuse during restoration process	The top soil is being spread at the designated area for green belt development at the project's facilities.
xxxi	Emergency Response Plan shall be based on the guidelines prepared by OISO, DGMS and Govt. of India. Recommendations mentioned in the Risk Assessment & Consequence Analysis and Disaster Management Plan shall be strictly followed.	Emergency response plan has been prepared as per the OISD & DGMS guidelines. Recommendations mentioned in risk assessment and consequence analysis are being duly implemented.
xxxii	Project proponent shall comply with the environment protection measures and safeguards recommended in the EIA/EMP/risk analysis report/disaster	Environmental protection measures and safeguards recommended in EMP/risk analysis report/disaster management plan have been implemented.

S. No.	EC Conditions	Compliance Status
	management plan.	
xxxiii	The company shall take measures after completion of drilling process by well plugging and secured enclosures, decommissioning of rig upon abandonment of the well and drilling site shall be restored in original condition. In the event that no economic quantity of hydrocarbon is found a full abandonment plan shall be implemented for the drilling site in accordance with the applicable Indian Petroleum Regulations.	Wells will be abandoned and restored to natural position if found unsuitable for hydrocarbon extraction. Wells will be fully abandoned in compliance with Indian Petroleum Regulations in the event of no economic quality of hydrocarbon is found.
xxxiv	Occupational health surveillance of the workers shall be carried out as per the prevailing Acts and Rules.	All employees have undergone pre-employment medical examination. Periodical occupational health surveillance is conducted and records are maintained.
xxxv	In case the commercial viability of the project is established, the Company shall prepare a detailed plan for development of gas fields and obtain fresh environmental clearance from the Ministry.	MoEF granted amendment in phase II EC for drilling 4 nos. of additional supporting wells at each well site to meet the production capacity over and above 5 lakh m3 per day.
xxxvi	All the commitments made to the public during the Public Hearing / Public Consultation meeting held on 26th March, 2010 shall be satisfactorily implemented.	Commitments made during the public hearing are being implemented.
xxxvii	Company shall adopt Corporate Environment Policy as per the Ministry's O.M. No. J-11 013/41/2006-1A.II (1) dated 26th April, 2011 and implemented.	Corporate Environmental Policy is in place and being implemented. The copy of the same was already enclosed in the earlier Compliance report.
xxxviii	Provision shall be made for the housing of construction labour 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	We do not intend to bring labor from outside; hence construction of colony is not envisaged. We have been hiring local labour for all construction work. Nonetheless, we are providing all the necessary infrastructure and facilities like porta- cabins, mobile toilets, soak pit & septic tank, safe drinking water, medical health care etc.

S. No.	EC Conditions	Compliance Status
General Condition		
i	The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board (SPCB), State Government and any other statutory authority.	We comply with the stipulations made by the State Pollution Control Board (SPCB), State Government and statutory bodies.
ii	No further expansion or modification in the project shall be carried out without prior approval of the Ministry of Environment & Forests. In case of deviations or alterations in the project proposal from those submitted to this Ministry for clearance, a fresh reference shall be made to the Ministry to assess the adequacy of conditions imposed and to add additional environmental protection measures required, if any	For any further expansion and modification in project configuration, we would approach MoEF for the prior Environmental Clearance.
iii	The project authorities must strictly comply with the rules and regulations under Manufacture, Storage and Import of Hazardous Chemicals Rules, 2000 as amended subsequently. Prior approvals from Chief Inspectorate of Factories, Chief Controller of Explosives, Fire Safety Inspectorate etc. must be obtained, wherever applicable.	We comply with the rules and regulations under Manufacture, Storage and Import of Hazardous Chemicals Rules, 2000 as amended subsequently. Prior approvals will be obtained from appropriate authority.
iv	The project authorities must strictly comply with the rules and regulation with regarding to handling and disposal of Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 wherever applicable. Authorization from the State Pollution Control Board must be obtained for collections/ treatment/ storage/disposal of hazardous wastes	We comply with the rules and regulations with regard to handling and disposal of Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008. Authorization from the West Bengal Pollution Control Board has been obtained and valid till 2023. The copy of the same was already enclosed with earlier report.
v	The overall noise levels in and around the plant area shall be kept well within the standards by providing noise control measures including acoustic hoods,	Acoustic hoods, silencers, enclosures will be provided to high noise generating equipment. Noise levels will be restricted to the standards prescribed

S. No.	EC Conditions	Compliance Status
	silencers, enclosures etc. on all sources of noise generation. The ambient noise levels shall conform to the standards prescribed under EPA Rules, 1989 viz. 75 dBA (daytime) and 70 dBA (nighttime).	under EPA Rules, 1989. Regular noise monitoring has been carried out. Please find the noise monitoring results attached with this report as **Annexure II**.
vi	A separate Environmental Management Cell equipped with full-fledged laboratory facilities must be set up to carry out the environmental management and monitoring functions.	A dedicated environment management is currently in operation and functioning for implementation of environment management plan at large. The sampling and analysis of environmental parameters is been carried out by Scientific Research laboratory, Kolkata (MoEF recognized).
vii	As proposed, Rs. 7.80 Crores earmarked for environment protection and pollution control measures shall be used to implement the conditions stipulated by the Ministry of Environment and Forests as well as the State Government along with the implementation schedule for all the conditions stipulated herein. The funds so provided shall not be diverted for any other purposes.	The environment expenditure for the environment activities is attached as **Annexure VII**.
viii	The Regional Office of this Ministry/Central Pollution Control Board/State Pollution Control Board will monitor the stipulated conditions. A six monthly compliance report and the monitored data along with statistical interpretation shall be submitted to them regularly.	Support has been and will be extended to the Regional office of this Ministry/Central Pollution Control Board/State Pollution Control Board for monitoring the stipulated conditions. Six monthly compliance reports of environmental clearances are regularly submitted to Regional office of MoEF.
ix	A copy of clearance letter shall be sent by the proponent to concerned Panchayat, ZilaParishad / Municipal Corporation, Urban Local Body and the local NGO, if any, from whom suggestions/representations, if any, were received while processing the proposal. The clearance letter shall also be put on the web site of the company by the proponent	A copy of Environmental Clearance (EC) has been circulated to the local administration and was uploaded on the Company's website.

S. No.	EC Conditions	Compliance Status
x	The project proponent shall upload the status of compliance of the stipulated environment 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 the MOEF, the respective Zonal Office of CPCB and the WBPCB. The criteria pollutant levels namely; SPM, RSPM, S02, NOx, HC (Methane & Non-methane), VOCs (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the projects shall be monitored and displayed at a convenient location near the main gate of the company in the public domain.	Compliance reports have been uploaded on company's website & sent to Regional Office of the MOEF, the respective Zonal Office of CPCB and the WBPCB. The Ambient air quality monitoring has been carried out as per revised NAAQM criteria. The criteria pollutant levels namely; SPM, RSPM, SO_2, NOx, HC (Methane & Non-methane), VOCs has been monitored periodically and displayed at the main entrance of the Gas Gathering Station.
xi	The project proponent shall also submit six monthly reports on the status of the compliance of the stipulated environmental conditions including results of monitored data (both in hard copies as well as by e-mail) to the Regional Office of MOEF, the respective Zonal Office of CPCB and the WBPCB. The Regional Office of this Ministry /CPCB / WBPCB shall monitor the stipulated conditions.	We are submitting the six monthly compliance reports on the status of the compliance of the stipulated environmental conditions including results of monitored data (both in hard copies as well as by e-mail) to the Regional Office of MOEF, the respective Zonal Office of CPCB and the WBPCB.
xii	The environmental statement for each financial year ending 31st 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 conditions and shall also be sent to the respective Regional Offices of the MOEF by e-mail.	The environmental statement for each financial year ending 31st March as Form-V is being regularly submitted to West Bengal Pollution Control Board and the same is uploaded on the company's website along with the status of compliance report. The copy of the same is enclosed as Annexure VIII.
xiii	The Project Proponent shall inform the public that. The project has been accorded environmental	The advertisement was published in The Telegraph, Calcutta and Anand Bazaar Pathrika on 30th

S. No.	EC Conditions	Compliance Status
	clearance by the Ministry and copies of the clearance letter are available with the WBPCB and may also be seen at Website of the Ministry of Environment and Forests at http:/envfor.nic.in. This shall be advertised within seven days from the date of issue of the clearance letter, at least in two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned and a copy of the same shall be forwarded to the Regional office.	September, 2011. A copy of the same has been submitted in the compliance report during the period Apr'11-Sep'11.
xiv	Project authorities shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of commencing the land development work	Financial closure has been prepared in the year of 2010. The development work was commenced on 7th Dec, 2011 after obtaining consent to establish from WBPCB.

Essar Oil and Gas Exploration and Production Limited
RG (East)-CBM-2001/1 (Phase-IIA) Half Yearly Environment Clearance Compliance Report
(April'20 to September' 20)
Ref: Environment Clearance no. F. No. J-11011/351/2009- IA II (I) dated 18.06.2012

S. No.	EC Conditions	Compliance Status
4(I)	As proposed, supporting wells (4 nos.) on each pilot-cum-production wells (58 nos.) shall be drilled upto a depth of 1000m. No additional wells/support well shall be drilled without prior permission of this Ministry.	4 supporting wells will be drilled at each pilot-cum-production wells (58x4=232 wells). No additional wells will be drilled without prior approval from MoEF.
4(ii)	Unit shall monitor ground water table within one Km radius of each well during pre-monsoon (i.e. May) and winter season (November). Trend analysis shall be carried out and report shall be submitted to the Ministry's regional office at Bhubaneswar.	Monitoring could not be carried out due to the restrictions imposed by GoI due to the ongoing COVID 19 pandemic, from Apr'20 to Jun'20, and also the laboratory was closed. Monitoring of ground water table was not been carried out in pre-monsoon (i.e. May).
4(iii)	Permission from CGWA for dewatering shall be obtained and submitted to the Ministry's Regional Office at Bhubaneswar.	Dewatering is an inherent process of CBM extraction & carried at much deeper depths (>500 m) which does not disturb the usable drinking water aquifers located at the shallow depths. "No Objection Certificate" regarding the same has been obtained from State Water Investigation Directorate (SWID), Water Resources Investigation & Development Department, Govt. of West Bengal. (A copy of the letter is attached with previous compliance report). In west Bengal, SWID is the approved local authority of CGWA for giving permission for water withdrawal.
4(iv)	Smokeless flare shall be installed	Smokeless flares will be installed for complete combustion of CBM. Flaring will be carried out only during process upsets.

S. No.	EC Conditions	Compliance Status
4(v)	All measures shall be taken to control noise pollution during drilling process. Acoustic enclosure/barrier shall be installed.	Only silent generator sets that meets the specifications of CPCB are used. Acoustic enclosures have been provided to major noise generating equipment. Earplugs have been provided to the working personnel at the site.
4(vi)	Any produced water shall be treated and recycled/reused within the project area. Any excess water shall be discharged after treatment and meeting the standards prescribed by the CPCB/SPCB. Regular water quality monitoring shall be carried out and monitoring report shall be submitted to the respective Regional Office of the MoEF.	Produced water is treated by Reverse Osmosis (RO) system. Treated water is being reused for work-over & construction activities of other wells. Excess water is discharged to the nearby streams only after complying with the discharge standards. Please find the RO treated water monitoring results attached with this report as **Annexure IV**. Also, please find the surface water monitoring results attached with this report as **Annexure IV A**. Monitoring could not be carried out due to the restrictions imposed by GoI due to the ongoing COVID 19 pandemic, from Apr'20 to Jun'20, and also the laboratory was closed. Reports of Mar '20 and from Jul' 20 to Sep' 20 are attached.
4(vii)	Approach road shall be constructed prior to the drilling	Approach roads are being constructed wherever the access is not available.
4(viii)	Land subsidence shall be monitored regularly and monitoring report shall be submitted to CPCB, SPCB and respective Ministry's regional office	Land Subsidence Study is carried has been started from year 2012 and has been carried out regularly as condition Amendment 4 (viii). In the last 7 years, no significant land subsidence have been observed. The last report of September' 2020 is attached with this report as **Annexure VI**. There is no active subsidence observed in the study.
5	All the specific conditions and general conditions specified in the environmental clearance accorded vide Ministry's letter no.J-11011/351/2009-IA II (I) dated 23rd September, 2011 shall be implemented	All the specific and general conditions of the Phase-II Environmental Clearance are being implemented.

S. No.	EC Conditions	Compliance Status
6	Consent to Establish & Operate for the revised proposal shall be obtained from the W.B. Pollution Control Board	Regular CTE & CTO will be obtained from Pollution Control Board and will be submitted to MoEF.
7	No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment and Forests. In case of deviations or alterations in the project proposal from those submitted to this Ministry for clearance, a fresh reference shall be made to the Ministry to assess the adequacy of conditions imposed and to add additional environmental protection measures if required, if any.	No further expansion or modification will be done in the project configuration without prior approval from the MoEF.

Ambient Air Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration 1roduction Liited

(Compliance Period: Mar' 20 - Sep'20)

ANNEXURE I

Name of Location			MCS				GGS- 01				GGS- 02			
Date			Mar' 20	Jul' 20	Aug' 20	Sep' 20	Mar' 20	Jul' 20	Aug' 20	Sep' 20	Mar' 20	Jul' 20	Aug' 20	Sep' 20
Parameter	UoM	NAAQS LIMIT												
PM 2.5	$\mu g/m^3$	60	37.59	37.89	28.07	24.69	51.52	35.76	32.59	24.72	43.38	34.63	30.30	30.09
PM 10	$\mu g/m^3$	100	76.99	72.33	63.20	56.12	84.37	71.93	67.24	63.46	88.08	66.68	63.18	61.69
Nitrogen Dioxide	$\mu g/m^3$	80	39.62	40.87	38.83	39.86	37.51	40.22	39.01	39.18	38.35	40.49	39.89	40.53
Sulphur Dioxide	$\mu g/m^3$	80	6.32	6.26	5.75	5.21	6.32	5.78	5.71	4.85	5.88	6.17	6.01	4.85
Carbon Monoxide	mg/m^3	2	0.472	0.458	0.434	0.412	0.472	0.470	0.428	0.424	0.456	0.456	0.433	0.438
Hydrocarbon	mg/m^3	NIL	1.82	1.98	1.77	1.56	1.93	1.89	1.58	1.69	1.78	1.72	1.60	1.62
Mercury	mg/m^3		< 0.002	< 0.002	-	-	< 0.002	< 0.002	-	-	< 0.002	< 0.002	-	-
Hydrocarbon as Non Methane	mg/m^3	NIL	< 0.003	< 0.003	-	-	< 0.003	< 0.003	-	-	< 0.003	< 0.003	-	-
VOC's	$\mu g/m^3$		3.08	3.23	-	-	3.15	3.14	-	-	3.05	2.76	-	-
Benzo(a)Pyrene	ng/m^3	1	0.46	0.42	-	-	0.47	0.39	-	-	0.43	0.27	-	-
Ammonia	$\mu g/m^3$	400	30.05	31.57	-	-	29.77	30.12	-	-	28.81	27.76	-	-
Ozone	$\mu g/m^3$	180	45.28	44.19	-	-	44.76	40.67	-	-	4.57	43.19	-	-
Lead	$\mu g/m^3$	1	0.19	0.20	-	-	0.19	0.17	-	-	0.18	0.15	-	-
Nickel	ng/m^3	20	18.88	19.23	-	-	17.70	18.37	-	-	18.29	14.88	-	-
Arsenic	ng/m^3	6	1.82	1.88	-	-	1.82	1.79	-	-	1.78	1.70	-	-
Benzene	$\mu g/m^3$	5	1.80	1.78	-	-	1.89	1.73	-	-	1.83	1.59	-	-

Ambient Air Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration 2roduction Liited

(Compliance Period: Mar' 20 - Sep'20)

ANNEXURE I

Name of Location			Gopalpur Warehouse				PARULIA				SARENGA			
Date			Mar' 20	Jul' 20	Aug' 20	Sep' 20	Mar' 20	Jul' 20	Aug' 20	Sep' 20	Mar' 20	Jul' 20	Aug' 20	Sep' 20
Parameter	UoM	NAAQS LIMIT												
PM 2.5	$\mu g/m^3$	60	42.98	39.72	30.15	29.97	43.78	36.44	31.17	30.25	37.45	37.97	29.14	36.35
PM 10	$\mu g/m^3$	100	89.38	68.70	66.18	63.09	91.59	69.20	60.15	65.05	75.83	68.44	61.55	78.20
Nitrogen Dioxide	$\mu g/m^3$	80	39.94	41.50	39.34	38.26	39.27	41.43	40.78	39.21	40.59	40.53	40.76	38.80
Sulphur Dioxide	$\mu g/m^3$	80	6.28	5.64	5.76	5.91	6.50	5.66	5.64	4.86	6.50	5.97	5.96	6.03
Carbon Monoxide	mg/m^3	2	0.465	0.462	0.402	0.468	0.485	0.466	0.436	0.422	0.456	0.455	0.422	0.448
Hydrocarbon	mg/m^3	NIL	1.89	1.85	1.68	1.67	1.88	1.85	1.80	1.47	1.95	1.80	1.68	1.76
Mercury	mg/m^3		< 0.002	< 0.002	-	-	< 0.002	< 0.002	-	-	< 0.002	< 0.002	-	-
Hydrocarbon as Non Methane	mg/m^3	NIL	< 0.003	< 0.003	-	-	< 0.003	< 0.003	-	-	< 0.003	< 0.003	-	-
VOC's	$\mu g/m^3$		3.17	2.79	-	-	2.84	2.93	-	-	3.23	2.82	-	-
Benzo(a)Pyrene	ng/m^3	1	0.51	0.32	-	-	0.36	0.40	-	-	0.54	0.34	-	-
Ammonia	$\mu g/m^3$	400	29.73	28.31	-	-	25.12	27.45	-	-	30.96	29.55	-	-
Ozone	$\mu g/m^3$	180	45.59	44.78	-	-	40.48	42.76	-	-	46.17	44.24	-	-
Lead	$\mu g/m^3$	1	0.21	0.14	-	-	0.15	0.17	-	-	0.22	0.16	-	-
Nickel	ng/m^3	20	19.14	13.62	-	-	15.84	16.34	-	-	19.35	15.88	-	-
Arsenic	ng/m^3	6	1.93	1.86	-	-	1.63	1.71	-	-	1.99	1.74	-	-
Benzene	$\mu g/m^3$	5	1.92	1.65	-	-	1.70	1.66	-	-	1.97	1.61	-	-

Ambient Air Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration 3roduction Liited

(Compliance Period: Mar' 20 - Sep'20)

ANNEXURE I

Name of Location			SARASWATIGUNJ				NACHAN				PRATPPUR			
Date			Mar' 20	Jul' 20	Aug' 20	Sep' 20	Mar' 20	Jul' 20	Aug' 20	Sep' 20	Mar' 20	Jul' 20	Aug' 20	Sep' 20
Parameter	UoM	NAAQS LIMIT												
PM 2.5	µg/m^3	60	40.14	38.48	29.26	32.89	47.46	36.69	29.94	24.33	37.77	40.11	30.60	29.10
PM 10	µg/m^3	100	84.46	70.43	64.09	72.27	87.79	68.29	59.81	58.53	75.20	70.90	64.62	64.08
Nitrogen Dioxide	µg/m^3	80	36.47	39.51	38.90	39.29	40.81	41.55	39.31	39.45	39.94	41.59	39.56	38.83
Sulphur Dioxide	µg/m^3	80	6.28	6.05	5.89	6.05	6.28	5.97	5.65	5.09	6.28	6.48	5.48	5.22
Carbon Monoxide	mg/m^3	2	0.485	0.472	0.432	0.472	0.492	0.454	0.412	0.402	0.470	0.464	0.446	0.428
Hydrocarbon	mg/m^3	NIL	1.92	1.82	1.72	1.89	1.81	1.78	1.78	1.53	2.05	1.95	1.62	1.65
Mercury	mg/m^3		< 0.002	< 0.002	-	-	< 0.002	< 0.002	-	-	< 0.002	< 0.002	-	-
Hydrocarbon as Non Methane	mg/m^3	NIL	< 0.003	< 0.003	-	-	< 0.003	< 0.003	-	-	< 0.003	< 0.003	-	-
VOC's	µg/m^3		3.03	2.95	-	-	3.01	2.83	-	-	3.19	3.15	-	-
Benzo(a)Pyrene	ng/m^3	1	0.42	0.33	-	-	0.40	0.31	-	-	0.53	0.34	-	-
Ammonia	µg/m^3	400	29.05	28.45	-	-	26.33	29.33	-	-	30.52	28.12	-	-
Ozone	µg/m^3	180	43.16	42.58	-	-	41.72	42.29	-	-	45.53	42.27	-	-
Lead	µg/m^3	1	0.15	0.16	-	-	0.17	0.16	-	-	0.21	0.19	-	-
Nickel	ng/m^3	20	14.84	16.73	-	-	16.29	15.89	-	-	19.07	13.82	-	-
Arsenic	ng/m^3	6	1.61	1.63	-	-	1.74	1.78	-	-	1.97	1.75	-	-
Benzene	µg/m^3	5	1.79	1.67	-	-	1.75	1.62	-	-	2.01	1.74	-	-

Ambient Air Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration 4roduction Liited

(Compliance Period: Mar' 20 - Sep'20)

ANNEXURE I

Name of Location			BANSIA				GGS-04				KANTABERIA			
Date			Mar' 20	Jul' 20	Aug' 20	Sep' 20	Mar' 20	Jul' 20	Aug' 20	Sep' 20	Mar' 20	Jul' 20	Aug' 20	Sep' 20
Parameter	UoM	NAAQS LIMIT												
PM 2.5	$\mu g/m^3$	60	39.66	35.87	31.47	34.93	42.84	33.91	28.50	43.72	51.52	34.96	34.13	27.57
PM 10	$\mu g/m^3$	100	83.01	67.23	63.14	63.02	83.53	69.59	61.89	82.22	84.37	70.40	66.31	61.38
Nitrogen Dioxide	$\mu g/m^3$	80	38.35	41.35	40.21	38.56	41.91	41.08	39.75	38.74	37.51	39.45	38.78	38.60
Sulphur Dioxide	$\mu g/m^3$	80	6.21	6.26	5.84	4.77	6.50	5.76	5.79	5.94	6.32	6.16	6.00	5.11
Carbon Monoxide	mg/m^3	2	0.474	0.468	0.428	0.418	0.468	0.454	0.426	0.468	0.472	0.468	0.422	0.418
Hydrocarbon	mg/m^3	NIL	2.11	1.92	1.84	1.59	1.84	1.79	1.72	1.79	1.93	1.84	1.68	1.63
Mercury	mg/m^3		< 0.002	< 0.002	-	-	< 0.002	< 0.002	-	-	< 0.002	< 0.002	-	-
Hydrocarbon as Non Methane	mg/m^3	NIL	< 0.003	< 0.003	-	-	< 0.003	< 0.003	-	-	< 0.003	< 0.003	-	-
VOC's	$\mu g/m^3$		3.28	2.88	-	-	3.12	2.97	-	-	3.15	2.89	-	-
Benzo(a)Pyrene	ng/m^3	1	0.57	0.36	-	-	0.48	37.00	-	-	0.47	0.35	-	-
Ammonia	$\mu g/m^3$	400	31.17	27.46	-	-	27.74	28.45	-	-	29.77	28.89	-	-
Ozone	$\mu g/m^3$	180	45.88	41.27	-	-	45.04	43.36	-	-	44.76	43.37	-	-
Lead	$\mu g/m^3$	1	0.23	0.16	-	-	0.20	0.13	-	-	0.19	0.15	-	-
Nickel	ng/m^3	20	19.78	16.04	-	-	18.87	17.65	-	-	17.70	13.29	-	-
Arsenic	ng/m^3	6	2.03	1.68	-	-	1.84	1.73	-	-	1.82	1.76	-	-
Benzene	$\mu g/m^3$	5	2.12	1.65	-	-	1.85	1.63	-	-	1.89	1.69	-	-

Ambient Air Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration 5roduction Liited

(Compliance Period: Mar' 20 - Sep'20)

ANNEXURE I

Name of Location			JAMGORA				JATGORIA				KULDIHA			
Date			Mar' 20	Jul' 20	Aug' 20	Sep' 20	Mar' 20	Jul' 20	Aug' 20	Sep' 20	Mar' 20	Jul' 20	Aug' 20	Sep' 20
Parameter	UoM	NAAQS LIMIT												
PM 2.5	µg/m^3	60	44.65	37.56	29.64	25.17	44.65	30.15	30.37	24.56	44.44	31.04	30.60	38.43
PM 10	µg/m^3	100	80.41	65.87	60.33	58.04	80.41	71.72	67.25	58.18	91.60	66.18	62.94	78.12
Nitrogen Dioxide	µg/m^3	80	41.47	41.50	40.37	39.20	41.47	39.32	37.94	37.59	37.51	38.88	37.78	40.43
Sulphur Dioxide	µg/m^3	80	6.50	6.03	5.73	5.06	6.50	6.28	5.77	4.92	6.10	5.74	5.62	6.18
Carbon Monoxide	mg/m^3	2	0.464	0.484	0.430	0.432	0.464	0.462	0.408	0.402	0.492	0.488	0.045	0.480
Hydrocarbon	mg/m^3	NIL	1.81	1.76	1.70	1.57	1.81	1.74	1.70	1.71	1.85	1.78	1.64	1.83
Mercury	mg/m^3		< 0.002	< 0.002	-	-	< 0.002	< 0.002	-	-	< 0.002	< 0.002	-	-
Hydrocarbon as Non Methane	mg/m^3	NIL	< 0.003	< 0.003	-	-	< 0.003	< 0.003	-	-	< 0.003	< 0.003	-	-
VOC's	µg/m^3		2.99	2.71	-	-	2.99	3.05	-	-	2.97	2.81	-	-
Benzo(a)Pyrene	ng/m^3	1	0.39	0.31	-	-	0.39	0.37	-	-	0.37	0.28	-	-
Ammonia	µg/m^3	400	27.76	27.31	-	-	27.76	29.32	-	-	27.14	26.56	-	-
Ozone	µg/m^3	180	43.18	44.58	-	-	43.18	41.16	-	-	42.29	41.77	-	-
Lead	µg/m^3	1	0.18	0.13	-	-	0.18	0.18	-	-	0.18	0.12	-	-
Nickel	ng/m^3	20	18.49	13.08	-	-	18.49	15.84	-	-	18.23	14.45	-	-
Arsenic	ng/m^3	6	1.85	1.65	-	-	1.85	1.75	-	-	1.77	1.59	-	-
Benzene	µg/m^3	5	1.76	1.56	-	-	1.76	1.71	-	-	1.71	1.54	-	-

Noise in Surrounding Villages (Leq dB (A))					
Date of sampling	LOCATION	DAY TIME		NIGHT TIME	
		Permissible Limit as per CPCB dB(A)	Noise Level dB(A)	Permissible Limit as per CPCB dB(A)	Noise Level dB(A)
21.09.2020 TO 22.09.2020	Jatgoria (EDD 005)	75	68.18	70	59.08
14.09.2020 TO 15.09.2020	Saraswatigunj (EDI 039)	75	62.54	70	59.05
19.09.2020 TO 20.09.2020	Kantaberia EDD 012	75	69.33	55	67.56
19.09.2020 TO 20.09.2020	Khatgoria (GGS 001)	75	65.41	70	60.07
15.09.2020 TO 16.09.2020	Jamgora (EDD 429)	75	66.17	70	58.52
14.09.2020 TO 15.09.2020	Kuldiha (EDN 099)	75	68.96	70	57.94
18.09.2020 TO 19.09.2020	Pratappur (EDD 049)	75	67.28	70	60.41
23.09.2020 TO 24.09.2020	Bansia (EDD 411)	75	65.94	70	63.66
22.09.2020 TO 23.09.2020	Parulia (EDC 413)	75	67.76	70	62.69
22.09.2020 TO 23.09.2020	Nachan (EDD 053)	75	68.33	70	67.97
16.09.2020 TO 17.09.2020	Akandara	75	68.58	70	66.08
16.09.2020 TO 17.09.2020	Gopalpur Warehouse	75	65.14	70	59.72
22.09.2020 TO 23.09.2020	Malandighi	75	63.68	70	59.04
15.09.2020 TO 16.09.2020	Gopalpur (GGS 004)	75	67.39	70	62.54
15.09.2020 TO 16.09.2020	Sarenga	75	63.29	70	58.97

Produced Water Analysis Report of CBM Raniganj Project of Essar Oil and Gas Exploration and Production Limited
(Compliance Period: Mar'20 -Sep'20)

ANNEXURE III

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDI-038-V1 (Swaraswatigunj)	EDI-039-D3 (Swaraswatigunj)	EDI-032-D1 (Akandara)	EDD-053-D1 (Nachan)	EDD-053-D4 (Nachan)
MONTH					March' 20				
1	pH		5.5 to 9.0	5.5-9.0	7.49	7.20	7.21	7.92	7.59
2	Temperature			40 deg	39.8°C	39.9°C	38.9°C	38.8°C	43.4°C
3	Total Suspended Solids	mg/l	100	100	4	4	5	18	3
4	Total Dissolved Solids	mg/l	---	2100	3286	4066	3392	2658	1962
5	Chloride	mg/l	---	600	1142	1620	1210	920	730
6	Total Hardness	mg/l	---	1000	95.00	47.50	83.20	43.60	31.70
7	Sulphate	mg/l	---	1000	10.6	12.3	8.6	6.6	5.2
8	Calcium	mg/l		100	25.4	12.7	23.8	12.7	7.9
9	Magnesium	mg/l	---	10	7.7	3.8	5.8	2.9	2.9
10	Dissolved Oxygen	mg/l		1.2	5.1	4.3	4.9	4.9	5.0
11	Biological Oxygen Demand, 3 Days at 27ºC	mg/l	30	30	<2	<2	<2	<2	<2
12	Chemical Oxygen Demand	mg/l	250	100	<8	8.0	<8	<8	<8
13	Oil & Grease (Hexane Extract)	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphide	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	2.4	3.15	2.65	1.65	0.93
17	Total Chromium	mg/l	2	0.1	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	0.1	0.024	0.036	0.022	0.017	0.019
19	Copper	mg/l	---	0.2	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l		3	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l		0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
23	SAR		---	0.1	57.4	116.5	67.8	81.1	65.2
24	Aluminium	mg/l	---		<0.01	<0.01	<0.01	<0.01	<0.01

Produced Water Analysis Report of CBM Raniganj Project of Essar Oil and Gas Exploration and Production Limited
(Compliance Period: Mar'20 -Sep'20)

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDI-038-V1 (Swaraswatigunj)	EDI-039-D3 (Swaraswatigunj)	EDI-032-D1 (Akandara)	EDD-053-D1 (Nachan)	EDD-053-D4 (Nachan)
MONTH					March' 20				
25	Lithium	mg/l			<0.5	<0.5	<0.5	<0.5	<0.5
26	Molybdenum	mg/l	---		<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---		<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---		<0.1	<0.1	<0.1	<0.1	<0.1
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			1007.00	1110.00	964.00	518.00	573.00
33	Sodium	mg/l	---		1280.0	1850.0	1420.0	1230.0	840.0
34	Cyanide	mg/l	0.2	0.2	<0.02	<0.02	<0.02	<0.02	<0.02
35	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01
36	% Sodium			60	96.7	98.8	97.4	98.4	98.3

Produced Water Analysis Report of CBM Raniganj Project of Essar Oil and Gas Exploration and Production Limited
(Compliance Period: Mar'20 -Sep'20)

ANNEXURE III

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDG-075-D1 (Parulia)	EDG-075-D7 (Parulia)	EDD-049-D4 (Pratappur)	EDD-015 D-4 (Bargoria)	EDD-007-D1 (Gopedanga)
MONTH					March' 20				
1	pH		5.5 to 9.0	5.5-9.0	7.72	7.55	7.46	7.77	7.91
2	Temperature			40 deg	41.9°C	42.9°C	36.7°C	46.7°C	38.4°C
3	Total Suspended Solids	mg/l	100	100	<2	<2	6	<2	2
4	Total Dissolved Solids	mg/l	---	2100	1396	1944	2324	2526	1534
5	Chloride	mg/l	---	600	594	836	1030	984	610
6	Total Hardness	mg/l	---	1000	35.60	47.5	39.60	51.50	35.60
7	Sulphate	mg/l	---	1000	5.7	8.3	9.2	9.7	4.9
8	Calcium	mg/l		100	9.5	11.1	11.1	14.2	7.9
9	Magnesium	mg/l	---	10	2.9	4.8	2.9	3.8	3.8
10	Dissolved Oxygen	mg/l		1.2	5.3	4.4	3.5	3.7	4.3
11	Biological Oxygen Demand, 3 Days at 27ºC	mg/l	30	30	<2	<2	<2	<2	<2
12	Chemical Oxygen Demand	mg/l	250	100	<8	<8	8.0	8.0	<8
13	Oil & Grease (Hexane Extract)	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphide	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	1.10	1.75	2.05	1.9	1.25
17	Total Chromium	mg/l	2	0.1	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	0.1	0.012	0.014	0.016	0.020	0.013
19	Copper	mg/l	---	0.2	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l		3	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l		0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
23	SAR		---	0.1	39.8	59.3	77.3	66.1	42.8
24	Aluminium	mg/l	---		<0.01	<0.01	<0.01	<0.01	<0.01

Produced Water Analysis Report of CBM Raniganj Project of Essar Oil and Gas Exploration and Production Limited
(Compliance Period: Mar'20 -Sep'20)

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDG-075-D1 (Parulia)	EDG-075-D7 (Parulia)	EDD-049-D4 (Pratappur)	EDD-015 D-4 (Bargoria)	EDD-007-D1 (Gopedanga)
MONTH					March' 20				
25	Lithium	mg/l			<0.5	<0.5	<0.5	<0.5	<0.5
26	Molybdenum	mg/l	---		<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---		<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---		<0.1	<0.1	<0.1	<0.1	<0.1
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			451.00	280	292.00	524.00	415.00
33	Sodium	mg/l	---		550.0	940	1120.0	1095.0	590.0
34	Cyanide	mg/l	0.2	0.2	<0.02	<0.02	<0.02	<0.02	<0.02
35	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01
36	% Sodium			60	97.1	97.7	98.4	97.9	97.3

Produced Water Analysis Report of CBM Raniganj Project of Essar Oil and Gas Exploration and Production Limited
(Compliance Period: Mar'20 -Sep'20)

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-003-D2 (Bargoria)	EDD-012-D1 (Kantaberia)	EDC-072-V1 (Parulia)	EDD-049-D1 (Pratappur)	EDD-054-D4(Nachan)
MONTH					March' 20		July' 20		
1	pH		5.5 to 9.0	5.5-9.0	7.63	7.52	7.61	7.59	7.53
2	Temperature			40 deg	43.6°C	38.2°C	38.9°C	37.8°C	35.5°C
3	Total Suspended Solids	mg/l	100	100	<2	<2	<2	<2	<2
4	Total Dissolved Solids	mg/l	---	2100	2356	2768	2640	2960	2898
5	Chloride	mg/l	---	600	908	1248	775	825	805
6	Total Hardness	mg/l	---	1000	43.60	39.60	47.50	51.50	43.50
7	Sulphate	mg/l	---	1000	7.3	8.5	5.7	4.9	6.0
8	Calcium	mg/l		100	12.7	9.5	11.1	12.7	9.5
9	Magnesium	mg/l	---	10	2.9	3.8	4.8	4.8	4.8
10	Dissolved Oxygen	mg/l		1.2	4.0	3.7	5.7	6.1	5.9
11	Biological Oxygen Demand, 3 Days at 27ºC	mg/l	30	30	<2	<2	<2	<2	<2
12	Chemical Oxygen Demand	mg/l	250	100	<8	<8	<8	<8	<8
13	Oil & Grease (Hexane Extract)	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphide	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	1.65	1.8	2.08	1.95	2.11
17	Total Chromium	mg/l	2	0.1	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	0.1	0.022	0.025	0.017	0.011	0.024
19	Copper	mg/l	---	0.2	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l		3	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l		0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
23	SAR		---	0.1	58.3	74.6	34	52	534
24	Aluminium	mg/l	---		<0.01	<0.01	<0.01	<0.01	<0.01

ANNEXURE III

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-003-D2 (Bargoria)	EDD-012-D1 (Kantaberia)	EDC-072-V1 (Parulia)	EDD-049-D1 (Pratappur)	EDD-054-D4(Nachan)
MONTH					March' 20		July' 20		
25	Lithium	mg/l			<0.5	<0.5	<0.5	<0.5	<0.5
26	Molybdenum	mg/l	---		<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---		<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---		<0.1	<0.1	<0.1	<0.1	<0.1
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			634.00	647.00	719.00	732.00	793.00
33	Sodium	mg/l	---		885.0	1080.0	820.0	860.0	810.0
34	Cyanide	mg/l	0.2	0.2	<0.02	<0.02	<0.02	<0.02	<0.02
35	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01
36	% Sodium			60	97.8	98.1	96.1	97.3	97.6

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ANNEXURE III

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-052-D2 (Pratappur)	EDH-033-V1 (Labnapara)	EDI-032-D2 (Akandara)	EDD-021-D3 (Jambon)	EDD-008-D3 (Jambon)
MONTH					July' 20				
1	pH		5.5 to 9.0	5.5-9.0	7.38	7.76	7.15	7.66	7.92
2	Temperature			40 deg	35.7°C	34.4°C	39.9°C	37.6°C	37.5°C
3	Total Suspended Solids	mg/l	100	100	<2	7	3	<2	<2
4	Total Dissolved Solids	mg/l	---	2100	3418	4818	5164	2724	2680
5	Chloride	mg/l	---	600	1210	1620	1910	1170	1085
6	Total Hardness	mg/l	---	1000	59.40	67.30	63.30	27.7	23.70
7	Sulphate	mg/l	---	1000	6.1	4.5	7.0	5.5	6.0
8	Calcium	mg/l		100	14.3	15.8	14.3	6.3	6.3
9	Magnesium	mg/l	---	10	5.8	6.7	6.7	2.9	1.9
10	Dissolved Oxygen	mg/l		1.2	5.6	5.3	5.7	6.1	5.0
11	Biological Oxygen Demand, 3 Days at 27ºC	mg/l	30	30	<2	<2	<2	<2	<2
12	Chemical Oxygen Demand	mg/l	250	100	<8	<8	<8	<8	<8
13	Oil & Grease (Hexane Extract)	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphide	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	1.9	3.25	3.60	2.05	2.8
17	Total Chromium	mg/l	2	0.1	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	0.1	0.022	0.029	0.034	0.019	0.024
19	Copper	mg/l	---	0.2	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l		3	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l		0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
23	SAR		---	0.1	72.7	81.5	110	90.4	99.6
24	Aluminium	mg/l	---		<0.01	<0.01	<0.01	<0.01	<0.01

ANNEXURE III

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-052-D2 (Pratappur)	EDH-033-V1 (Labnapara)	EDI-032-D2 (Akandara)	EDD-021-D3 (Jambon)	EDD-008-D3 (Jambon)
MONTH					July' 20				
25	Lithium	mg/l			<0.5	<0.5	<0.5	<0.5	<0.5
26	Molybdenum	mg/l	---		<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---		<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---		<0.1	<0.1	<0.1	<0.1	<0.1
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			1010.00	1112.00	1183	732.00	866.00
33	Sodium	mg/l	---		1290.0	1540.0	2015	1090.0	1110.0
34	Cyanide	mg/l	0.2	0.2	<0.02	<0.02	<0.02	<0.02	<0.02
35	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01
36	% Sodium			60	94.9	98.0	98.6	98.9	99.0

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ANNEXURE III

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-004 V-1 (Bargoria)	EDD-012-V1 (Kantaberia)	EDE-005-D2 (Jatgoria)	EDI-038-D2 (Swaraswatigunj)	EDD-017-D3 (Pratappur)
MONTH					July' 20				August' 20
1	pH		5.5 to 9.0	5.5-9.0	7.60	7.89	7.80	7.10	7.52
2	Temperature			40 deg	41.9°C	36.9°C	35.1°C	37.9°C	38.9°C
3	Total Suspended Solids	mg/l	100	100	<2	<2	<2	4	<2
4	Total Dissolved Solids	mg/l	---	2100	2240	2984	2868	5248	2642
5	Chloride	mg/l	---	600	910	1190	1060	2110	815
6	Total Hardness	mg/l	---	1000	35.60	35.60	31.70	95.00	39.60
7	Sulphate	mg/l	---	1000	3.9	5.7	6.2	7.5	7.5
8	Calcium	mg/l		100	7.9	7.9	7.9	23.8	3.5
9	Magnesium	mg/l	---	10	3.8	3.8	2.9	8.7	3.8
10	Dissolved Oxygen	mg/l		1.2	5.1	5.3	5.0	4.6	4.1
11	Biological Oxygen Demand, 3 Days at 27ºC	mg/l	30	30	<2	<2	<2	<2	<2
12	Chemical Oxygen Demand	mg/l	250	100	<8	<8	<8	<8	<8
13	Oil & Grease (Hexane Extract)	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphide	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	3.11	2.8	2.55	3.45	4.15
17	Total Chromium	mg/l	2	0.1	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	0.1	0.021	0.024	0.027	0.036	0.029
19	Copper	mg/l	---	0.2	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l		3	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l		0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
23	SAR		---	0.1	61.3	92	92.1	88.2	65
24	Aluminium	mg/l	---		<0.01	<0.01	<0.01	<0.01	<0.01

ANNEXURE III

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-004 V-1 (Bargoria)	EDD-012-V1 (Kantaberia)	EDE-005-D2 (Jatgoria)	EDI-038-D2 (Swaraswatigunj)	EDD-017-D3 (Pratappur)
MONTH					July' 20				August' 20
25	Lithium	mg/l			<0.5	<0.5	<0.5	<0.5	<0.5
26	Molybdenum	mg/l	---		<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---		<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---		<0.1	<0.1	<0.1	<0.1	<0.1
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			671.00	780.00	866.00	1110.00	805.00
33	Sodium	mg/l	---		840.0	1260.0	1190.0	1980.0	940.0
34	Cyanide	mg/l	0.2	0.2	<0.02	<0.02	<0.02	<0.02	<0.02
35	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01
36	% Sodium			60	98.1	98.7	98.8	97.8	98.1

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ANNEXURE III

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-015-D4 (Bargoria)	EDD-401-D1(Khargoria)	EDD-406-D2 (Jamgora)	EDD-406-D3 (Jamgora)	EDD-429-D1 (Jamgora)	EDD-429-D2 (Jamgora)
MONTH					August' 20					
1	pH		5.5 to 9.0	5.5-9.0	7.61	7.70	7.94	7.82	7.35	7.61
2	Temperature			40 deg	37.8°C	35.5°C	35.7°C	34.4°C	39.9°C	37.6°C
3	Total Suspended Solids	mg/l	100	100	<2	<2	<2	<2	<2	<2
4	Total Dissolved Solids	mg/l	---	2100	2126	1578	958	854	1088	1064
5	Chloride	mg/l	---	600	790	570	356	290	450	405
6	Total Hardness	mg/l	---	1000	19.80	43.60	23.80	15.80	27.70	27.7
7	Sulphate	mg/l	---	1000	6.0	4.7	4.0	3.8	4.7	5.1
8	Calcium	mg/l		100	4.8	11.1	6.3	3.2	6.3	7.9
9	Magnesium	mg/l	---	10	1.9	4.8	1.9	1.9	2.9	1.9
10	Dissolved Oxygen	mg/l		1.2	4.9	5.3	5.5	5.0	4.7	5
11	Biological Oxygen Demand, 3 Days at 27ºC	mg/l	30	30	<2	<2	<2	<2	<2	<2
12	Chemical Oxygen Demand	mg/l	250	100	<8	<8	<8	<8	<8	<8
13	Oil & Grease (Hexane Extract)	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphide	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	2.1	1.8	0.4	0.62	0.45	0.53
17	Total Chromium	mg/l	2	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	0.1	0.021	0.017	0.014	0.016	0.020	0.015
19	Copper	mg/l	---	0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l		3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	SAR		---	0.1	86.5	42.1	36.5	39.5	26.7	27
24	Aluminium	mg/l	---		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-015-D4 (Bargoria)	EDD-401-D1(Khargoria)	EDD-406-D2 (Jamgora)	EDD-406-D3 (Jamgora)	EDD-429-D1 (Jamgora)	EDD-429-D2 (Jamgora)
MONTH					August' 20					
25	Lithium	mg/l			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
26	Molybdenum	mg/l	---		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			680.00	543.00	226.00	311.00	250	262.00
33	Sodium	mg/l	---		885.0	640.0	410.0	360.0	475	480.0
34	Cyanide	mg/l	0.2	0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
35	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
36	% Sodium			60	99	97	97.4	98.0	94.6	94.6

Produced Water Analysis Report of CBM Raniganj Project of Essar Oil and Gas Exploration and Production Limited
(Compliance Period: Mar'20 -Sep'20)

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-003-D1 (Bargoria)	EDD-053-D5 (Nachan)	EDI-032 (Akandara)	EDI-123-D5 (Lohaguri)	EDN-162-D7 (Bhalukunda)	EDG-77-D5 (Kamalpur)
MONTH					August' 20					September' 20
1	pH		5.5 to 9.0	5.5-9.0	8.23	7.58	7.30	6.45	6.75	7.91
2	Temperature			40 deg	37.5°C	41.9°C	36.9°C	35.1°C	37.9°C	43.8°C
3	Total Suspended Solids	mg/l	100	100	<2	4	3	29	11	<2
4	Total Dissolved Solids	mg/l	---	2100	2348	2984	4124	7348	3980	2214
5	Chloride	mg/l	---	600	905	1086	1610	2460	1430	908
6	Total Hardness	mg/l	---	1000	39.60	43.60	75.20	558.30	752.40	39.60
7	Sulphate	mg/l	---	1000	6.2	6.4	7.5	11.0	8.5	4.2
8	Calcium	mg/l		100	11.1	11.1	19	142.8	190	9.5
9	Magnesium	mg/l	---	10	2.9	3.8	6.7	54.8	67.3	3.8
10	Dissolved Oxygen	mg/l		1.2	4.3	3.9	4.1	3.9	4.8	5.7
11	Biological Oxygen Demand, 3 Days at 27ºC	mg/l	30	30	<2	<2	<2	2	<2	<2
12	Chemical Oxygen Demand	mg/l	250	100	<8	<8	8.0	10.0	<8	<8
13	Oil & Grease (Hexane Extract)	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphide	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	1.7	4.2	1.6	2.05	1.2	1.9
17	Total Chromium	mg/l	2	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	0.1	0.025	0.031	0.022	0.027	0.019	0.024
19	Copper	mg/l	---	0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l		3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	SAR		---	0.1	60.9	75.5	86.3	46.2	24.3	61.3
24	Aluminium	mg/l	---		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-003-D1 (Bargoria)	EDD-053-D5 (Nachan)	EDI-032 (Akandara)	EDI-123-D5 (Lohaguri)	EDN-162-D7 (Bhalukunda)	EDG-77-D5 (Kamalpur)
MONTH					August' 20					September' 20
25	Lithium	mg/l			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
26	Molybdenum	mg/l	---		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			836.00	1037.00	1208.00	1854.00	1196.00	549.00
33	Sodium	mg/l	---		880.0	1145.0	1720.0	2510.0	1535.0	885.0
34	Cyanide	mg/l	0.2	0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
35	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
36	% Sodium			60	98.0	98.3	98	90.7	81.7	98

Produced Water Analysis Report of CBM Raniganj Project of Essar Oil and Gas Exploration and Production Limited
(Compliance Period: Mar'20 -Sep'20)

ANNEXURE III

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDG-74-D4 (Parulia)	EDD-407-D1(Jamgora)	EDD-49-D1 (Pratappur)	EDD-405-D5 (Kalikapur)	EDD-003-D2 (Bargoria)	EDD-022-D1 (Gopedanga)
MONTH					September' 20					
1	pH		5.5 to 9.0	5.5-9.0	7.60	8.11	7.30	7.52	7.92	7.58
2	Temperature			40 deg	35.6°C	39.8°C	38.5°C	46.5°C	43.2°C	39.5°C
3	Total Suspended Solids	mg/l	100	100	<2	<2	<2	<2	<2	<2
4	Total Dissolved Solids	mg/l	---	2100	1768	1336	2638	1730	2288	1804
5	Chloride	mg/l	---	600	690	530	945	740	870	735
6	Total Hardness	mg/l	---	1000	43.60	31.70	35.60	35.60	43.50	39.6
7	Sulphate	mg/l	---	1000	3.0	<2.5	6.6	4.0	5.2	3.5
8	Calcium	mg/l		100	11.1	7.9	7.9	7.9	9.5	9.5
9	Magnesium	mg/l	---	10	3.8	2.9	3.8	3.8	4.8	3.8
10	Dissolved Oxygen	mg/l		1.2	5	5.3	5.1	5.0	5.5	5.4
11	Biological Oxygen Demand, 3 Days at 27ºC	mg/l	30	30	<2	<2	<2	<2	<2	<2
12	Chemical Oxygen Demand	mg/l	250	100	<8	<8	<8	<8	<8	<8
13	Oil & Grease (Hexane Extract)	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphide	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	1.5	1.1	2.4	1.85	2.10	1.9
17	Total Chromium	mg/l	2	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	0.1	0.018	0.012	0.033	0.020	0.029	0.023
19	Copper	mg/l	---	0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l		3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	SAR		---	0.1	46.5	47.3	73.7	55.9	59.4	49.5
24	Aluminium	mg/l	---		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDG-74-D4 (Parulia)	EDD-407-D1(Jamgora)	EDD-49-D1 (Pratappur)	EDD-405-D5 (Kalikapur)	EDD-003-D2 (Bargoria)	EDD-022-D1 (Gopedanga)
MONTH					September' 20					
25	Lithium	mg/l			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
26	Molybdenum	mg/l	---		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			452.00	317.00	915.00	390.00	683	616.00
33	Sodium	mg/l	---		705.0	610.0	1010.0	765.0	902	715.0
34	Cyanide	mg/l	0.2	0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
35	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
36	% Sodium			60	97.3	97.7	98.4	98.0	97.9	97.5

Produced Water Analysis Report of CBM Raniganj Project of Essar Oil and Gas Exploration and Production Limited
(Compliance Period: Mar'20 -Sep'20)

ANNEXURE III

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDE-013-D2 (Jatgoria)	EDI-115-V1 (Saraswatigunj)	EDI-041 D3 (Ghatakdanga)	EDI-032-D3 (Akandara)	EDI-071-D2 (Malandighi)
MONTH					September' 20				
1	pH		5.5 to 9.0	5.5-9.0	7.64	7.40	7.23	7.37	6.90
2	Temperature			40 deg	36.1°C	35.6°C	37.8°C	36.8°C	36.4°C
3	Total Suspended Solids	mg/l	100	100	<2	5	14	8	16
4	Total Dissolved Solids	mg/l	---	2100	2198	2068	4228	4636	7742
5	Chloride	mg/l	---	600	875	806	1505	1620	2890
6	Total Hardness	mg/l	---	1000	55.40	51.50	122.70	67.30	403.90
7	Sulphate	mg/l	---	1000	4.2	4.8	7.7	7.2	9.0
8	Calcium	mg/l		100	12.7	11.1	30.1	15.8	101.6
9	Magnesium	mg/l	---	10	5.7	5.7	11.5	6.7	36.5
10	Dissolved Oxygen	mg/l		1.2	5.0	4.8	4.0	4.7	3.7
11	Biological Oxygen Demand, 3 Days at 27ºC	mg/l	30	30	<2	<2	2	<2	2
12	Chemical Oxygen Demand	mg/l	250	100	<8	<8	10.0	<8	12.0
13	Oil & Grease (Hexane Extract)	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphide	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	2.55	1.75	2.45	2.9	3.6
17	Total Chromium	mg/l	2	0.1	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	0.1	0.025	0.031	0.031	0.029	0.043
19	Copper	mg/l	---	0.2	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l		3	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l		0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
23	SAR		---	0.1	51.9	47.8	58.1	90.1	67.3
24	Aluminium	mg/l	---		<0.01	<0.01	<0.01	<0.01	<0.01

ANNEXURE III

S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDE-013-D2 (Jatgoria)	EDI-115-V1 (Saraswatigunj)	EDI-041 D3 (Ghatakdanga)	EDI-032-D3 (Akandara)	EDI-071-D2 (Malandighi)
MONTH					September' 20				
25	Lithium	mg/l			<0.5	<0.5	<0.5	<0.5	<0.5
26	Molybdenum	mg/l	---		<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---		<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---		<0.1	<0.1	<0.1	<0.1	<0.1
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			762.00	555.00	1513.00	1842.00	2464.00
33	Sodium	mg/l	---		890.0	790.0	1480.0	1705.0	3110.0
34	Cyanide	mg/l	0.2	0.2	<0.02	<0.02	<0.02	<0.02	<0.02
35	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01
36	% Sodium			60	97.2	97.1	96.3	98.2	94.4

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					March' 20						
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	GGS 01			EDD 050			EDH 044
					R.O-Inlet	R.O-Outlet	R.O-Reject	R.O-Inlet	R.O-outlet	R.O-Reject	R.O Inlet
1	pH		5.5 to 9.0	5.5-9.0	7.66	7.60	7.69	8.18	7.71	8.20	7.30
2	Temperature	deg C			33.8°C	31.6°C	33.7°C	34.6°C	34.8°C	30.6°C	33.6°C
3	Total Suspended Solids	mg/l	100	100	20	<2	14	5	<2	13	4
4	Total Dissolved Solids	mg/l	---	2100	2506	742	3184	2248	904	2868	2988
5	Chlorides	mg/l	---	600	992	306	1215	860	390	1210	1090
6	Total Hardness	mg/l	---	---	55.4	27.7	63.4	51.5	31.7	59.4	158.4
7	Sulphates	mg/l	---	1000	3.7	2.8	4.6	7.3	5.1	8.1	6.1
8	Calcium	mg/l			12.7	7.9	14.2	12.7	7.9	15.9	46.0
9	Magnesium	mg/l	---	---	5.8	1.90	6.7	4.8	2.9	4.8	10.6
10	Dissolved Oxygen	mg/l			2.7	3.90	2.1	3.3	4.3	2.9	3.7
11	BOD	mg/l	30	30	<2	<2	<2	<2	<2	<2	<2
12	COD	mg/l	250	100	<8	<8	<8	<8	<8	9.0	<8
13	Oil & Grease	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphides	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluorides	mg/l	2	1.5	1.10	0.58	1.85	1.9	0.70	2.25	2.65
17	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	---	0.013	<0.01	0.018	0.019	<0.01	0.023	0.021
19	Copper	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	Sodium Absorption Ratio		---	---	68.7	24.4	78	50.6	28.0	66.6	40.9
24	Aluminum	mg/l	---	---	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
25	Lithium	mg/l			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
26	Molybednum	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---	---	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					March' 20						
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	GGS 01			EDD 050			EDH 044
					R.O-Inlet	R.O-Outlet	R.O-Reject	R.O-Inlet	R.O-outlet	R.O-Reject	R.O Inlet
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			592.0	226.0	671.0	580.0	232.0	692.0	885.0
33	Sodium	mg/l	---	---	1170.0	295.0	1420.0	835.0	360.0	1180.0	1185.0
34	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
35	Cyanide	mg/l	0.2		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
36	% Sodium				97.9	95.9	98	97.3	96.2	97.7	94.2

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					March' 20		March' 20			July' 20	
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDH 044		EDN 099			EDD-50	
					R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet
1	pH		5.5 to 9.0	5.5-9.0	7.46	7.20	7.26	8.05	7.73	7.78	7.56
2	Temperature	deg C			29.3°C	35.1°C	30.8°C	30.8°C	30.8°C	32.9°C	33.5°C
3	Total Suspended Solids	mg/l	100	100	<2	6	3	2	4	3	<2
4	Total Dissolved Solids	mg/l	---	2100	716	4344	2980	760	3732	2410	912
5	Chlorides	mg/l	---	600	286	1760	1190	315	1530	980	320
6	Total Hardness	mg/l	---	---	51.5	202.0	127.0	23.8	91.1	27.7	23.7
7	Sulphates	mg/l	---	1000	3.9	7.0	5.8	4.5	7.5	6.6	4.2
8	Calcium	mg/l			11.0	57.1	31.7	6.3	27.0	7.9	6.3
9	Magnesium	mg/l	---	---	5.8	14.4	1.5	1.9	5.8	1.9	1.90
10	Dissolved Oxygen	mg/l			3.9	3.3	3.5	4.3	3.0	6.1	5.90
11	BOD	mg/l	30	30	<2	<2	<2	<2	<2	<2	<2
12	COD	mg/l	250	100	<8	<8	<8	<8	<8	<8	<8
13	Oil & Grease	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphides	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluorides	mg/l	2	1.5	0.45	2.8	2.05	0.7	2.90	3.20	1.6
17	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	---	<0.01	0.031	0.023	<0.01	0.039	0.024	0.019
19	Copper	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	Sodium Absorption Ratio		---	---	18.8	55.7	41.2	29.2	66.8	88	36.7
24	Aluminum	mg/l	---	---	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
25	Lithium	mg/l			<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1
26	Molybednum	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---	---	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					March' 20		March' 20			July' 20	
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDH 044		EDN 099			EDD-50	
					R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			183.0	1269.0	1122.0	153.0	1366.0	732.0	342.0
33	Sodium	mg/l	---	---	310.0	1820.0	1070.0	330.0	1460.0	965.0	410.0
34	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
35	Cyanide	mg/l	0.2		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
36	% Sodium				98.0	95.2	94.8	96.8	97.2	98.7	97.4

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					July' 20						
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-50	GGS-01			EDH 044		
					R.O Reject	R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Inlet
1	pH		5.5 to 9.0	5.5-9.0	7.46	7.72	7.52	7.95	7.80	7.38	6.53
2	Temperature	deg C			32.3°C	36.1°C	36.40	35.4°C	32.8°C	32.7°C	33.9°C
3	Total Suspended Solids	mg/l	100	100	2	<2	<2	<2	<2	<2	<2
4	Total Dissolved Solids	mg/l	---	2100	2878	2430	1262	3396	4812	1012	3248
5	Chlorides	mg/l	---	600	1210	1010	525	1220	2016	390	1170
6	Total Hardness	mg/l	---	---	35.6	102.9	27.7	63.3	122.7	39.6	392.0
7	Sulphates	mg/l	---	1000	5.9	5.9	4.7	7.2	6.0	3.9	5.7
8	Calcium	mg/l			9.5	25.4	6.3	15.8	30.1	9.5	95.2
9	Magnesium	mg/l	---	---	2.9	9.6	2.9	5.8	11.5	3.8	36.5
10	Dissolved Oxygen	mg/l			6.3	5.3	6.0	4.9	4.2	5.5	4.4
11	BOD	mg/l	30	30	<2	<2	<2	<2	<2	<2	<2
12	COD	mg/l	250	100	<8	<8	<8	<8	<8	<8	<8
13	Oil & Grease	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphides	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluorides	mg/l	2	1.5	3.45	2.4	0.86	3.3	2.6	0.91	1.9
17	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	---	0.021	0.027	0.012	0.031	0.033	<0.01	0.017
19	Copper	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	Sodium Absorption Ratio		---	---	79.6	41.6	42.3	77.8	77.7	28.5	27.3
24	Aluminum	mg/l	---	---	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
25	Lithium	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
26	Molybednum	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---	---	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					July' 20						
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD-50	GGS-01			EDH 044		
					R.O Reject	R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Inlet
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			1074.0	793.0	402.0	1196.0	1354.0	305.0	756.0
33	Sodium	mg/l	---	---	1090.0	970.0	510.0	1425.0	1980.0	412.0	1240.0
34	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
35	Cyanide	mg/l	0.2		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
36	% Sodium				98.5	95.4	97.6	97.4	97.2	95.8	87.4

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					July' 20		August' 20				
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDN 099		GGS 01			EDD 050	
					R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet
1	pH		5.5 to 9.0	5.5-9.0	7.64	6.45	7.97	7.88	7.85	7.72	7.74
2	Temperature	deg C			30.7°C	33.8°C	35.0°C	33.5°C	35.3°C	33.9°C	34.40
3	Total Suspended Solids	mg/l	100	100	<2	<2	<2	<2	<2	<2	<2
4	Total Dissolved Solids	mg/l	---	2100	1180	4834	1928	870	2840	2620	846
5	Chlorides	mg/l	---	600	456	1890	780	354	830	1120	280
6	Total Hardness	mg/l	---	---	134.6	435.6	55.4	39.6	47.5	43.6	31.7
7	Sulphates	mg/l	---	1000	<2.5	6.7	5.5	3.9	6.5	5.5	<2.5
8	Calcium	mg/l			33.3	107.9	12.7	9.5	12.7	11.1	7.9
9	Magnesium	mg/l	---	---	12.5	40.4	5.8	3.8	3.8	4.8	2.9
10	Dissolved Oxygen	mg/l			5.5	4.0	4.5	5.30	4.7	3.9	4.1
11	BOD	mg/l	30	30	<2	<2	<2	<2	<2	<2	<2
12	COD	mg/l	250	100	<8	<8	<8	<8	<8	<8	<8
13	Oil & Grease	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphides	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluorides	mg/l	2	1.5	1.1	3.6	1.30	0.8	1.65	1.75	0.60
17	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	---	<0.01	0.020	0.018	<0.01	0.019	0.021	0.011
19	Copper	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	Sodium Absorption Ratio		---	---	19.1	42.5	44.3	27.8	50.2	71.2	25.0
24	Aluminum	mg/l	---	---	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
25	Lithium	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
26	Molybednum	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---	---	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					July' 20		August' 20				
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDN 099		GGS 01			EDD 050	
					R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			317.0	1476.0	549.0	171.0	672.0	768.0	311.0
33	Sodium	mg/l	---	---	510.0	2040.0	760.0	402.0	795.0	1080.0	325.0
34	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
35	Cyanide	mg/l	0.2		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
36	% Sodium				89.2	91.1	96.8	95.7	97.3	98.2	95.1

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					August' 20					August' 20	
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD 050	EDH 044				EDN 099	
					R.O Reject	R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Reject
1	pH		5.5 to 9.0	5.5-9.0	7.98	7.37	7.31	7.56	7.16	6.27	6.89
2	Temperature	deg C			33.1°C	32.2°C	32.3°C	32.0°C	35.3°C	36.8°C	36.5°C
3	Total Suspended Solids	mg/l	100	100	<2	2	2	3	4	<2	4
4	Total Dissolved Solids	mg/l	---	2100	3182	4824	1388	5260	3098	1758	3346
5	Chlorides	mg/l	---	600	1420	1810	525	2140	1230	710	1310
6	Total Hardness	mg/l	---	---	51.4	202.0	198.0	229.6	372.2	178.2	530.6
7	Sulphates	mg/l	---	1000	6.3	6.5	4.9	7.2	7.1	3.7	6.0
8	Calcium	mg/l			12.7	50.8	49.2	57.1	92.0	42.8	134.9
9	Magnesium	mg/l	---	---	4.8	18.3	18.3	21.2	34.6	17.3	47.2
10	Dissolved Oxygen	mg/l			3.7	4.9	5.2	4.5	4.2	5.0	4.0
11	BOD	mg/l	30	30	<2	<2	<2	<2	<2	<2	<2
12	COD	mg/l	250	100	<8	<8	<8	<8	<8	<8	<8
13	Oil & Grease	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphides	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluorides	mg/l	2	1.5	1.9	2.05	1.1	2.44	1.9	0.91	2.14
17	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	---	0.027	0.022	0.015	0.026	0.020	0.017	0.024
19	Copper	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	Sodium Absorption Ratio		---	---	74.5	53.2	18.2	59.9	26.6	22.3	23.1
24	Aluminum	mg/l	---	---	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
25	Lithium	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
26	Molybednum	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---	---	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					August' 20					August' 20	
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD 050	EDH 044				EDN 099	
					R.O Reject	R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Reject
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			939.0	1110.0	415.0	1408.0	1196.0	647.0	1318.0
33	Sodium	mg/l	---	---	1230.0	1740.0	590.0	2085.0	1180.0	680.0	1225.0
34	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
35	Cyanide	mg/l	0.2		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
36	% Sodium				98.1	95	86.7	95.2	87.4	89.3	83.5

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					September' 20						
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDH 044			GGS-01			
					R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet
1	pH		5.5 to 9.0	5.5-9.0	8.25	7.70	8.21	7.75	8.02	8.11	8.60
2	Temperature	deg C			31.8°C	32.0°C	31.9°C	34.9°C	34.6°C	34.9°C	33.7°C
3	Total Suspended Solids	mg/l	100	100	<2	<2	<2	<2	<2	<2	<2
4	Total Dissolved Solids	mg/l	---	2100	2852	928	3914	1564	784	2476	2428
5	Chlorides	mg/l	---	600	1130	407	1520	645	296	1020	936
6	Total Hardness	mg/l	---	---	95.1	39.6	134.6	43.6	23.7	43.6	35.6
7	Sulphates	mg/l	---	1000	5.0	<2.5	5.7	3.8	<2.5	4.3	6.0
8	Calcium	mg/l			23.8	9.5	34.9	11.1	4.7	11.1	7.9
9	Magnesium	mg/l	---	---	8.7	3.8	11.5	3.8	2.9	3.8	3.8
10	Dissolved Oxygen	mg/l			4.8	5.70	5.0	5.4	5.8	5.2	4.1
11	BOD	mg/l	30	30	<2	<2	<2	<2	<2	<2	<2
12	COD	mg/l	250	100	<8	<8	<8	<8	<8	<8	<8
13	Oil & Grease	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphides	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluorides	mg/l	2	1.5	0.96	0.65	1.2	1.59	0.90	1.7	1.22
17	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	---	0.022	<0.01	0.026	0.016	<0.01	0.020	0.024
19	Copper	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23	Sodium Absorption Ratio		---	---	55.1	25.9	61.1	38.2	29.1	64.6	75.5
24	Aluminum	mg/l	---	---	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
25	Lithium	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
26	Molybednum	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---	---	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					September' 20						
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDH 044			GGS-01			
					R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Reject	R.O Inlet
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			769.0	232.0	939.0	470.0	250.0	866.0	744.0
33	Sodium	mg/l	---	---	1235.0	375.0	1630.0	580.0	325.0	980.0	1035.0
34	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
35	Cyanide	mg/l	0.2		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
36	% Sodium				96.6	95.4	96.4	96.7	96.8	98	98.5

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					September' 20				
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD 050		EDN 099		
					R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Reject
1	pH		5.5 to 9.0	5.5-9.0	7.80	8.19	6.84	7.20	7.08
2	Temperature	deg C			35.4°C	33.3°C	33.4°C	30.9°C	34.7°C
3	Total Suspended Solids	mg/l	100	100	<2	3	<2	<2	<2
4	Total Dissolved Solids	mg/l	---	2100	688	2980	3048	1168	4360
5	Chlorides	mg/l	---	600	255	1125	1085	485	1620
6	Total Hardness	mg/l	---	---	35.6	47.5	348.5	114.8	566.3
7	Sulphates	mg/l	---	1000	<2.5	6.5	7.0	4.0	5.5
8	Calcium	mg/l			7.9	11.1	89.0	28.5	147.6
9	Magnesium	mg/l	---	---	3.8	4.8	30.8	10.6	48.1
10	Dissolved Oxygen	mg/l			4.9	4.4	4.0	4.8	3.7
11	BOD	mg/l	30	30	<2	<2	<2	<2	<2
12	COD	mg/l	250	100	<8	<8	<8	<8	<8
13	Oil & Grease	mg/l	10	10	<5.0	<5.0	<5.0	<5.0	<5.0
14	Phenolic Compounds	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphides	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluorides	mg/l	2	1.5	0.7	1.45	2.6	1.1	2.4
17	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05	<0.05
18	Zinc	mg/l	---	---	0.011	0.026	0.033	0.015	0.040
19	Copper	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05
20	Nickel	mg/l			<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1
22	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
23	Sodium Absorption Ratio		---	---	19.6	68.8	26.2	13.9	31.4
24	Aluminum	mg/l	---	---	<0.01	<0.01	<0.01	<0.01	<0.01
25	Lithium	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1
26	Molybednum	mg/l	---	---	<0.05	<0.05	<0.05	<0.05	<0.05
27	Palladium	mg/l	---	---	<0.5	<0.5	<0.5	<0.5	<0.5
28	Selenium	mg/l			<0.005	<0.005	<0.005	<0.005	<0.005
29	Vanadium	mg/l	---	---	<0.1	<0.1	<0.1	<0.1	<0.1

R.O. water analysis report of CBM Raniganj Project of EOGEPL
(Compliance period: Mar'20 to Sep'20)

ANNEXURE IV

Date					September' 20				
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDD 050		EDN 099		
					R.O Outlet	R.O Reject	R.O Inlet	R.O Outlet	R.O Reject
30	Cadmium	mg/l			<0.02	<0.02	<0.02	<0.02	<0.02
31	Cobalt	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1
32	Bicarbonate	mg/l			256.0	1159.0	952.0	495.0	1196.0
33	Sodium	mg/l	---	---	270.0	1090.0	1125.0	342.0	1715.0
34	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01
35	Cyanide	mg/l	0.2		<0.02	<0.02	<0.02	<0.02	<0.02
36	% Sodium				94.3	98	87.6	86.7	86.9

Surface Water Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration Production Limited

(Compliance Period: Mar'20 to Sep'20)

ANNEXURE IV A

Date					March' 20			
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	GGS-1(R.O Discharge)	Kunur Nala Upstream Near GGS-1	EDD-50 (R.O-Discharge)	Kunur Nala Downstream between EDH 58 & 64
1	pH at 27 C		5.5 to 9.0	5.5-9.0	8.14	8.06	8.29	8.19
2	Temperature	Deg C	---		30.8°C	27.8°C	30.7°C	28.1°C
3	Total Suspended Solids	mg/l	100	100	<2	13	2	41
4	Total Dissolved Solids	mg/l	---	2100	1178	452	1062	1574
5	Acidity as CaCO3	mg/l	---		NIL	2.6	NIL	NIL
6	Total Alkalinity as CaCO3	mg/l	---		306	87	295	330
7	Chloride as Chlorine	mg/l	---	600	410	110	370	525
8	Total Hardness	mg/l	---		55.4	27.7	39.6	75.2
9	Calcium	mg/l	---		14.2	7.9	11.1	20.6
10	Magnesium	mg/l	---		4.8	1.9	2.9	5.8
11	Biochemical Oxygen Demand	mg/l	30	30	<2	<2	<2	2
12	Chemical Oxygen Demand	mg/l	250	100	<8	8	<8	10
13	Oil & Grease	mg/l	10	10	<5	<5	<5	<5
14	Phenolic Compounds (as C6H5OH)	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002
15	Sulphides (as S2) in mg/l	mg/l	2	2	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	0.86	0.42	0.91	1.06
17	Sodium	mg/l	---		435	165	405	545
18	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05
19	Zinc	mg/l	5		0.017	<0.01	0.013	0.021
20	Copper	mg/l	3		<0.05	<0.05	<0.05	<0.05
21	Nickel	mg/l	3		<0.05	<0.05	<0.05	<0.05
22	Lead	mg/l	0.1		<0.1	<0.1	<0.1	<0.1
23	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001
24	SAR		---		25.5	13.8	27.9	27.2

Surface Water Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration Production Limited

(Compliance Period: Mar'20 to Sep'20)

ANNEXURE IV A

Date					March' 20			
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	GGS-1(R.O Discharge)	Kunur Nala Upstream Near GGS-1	EDD-50 (R.O-Discharge)	Kunur Nala Downstream between EDH 58 & 64
25	Electrical Conductivity at 25° C	µmhos/cm	---		1870	763	1950	2810
26	Cyanide	mg/l	---		<0.02	<0.02	<0.02	<0.02
27	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01
28	%Sodium		---		94.5	92.5	95.7	94.1
29	Nitrate Nitrogen(as N),mg/L		0.5		1.18	0.85	1.25	1.6
30	Vanadium	mg/l	0.2		<0.1	<0.1	<0.1	<0.1
31	Iron		3		0.54	1.05	0.80	2.65
32	Manganese	mg/l	2		<0.05	<0.05	<0.05	0.072
33	Dissolved Phosphate	mg/l	5		0.18	0.09	0.21	0.3
34	Selenium		0.05		<0.005	<0.005	<0.005	<0.005
35	Cadmium	mg/l	2		<0.02	<0.02	<0.02	<0.02
36	Arsenic	mg/l	0.2		<0.01	<0.01	<0.01	<0.01
37	Free Amonia	mg/l	5		0.19	0.1	0.35	0.34
38	Ammonical Nitrogen	mg/l	50		3.1	1.7	3.5	4.2
39	Total residual chlorine	mg/l	1		<0.1	<0.1	<0.1	<0.1
40	colour	Hazen Units	Colourless		<5	<5	<5	<5
41	Odor		Odourless		Agreeable	Agreeable	Agreeable	Agreeable

Surface Water Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration Production Limited

(Compliance Period: Mar'20 to Sep'20)

ANNEXURE IV A

Date					March' 20		July' 19	
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDN-99 (R.O-Discharge)	Kunur Nala Downstream Near Kuldiha Bridge	EDD-50 (R.O-Discharge)	GGS-1(R.O Discharge)
1	pH at 27 C		5.5 to 9.0	5.5-9.0	7.68	7.49	8.15	7.86
2	Temperature	Deg C	---		29.9°C	30.5°C	33.5°C	35.2°C
3	Total Suspended Solids	mg/l	100	100	4	14	<2	<2
4	Total Dissolved Solids	mg/l	---	2100	1520	632	1016	1688
5	Acidity as CaCO3	mg/l	---		16	34	NIL	18
6	Total Alkalinity as CaCO3	mg/l	---		390	179	219	414
7	Chloride as Chlorine	mg/l	---	600	550	210	410	680
8	Total Hardness	mg/l	---		106.9	83.2	19.8	15.8
9	Calcium	mg/l	---		28.6	19.0	4.8	3.2
10	Magnesium	mg/l	---		8.7	8.7	1.9	1.9
11	Biochemical Oxygen Demand	mg/l	30	30	<2	<2	<2	<2
12	Chemical Oxygen Demand	mg/l	250	100	<8	<8	<8	<8
13	Oil & Grease	mg/l	10	10	<5	<5	<5	<5
14	Phenolic Compounds (as C6H5OH)	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002
15	Sulphides (as S2) in mg/l	mg/l	2	2	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	1.3	0.75	1.20	1.65
17	Sodium	mg/l	---		575	260	425	710
18	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05
19	Zinc	mg/l	5		0.021	0.017	0.015	0.019
20	Copper	mg/l	3		<0.05	<0.05	<0.05	<0.05
21	Nickel	mg/l	3		<0.05	<0.05	<0.05	<0.05
22	Lead	mg/l	0.1		<0.1	<0.1	<0.1	<0.1
23	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001
24	SAR		---		24.3	12.4	41.9	77.3

Surface Water Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration Production Limited

(Compliance Period: Mar'20 to Sep'20)

ANNEXURE IV A

Date					March' 20		July' 19	
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDN-99 (R.O-Discharge)	Kunur Nala Downstream Near Kuldiha Bridge	EDD-50 (R.O-Discharge)	GGS-1(R.O Discharge)
25	Electrical Conductivity at 25° C	µmhos/cm	---		2310	940	1610	2420
26	Cyanide	mg/l	---		<0.02	<0.02	<0.02	<0.02
27	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01
28	%Sodium		---		92.2	87.4	98	99
29	Nitrate Nitrogen(as N),mg/L		0.5		1.25	0.90	1.16	1.71
30	Vanadium	mg/l	0.2		<0.1	<0.1	<0.1	<0.1
31	Iron		3		0.66	2.05	0.24	0.31
32	Manganese	mg/l	2		<0.05	0.059	<0.05	<0.05
33	Dissolved Phosphate	mg/l	5		0.19	0.07	0.07	0.05
34	Selenium		0.05		<0.005	<0.005	<0.005	<0.005
35	Cadmium	mg/l	2		<0.02	<0.02	<0.02	<0.02
36	Arsenic	mg/l	0.2		<0.01	<0.01	<0.01	<0.01
37	Free Amonia	mg/l	5		0.12	0.03	0.13	0.1
38	Ammonical Nitrogen	mg/l	50		4.1	1.7	2.1	2.5
39	Total residual chlorine	mg/l	1		<0.1	<0.1	<0.1	<0.1
40	colour	Hazen Units	Colourless		<5	<5	<5	<5
41	Odor		Odourless		Agreeable	Agreeable	Agreeable	Agreeable

Surface Water Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration Production Limited

(Compliance Period: Mar'20 to Sep'20)

ANNEXURE IV A

Date					July' 19			
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	Kunur Nala Upstream Near GGS-1	Kunur Nala Downstream between EDH 58 & 64	EDN-99 (R.O-Discharge)	Kunur Nala Downstream Near Kuldiha Bridge
1	pH at 27 C		5.5 to 9.0	5.5-9.0	7.45	7.31	7.1	7.1
2	Temperature	Deg C	---		31.0°C	31.1°C	31.8°C	30.9°C
3	Total Suspended Solids	mg/l	100	100	8	18	<2	54
4	Total Dissolved Solids	mg/l	---	2100	192	262	1442	288
5	Acidity as CaCO3	mg/l	---		38	45	56	52
6	Total Alkalinity as CaCO3	mg/l	---		65	109	117.6	75
7	Chloride as Chlorine	mg/l	---	600	59	81	585	80
8	Total Hardness	mg/l	---		106.9	51.5	170.2	146.5
9	Calcium	mg/l	---		25.4	12.7	41.2	34.9
10	Magnesium	mg/l	---		10.6	4.8	16.3	14.4
11	Biochemical Oxygen Demand	mg/l	30	30	<2	3	<2	3
12	Chemical Oxygen Demand	mg/l	250	100	8	11	<8	12
13	Oil & Grease	mg/l	10	10	<5	<5	<5	<5
14	Phenolic Compounds (as C6H5OH)	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002
15	Sulphides (as S2) in mg/l	mg/l	2	2	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	0.35	0.41	1.8	0.51
17	Sodium	mg/l	---		74	90	640	92
18	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05
19	Zinc	mg/l	5		<0.01	<0.01	0.021	0.011
20	Copper	mg/l	3		<0.05	<0.05	<0.05	<0.05
21	Nickel	mg/l	3		<0.05	<0.05	<0.05	<0.05
22	Lead	mg/l	0.1		<0.1	<0.1	<0.1	<0.1
23	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001
24	SAR		---		3.1	5.5	21.5	3.3

Surface Water Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration Production Limited

(Compliance Period: Mar'20 to Sep'20)

ANNEXURE IV A

Date					July' 19			
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	Kunur Nala Upstream Near GGS-1	Kunur Nala Downstream between EDH 58 & 64	EDN-99 (R.O-Discharge)	Kunur Nala Downstream Near Kuldiha Bridge
25	Electrical Conductivity at 25° C	µmhos/cm	---		290	320	2130	445
26	Cyanide	mg/l	---		<0.02	<0.02	<0.02	<0.02
27	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01
28	%Sodium		---		60.3	79.4	89.2	58
29	Nitrate Nitrogen(as N),mg/L		0.5		0.4	1.03	1.10	2.63
30	Vanadium	mg/l	0.2		<0.1	<0.1	<0.1	<0.1
31	Iron		3		1.86	8.9	0.25	10.3
32	Manganese	mg/l	2		0.075	0.104	<0.05	0.186
33	Dissolved Phosphate	mg/l	5		0.09	0.11	0.05	0.09
34	Selenium		0.05		<0.005	<0.005	<0.005	<0.005
35	Cadmium	mg/l	2		<0.02	<0.02	<0.02	<0.02
36	Arsenic	mg/l	0.2		<0.01	<0.01	<0.01	<0.01
37	Free Amonia	mg/l	5		0.06	0.04	0.03	0.04
38	Ammonical Nitrogen	mg/l	50		3.2	4	2.5	3.9
39	Total residual chlorine	mg/l	1		<0.1	<0.1	<0.1	<0.1
40	colour	Hazen Units	Colourless		<5	<5	<5	<5
41	Odor		Odourless		Agreeable	Agreeable	Agreeable	Agreeable

Surface Water Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration Production Limited

(Compliance Period: Mar'20 to Sep'20)

ANNEXURE IV A

Date					August' 20			
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	Kunur Nala Upstream Near GGS-1	EDD-50 (R.O-Discharge)	Kunur Nala Downstream between EDH 58 & 64	Kunur Nala Downstream Near Kuldiha Bridge
1	pH at 27 C		5.5 to 9.0	5.5-9.0	7.42	7.94	8.1	7.14
2	Temperature	Deg C	---		29.7°C	33.3°C	30.4°C	31.7°C
3	Total Suspended Solids	mg/l	100	100	25	<2	22	15
4	Total Dissolved Solids	mg/l	---	2100	120	1266	144	220
5	Acidity as CaCO3	mg/l	---		44	18	20	48
6	Total Alkalinity as CaCO3	mg/l	---		32	306	35	60
7	Chloride as Chlorine	mg/l	---	600	43	512	50	78
8	Total Hardness	mg/l	---		75.2	63.4	99	91.1
9	Calcium	mg/l	---		17.4	25.4	39.6	36.5
10	Magnesium	mg/l	---		7.7	5.8	8.7	8.7
11	Biochemical Oxygen Demand	mg/l	30	30	<2	<2	<2	<2
12	Chemical Oxygen Demand	mg/l	250	100	<8	<8	<8	<8
13	Oil & Grease	mg/l	10	10	<5	<5	<5	<5
14	Phenolic Compounds (as C6H5OH)	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002
15	Sulphides (as S2) in mg/l	mg/l	2	2	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	0.25	1.07	0.3	0.45
17	Sodium	mg/l	---		38	520	48	82
18	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05
19	Zinc	mg/l	5		0.011	0.022	0.013	0.023
20	Copper	mg/l	3		<0.05	<0.05	<0.05	<0.05
21	Nickel	mg/l	3		<0.05	<0.05	<0.05	<0.05
22	Lead	mg/l	0.1		<0.1	<0.1	<0.1	<0.1
23	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001
24	SAR		---		1.9	28.4	2.1	3.8

Surface Water Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration Production Limited

(Compliance Period: Mar'20 to Sep'20)

ANNEXURE IV A

Date					August' 20			
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	Kunur Nala Upstream Near GGS-1	EDD-50 (R.O-Discharge)	Kunur Nala Downstream between EDH 58 & 64	Kunur Nala Downstream Near Kuldiha Bridge
25	Electrical Conductivity at 25° C	µmhos/cm	---		156	1745	168	296
26	Cyanide	mg/l	---		<0.02	<0.02	<0.02	<0.02
27	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01
28	%Sodium		---		53.1	94.7	51.9	97.6
29	Nitrate Nitrogen(as N),mg/L		0.5		0.81	1.31	0.38	1.43
30	Vanadium	mg/l	0.2		<0.1	<0.1	<0.1	<0.1
31	Iron		3		4.6	0.35	3.9	3.9
32	Manganese	mg/l	2		0.168	<0.05	0.152	0.147
33	Dissolved Phosphate	mg/l	5		0.08	0.2	0.09	0.21
34	Selenium		0.05		<0.005	<0.005	<0.005	<0.005
35	Cadmium	mg/l	2		<0.02	<0.02	<0.02	<0.02
36	Arsenic	mg/l	0.2		<0.01	<0.01	<0.01	<0.01
37	Free Amonia	mg/l	5		0.02	0.14	0.07	0.03
38	Ammonical Nitrogen	mg/l	50			2.82	1.2	3
39	Total residual chlorine	mg/l	1		<0.1	<0.1	<0.1	<0.1
40	colour	Hazen Units	Colourless		<5	<5	<5	<5
41	Odor		Odourless		Agreeable	Agreeable	Agreeable	Agreeable

Surface Water Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration Production Limited

(Compliance Period: Mar'20 to Sep'20)

ANNEXURE IV A

Date					August' 20	September'20			
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDN-99 (R.O-Discharge)	Kunur Nala Upstream Near GGS-1	EDD-50 (R.O-Discharge)	Kunur Nala Downstream between EDH 58 & 64	Kunur Nala Downstream Near Kuldiha Bridge
1	pH at 27 C		5.5 to 9.0	5.5-9.0	7.24	7.7	8.41	7.7	6.6
2	Temperature	Deg C	---		34.9°C	33.3°C	30.4°C	32.4°C	34.9°C
3	Total Suspended Solids	mg/l	100	100	<2	10	4	7	9
4	Total Dissolved Solids	mg/l	---	2100	1866	222	740	196	328
5	Acidity as CaCO3	mg/l	---		46	35	Nil	35	65
6	Total Alkalinity as CaCO3	mg/l	---		408	48	180	49	85
7	Chloride as Chlorine	mg/l	---	600	708	88	307	72	135
8	Total Hardness	mg/l	---		170.2	83.1	31.7	83.1	110.9
9	Calcium	mg/l	---		42.8	20.6	7.9	19	26.9
10	Magnesium	mg/l	---		15.4	7.7	2.8	6.7	10.6
11	Biochemical Oxygen Demand	mg/l	30	30	<2	<2	<2	<2	<2
12	Chemical Oxygen Demand	mg/l	250	100	<8	<8	<8	<8	<8
13	Oil & Grease	mg/l	10	10	<5	<5	<5	<5	<5
14	Phenolic Compounds (as C6H5OH)	mg/l	1	1.2	<0.002	<0.002	<0.002	<0.002	<0.002
15	Sulphides (as S2) in mg/l	mg/l	2	2	<0.5	<0.5	<0.5	<0.5	<0.5
16	Fluoride	mg/l	2	1.5	0.65	0.4	1.05	0.54	0.82
17	Sodium	mg/l	---		814	75	275	65	120
18	Total Chromium	mg/l	2	1	<0.05	<0.05	<0.05	<0.05	<0.05
19	Zinc	mg/l	5		0.011	<0.01	0.022	<0.01	<0.01
20	Copper	mg/l	3		<0.05	<0.05	<0.05	<0.05	<0.05
21	Nickel	mg/l	3		<0.05	<0.05	<0.05	<0.05	<0.05
22	Lead	mg/l	0.1		<0.1	<0.1	<0.1	<0.1	<0.1
23	Mercury	mg/l	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
24	SAR		---		27.2	3.6	21.4	3.1	4.9

Surface Water Analysis Report of CBM Raniganj Project of Essar Oil Gas Exploration Production Limited

(Compliance Period: Mar'20 to Sep'20)

ANNEXURE IV A

Date					August' 20	September'20			
S. No.	Parameter	Unit	CPCB Limit for Discharge	Onshore Discharge Standards	EDN-99 (R.O-Discharge)	Kunur Nala Upstream Near GGS-1	EDD-50 (R.O-Discharge)	Kunur Nala Downstream between EDH 58 & 64	Kunur Nala Downstream Near Kuldiha Bridge
25	Electrical Conductivity at 25° C	µmhos/cm	---		2810	330	1010	340	430
26	Cyanide	mg/l	---		<0.02	<0.02	<0.02	<0.02	<0.02
27	Hexavalent Chromium	mg/l	0.1		<0.01	<0.01	<0.01	<0.01	<0.01
28	%Sodium		---		91.3	66.9	95.1	63.2	70.5
29	Nitrate Nitrogen(as N),mg/L		0.5		1.23	0.23	<0.1	<0.1	1.53
30	Vanadium	mg/l	0.2		<0.1	<0.1	<0.1	<0.1	<0.1
31	Iron		3		0.4	2.15	1.5	1.15	2.95
32	Manganese	mg/l	2		<0.05	0.052	0.05	0.059	0.068
33	Dissolved Phosphate	mg/l	5		0.06	0.05	0.09	0.05	0.11
34	Selenium		0.05		<0.005	<0.005	<0.005	<0.005	<0.005
35	Cadmium	mg/l	2		<0.02	<0.02	<0.02	<0.02	<0.02
36	Arsenic	mg/l	0.2		<0.01	<0.01	<0.01	<0.01	<0.01
37	Free Amonia	mg/l	5		0.02	0.08	0.4	0.08	Nil
38	Ammonical Nitrogen	mg/l	50		2	2.5	3.3	2.6	3.1
39	Total residual chlorine	mg/l	1		<0.1	<0.1	<0.1	<0.1	<0.1
40	colour	Hazen Units	Colourless		<5	<5	<5	<5	<5
41	Odor		Odourless		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable

Annexure V

FORM 10

2nd Copy

WEST BENGAL WASTE MANAGEMENT LIMITED

J.L. No. – 103, Mouza – Purba Srikrishnapur, P.O. & P.S. – Sutahata, PIN – 721635, Haldia, Dist. – Purba Medinipur, West Bengal

MANIFEST FOR HAZARDOUS AND OTHER WASTE

1	Sender's name and mailing address (including Phone No. and e-mail) :	Essar oil and gas exploration and production ltd. AN 81B, sector-2, martin luther king sarani Bithanagar, Durgapur - 713212
2	Sender's authorization No. :	15/25 (HW) - 2449 /2008
3	Manifest Document No. :	1 11838
4	Transporter's name and address (including Phone No. and e-mail) :	**West Bengal Waste Management Limited** J.L. No. 103, Mouza Purba Srikrishnapur, P.O. & P.S. Sutahata, Haldia 721635 Dist. Purba Medinipur, West Bengal, Ph. No.-03224-278238 / 39 E-mail : wbwml_haldia@ramky.com
5	Type of vehicle :	(Truck/Tanker/Special Vehicle)
6	Transporter's registration No. :	1-MD(E)/X/06
7	Vehicle registration No. :	WB 29 - 8073
8	Receiver's name and mailing address (including Phone No. and e-mail) :	**West Bengal Waste Management Limited** J.L. No. 103, Mouza Purba Srikrishnapur, P.O. & P.S. Sutahata, Haldia 721635 Dist. Purba Medinipur, West Bengal, Ph. No.-03224-278238 / 39 E-mail : wbwml_haldia@ramky.com
9	Receiver's authorization No. :	
10	Waste description :	oil contaminated waste & filter
11	Total quantity No. of Containers :	1.535 ..... m3 or MT ..... Nos.
12	Physical form :	**(Soild/Semi-Solid/Sludge/Oily/Tarry/Slurry/Liquid)**
13	Special handling instructions and additional information	Use safety shoe, Hand gloves, eye protector face musk
14	Sender's Certificate	I hereby declare that the contents of the consignment are fully and accurately described above by proper shipping categorized, packed, marked and name and are labeled and are in all respects in proper conditions for transport by road according to applicable National Government Regulations.
	Name and stamp: S. RAY	Signature: Sukanta Ray — Day: 22 — Month: 07 — Year: 2020
15	Transporter acknowledgement of receipt of Wastes :	
	Name and stamp: Debdulal Jana	Signature: D Jana — Day: 22 — Month: 07 — Year: 2020
16	Receiver's certification for receipt of hazardous and other waste :	
	Name and stamp:	Signature: Sukanta Ray — Day: — Month: — Year:

1. White Colour forwarded to WBPCB by HzW Sender
2. Yellow Colour retained by HzW sender
3. Pink Colour retained by HzW Receiver
4. Orange Colour retained by transporter
5. Green Colour forwarded to WBPCP ofter disposal by HzW Receiver
6. Blue Colour returned to sender after disposal by HzW Receiver

Form 10 1st Copy

[See Rule 19(1)]

MANIFEST FOR HAZARDOUS AND OTHER WASTE

1	Sender's Name & Mailing Address (including Phone No. & Email)		ESSAR OIL AND GAS EXPLORATION AND PRODUCTION LTD. GOPALPUR SARENGA ROAD. P.S. KANKSHA, DURGAPUR - 713212 (WB)
2	Sender's Authorisation No.	:	15/2S(HW) - 2449/2008.
3	Manifest Document No.	:	
4	Transporter's Name & Address (Including Phone No. and email)	:	LUBRINA RECYCLING PVT LTD JOY CHONDIPUR, P.O. - BAKHRAHAT, P.S.- BISHNUPUR, SOUTH - 24 PARGANAS, WEST BENGAL -743377
5	Type of Vehicle	:	(Truck/ Tanker/ Special Vehicle)
6	Transporter's Registration No.	:	183/2S(HW)- 3215/2016
7	Vehicle Registration No.	:	NL 01AD - 6450
8	Receivers Name & Mailing Address (including Phone No. and Email)	:	LUBRINA RECYCLING PVT LTD JOY CHONDIPUR, P.O. - BAKHRAHAT, P.S.- BISHNUPUR, SOUTH - 24 PARGANAS, WEST BENGAL -743377 Mob: 9830027779 Email - info@lubrinare.com
9	Receivers 's Registration No	:	183/2S(HW)-3215/2016
10	Waste Description	:	
11	Total Quantity No. of Containers	: :	16800 + 16170 = 32,970 .....m3 or MT 77 + 80 = 157 .....Nos.
12	Physical Form	:	(Solid/Semi-Solid/Sludge/Oily/Tarry/Slurry/Liquid)
13	Special Handling Instructions & Additional Information	:	Handle With Care
14	SENDER'S CERTIFICATE	:	I hereby declare that the contents of the consignment are fully and accurately described ,above by proper shipping name and are categorized , packed, marked, and labeled , and are in all respects in proper condition for transport by road according to applicable national government regulations.
	Name and Stamp : SUKANTA RAY Signature : Sukanta Ray.		Month: 07 Day: 27 Year: 2020
15	Transporters Acknowledgement of Receipt of Hazardous wastes		
	Name and Stamp : Signature : Uttam Ram		Month: 07 Day: 27 Year: 2020
16	Receiver's Certification of Receipt of Hazardous waste		
	Name and Stamp : Signature :		Month: Day: Year:

Land Subsidence Monitoring Study at ESSAR Raniganj CBM Block at Durgapur

[RG (E) –CBM-2001/1 Block]

FOR

Essar Oil and Gas Exploration and Production Limited

PREPARED BY

DEPARTMENT OF EARTH AND ENVIRONMENTAL STUDIES

NATIONAL INSTITUTE OF TECHNOLOGY

DURGAPUR- 713209

Dr. Kalyan Adhikari
Dept. of EES
Principal Investigator

OCTOBER 2020

Dr. Supriya Pal
Dept. of CE
Investigator

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IMPORTANT TERMS

- **Base Station:** A base station is a receiver placed at a known point on a job site that tracks the same satellites as an RTK rover, and provides a real-time differential correction message stream through radio to their Rover, to obtain centimeter level positions on a continuous real-time basis. A base station can also be a part of a virtual reference station network, or a location at which GPS observations are collected over a period of time, for subsequent post processing to obtain the most accurate position for the location.
- **RINEX (Receiver Independent Exchange Format):** RINEX is the standard format that allows the management and disposal of the data generated by a receiver, as well as their off-line processing by a multitude of applications, irrespective of the manufacturer of both the receiver and the computer application.

- **Rover:** A rover is any mobile GPS receiver that is used to collect or update data in the field, typically at an unknown location.
- **WGS84 (World Geodetic System):** A geodetic datum is the tool used to define the shape and size of the earth, as well as the reference point for the various coordinate systems used in mapping the earth. All GPS coordinates are based on theWGS-84 datum surface.

- **Coordinate systems: -** Aligning geographic data to a known coordinate system so that it can be viewed, queried, and analyzed with other geographic data. Geo-referencing may involve shifting, rotating, scaling, skewing, and in some cases warping, rubber sheeting, or ortho- rectifying the data.

ABBREVIATIONS

PCP : Primary control points.

DGPS : Differential Global Positioning System.

RTK : Real Time Kinematic mode.

ETS : Electronic Total station.

RINEX : Receiver Independent Exchange Format

UTM : Universal Transverse Mercator

GIS : Geographical Information System

GCP : Ground Control Point.

1. Introduction:

Essar Oil Limited (EOL) was awarded block RG (East)-CBM-2001/1 covering an area of approx. 500 sq km under the CBM-I Round, contract signed on 26th July 2002. EOL holds 100% participating interest in the block. The Petroleum Exploration License (PEL) was issued by the Government of West Bengal on 29th March 2005.

The Ministry of Environment & Forests (MoEF) granted Environment Clearance for drilling 650 development cum production wells, laying 8 Gas Gathering Stations, 1 Main Compressor Station and pipeline vide F.No.J-11011/491/2011-IA II(I) dated 26th February, 2013.

It was further suggested by MoEF to get the land subsidence study carried out by an institute of repute. In view of above, it was requested by ESSAR to Department of Earth and Environmental Studies, National Institute of Technology (NIT) Durgapur for carrying out land subsidence study on prefixed control stations (vertical concrete pillars) at RG (E) –CBM-2001/1 block. Department of Earth and Environmental Studies, NIT Durgapur was awarded a research project for a period of two years with half yearly frequency subsidence monitoring to all established monitoring stations. Accordingly, a visit was made by the Investigators for reconnaissance study of the site in the month of June 2016. During the study, it was observed that few controlling stations are in damaged conditions. However, first, second, third and fourth phase monitoring work were executed in the mid of June, 2016, mid of January 2017, first week of February, 2019 and last week of July, 2019. The tenure and scope of the ongoing research project came to an end with the completion of four number of field studies and submission of the 4th and final phase of report.

To comply with the statutory requirement Dept. of Earth and Environmental Studies, NIT Durgapur was offered a consultancy project with the scope of one time subsidence monitoring survey of the same study area.

A report was prepared based on the data obtained from the site.

This report mainly consists of the following

- A brief description of the Essar CBM Block, RG (East)-CBM-2001/1
- Details of locations of monitoring stations over the surface of the CBM block, RG (East)-CBM-2001/1
- Methodology adopted for subsidence study through DGPS observation.

- Plot of ground elevation of the control stations.

2. Location and Accessibility:

Block: RG (East)-CBM-2001/1 covers an area of 500 sq.km. (Approximately) and is located in the eastern-most part of the Raniganj Coalfield. It falls largely in Bardhaman district (90%), West Bengal. The block is bounded by Latitude 23°21'45" and 23°41'12" N and Longitude: 87°14'40" and 87°28'46" E. It lies in the Survey of India Topographical Sheet Nos. 73 M/2, M/3, M/6 & M/7 (1:50,000). **The locations specified for monitoring stations are situated within longitude 87°20'58.77"E (535665.04E) - 87°23'21.89"E (539727.20E) and latitude 23°36'29.98"N (2610918.92N) - 23°37'50.31"N (2613378.03N).**

3. Development of subsidence

Coal seam gas production often involves the extraction of groundwater to facilitate depressurization of the target coal seam. The disposal or reuse of this collected water is an area of great public interest, as depressurization results in compaction of the ground and leads to settlement of the ground surface (surface subsidence). The reduction in pressure results in compaction of the geological units in which depressurization occurs. In addition, the liberation of gas from coal seams results in compaction of the coal. Subsidence at the ground surface is some component of the total compaction occurring within (potentially) multiple geological units. It is dependent on the magnitude and direction of compression (which is dictated by pressure changes from groundwater withdrawal and desorption of gas from coal seams), the depth and depth-interval over which compression occurs, and the geotechnical properties of the geological units throughout the depth profile.

4. Impacts of subsidence

Land subsidence may affect a variety of assets, including infrastructure (such as buildings, roads, railways, pipelines, dams, water channels, levees and electrical infrastructure) and environmental assets (such as aquifers, groundwater dependent ecosystems, streams, lakes, springs, and other surface water resources). Impacts of subsidence on infrastructure could include structural damage to buildings, buried pipes and sewers, and reduction in stability of buildings and electrical transmission lines and towers/poles. The serviceability of roads and railways may be affected by distortion of the road surface and rail foundation. Depressions in the ground surface due to subsidence may increase exposure to flooding, overflowing levees or storm surges in areas near the coast. Impacts of subsidence on environmental assets could include the formation of ground fissures and partial or complete loss of surface water drainage to deeper strata, stream bed and bank erosion, development of subsidence troughs and ponding of water, disruption to hillside groundwater springs and sensitive wetlands or swamps, and potential shearing of groundwater supply wells.

5. Instruments:

For DGPS Survey we have used the following instruments as detailed below:

i) DGPS (Leica Make) GNSS, GPS/GLONASS/GALILEO with Triple frequency RTK receiver.

GPS1200+ is loaded with a multitude of features and functions to meet the many different needs of users all over the world, yet it is remarkably easy to use.

GPS1200+ receivers: GX1230+ GNSS/ ATX1230+ GNSS

- Triple frequency
- GPS/ GLONASS/ Galileo/ Compass[1]
- 120 Channels
- L1/L2/L5 GPS
- L1/L2 GLONASS
- E1/ E5a/ E5b /Alt-BOC Galileo
- 4 SBAS
- Full Real Time RTK
- Use as rover or reference

Base:

-GX1230 GPS L1/L2 Receiver
-RX1210 Terminal
-AX1202 GPS L1/L2 Antenna w/ Cable
-Leica Pro Tribrach w/ Optical Plummet
-GRT144 Carrier w/ Stub and Quick Change Adapter
-Pacific Crest PDL Radio 35w, 450-470MHz w/ 1/4 Wave Antenna, Power/Data Cable, and Pelican Case.
-32MB Industrial CF Memory Card
-Leica Power Cable w/ Car Battery Adapter
-GZS4-1 Height Hook

Rover:

-RX1250X GPS Data Collector, Smartworx v8.50. Ext. OWI key. GLONASS ready.
-ATX1230 GG GNSS Antenna w/ Bluetooth
-GHT56 GFU Cradle w/ Rod Clamp
-GFU15-2 PDL Radio, 450-470MHz w/ Antenna
-GKL211 Charger
-GEB221 Battery (New Aftermarket)
-3 x GEB211 Battery (New Aftermarket)
-32MB Industrial CF Memory Card
-USB CF Multi Card Reader (New)

ii) **Prismatic Compass with all standard accessories.**

A prismatic compass is a navigation and surveying instrument which is extensively used for determining course, waypoints (an endpoint of the leg of a course) and direction, and for calculating bearings of survey lines and included angles between them. Compass surveying is a type of surveying in which the directions of surveying lines are determined with a magnetic compass, and the length of the surveying lines are measured with a tape or chain or laser range finder. The compass is generally used to run a traverse line. The compass calculates bearings of lines with respect to magnetic north. The included angles can then be calculated using suitable formulas in case of clockwise and anti-clockwise traverse

respectively. For each survey line in the traverse, surveyors take two bearings that is fore bearing and back bearing which should exactly differ by 180° if local attraction is negligible. The name Prismatic compass is given to it because it essentially consists of a prism which is used for taking observations more accurately.

6. Procedure:

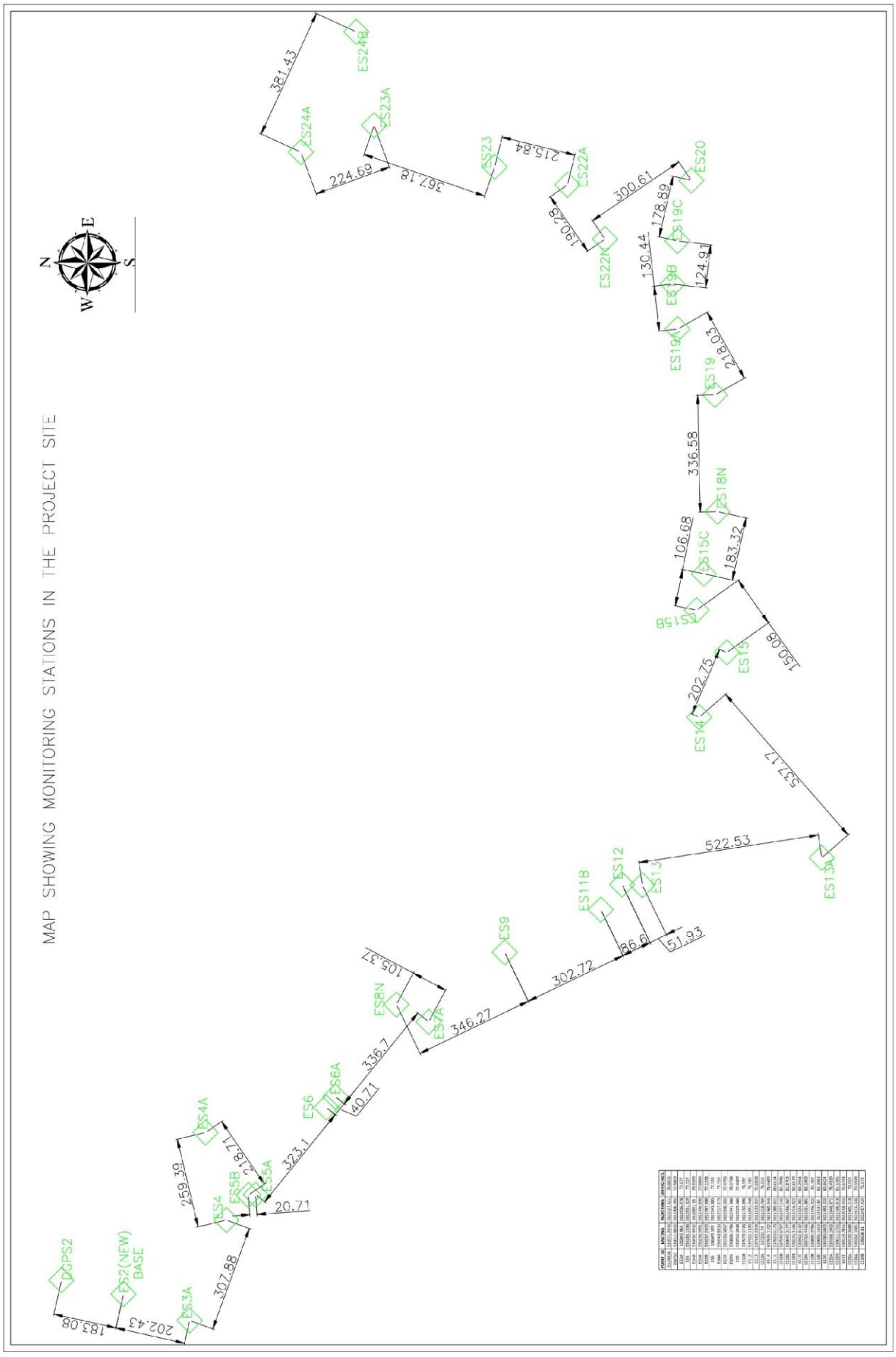
Survey work conducted from one DGPS Control Pillar to another control pillar by using DGPS.

The phase-wise subsidence monitoring studies were conducted by measuring the ground elevation of all pre-established permanent control stations near the well locations at the project site. The coordinates (X, Y, Z) of the stations were also checked. These control stations were found established by embedding and casting concrete pillars in the ground to a depth of at least 0.5 meters. At the time of survey we found some control points are partly or complete damaged. At some well locations, existing concrete cemented foundation blocks were selected and control points were marked on the block using the appropriate markers. Table 1 exhibits the identification marks, corresponding Station ID and present status of the control points.

Control station details:

Station no.	Location details	Present Status
DGPS1	BENCH MARK. BARREN LAND NEAR GGS-1	Completely Damaged
DGPS2	CULVERT OPPOSITE TO SCHOOL	Under Tree Cover
ES2 (NEW)	CONCRETE PILLAR NEAR GGS-1 ENTRANCE OLD SECURITY ROOM	Treated as New Base
ES3A	CONCRETE SMALL PILLAR NEAR SECURITY ROOM AT EDD009	Repaired after third phase
ES4	CONCRETE SMALL PILLAR NEAR SECURITY ROOM AT EDD011	Ok
ES4A	CONCRETE SMALL PILLAR NEAR SECURITY ROOM AT EDD006	Ok
ES5B	CONCRETE PILLAR NEAR WATER TANK AT EDD011	Under High Voltage Electrical Line
ES5A	PAINT MARK ON EXISTING FOUNDATION NEAR DG SET AT EDD011	Completely Damaged
ES6	ANCHOR PILLAR NEAR WATER POND AT EDD010	Completely Damaged
ES6A	CONCRETE PILLAR NEAR BOUNDARY AT EDD010	Ok
ES7A	CONCRETE PILLAR NEAR BOUNDARY & GATE AT EDD003	Under Dense Tree Cover
ES8N	PAINT MARK ON EXISTING FOUNDATION OF EARTH PROTECTOR PIPE NEAR ROAD SIDE TOWARDS EDD003	Ok
ES9	CONCRETE SMALL PILLAR NEAR BOUNDARY AT ROAD SIDE NEAR NEAM TREE	Under Tree Cover

Station no.	Location details	Present Status
ES10N	NAIL ON ROAD SIDE NEAR TEMPLE & BEDI	Missing
ES11 (NEW)	SURVEY PEG WITH NAIL AT ROAD SIDE NEAR TRANSFORMER	Missing
ES11B	KM MILESTONE PILLAR ROADSIDE LEADING TO KANTABERIA	Ok
ES12	BROKEN CONCRETE PILLAR AT ROAD SIDE NEAR ENTRY EDD004 (R/S)	Completely tilted pillar
ES13	EDD004	Ok
ES13A	EDD026	New constructed Pillar shifted to nearest location
ES14	EDD012	Ok
ES15	ROAD SIDE CULVERT	Completely Damaged
ES15A(NEW)	KM MILESTONE PILLAR ROADSIDE KANTABERIA CHOWK	Somehow ok
ES15B	ROAD SIDE RIGHT HAND CULVERT AFTER KANTABERIA CHOWK	Almost Damaged
ES15C	ROAD SIDE KM MILE STONE AFTER KANTABERIA CHOWK	Under Tree Cover
ES18N	NEAR BOUNDARY WALL OF PLAYGROUND AFTER KANTABERIA CHOWK	Ok
ES19	EDD008	Ok
ES19A	PAINT MARK ON FOUNDATION OF PIPE LINE SIGN BOARD RIGHT SIDE ROAD AFTER EDD008	Almost Not Visible
ES19B	PAINT MARK ON FOUNDATION OF EARTH PROTECTOR RIGHT SIDE ROAD AFTER EDD008	Almost Not Visible
ES19C	PAINT MARK ON KM MILE STONE RIGHT SIDE ROAD AFTER EDD008	Ok
ES20	EDD005	Ok
ES22N	IN FRONT OF EDD013 ON HIGH MOUND GROUND NEAR TEMPORARY SHED	Ok
ES22A	LEFT SIDE CULVERT NEAR WATER SETLING POND AFTER EDD013	Ok
ES23	EDD002	Ok
ES23A	CONCRETE PILLAR LEFT SIDE OF ROAD AFTER EDD002, BARREN LAND	Ok
ES24A	EDD018	Ok
ES24B	EDD025	Ok


MAP SHOWING MONITORING STATIONS IN THE PROJECT SITE
N
E
S
W
DGPS2
ES2(NEW) BASE
ES3A
ES4
ES4A
ES5A
ES5B
ES6
ES6A
ES7A
ES8N
ES9
ES11B
ES12
ES13
ES13A
ES14
ES15
ES15B
ES15C
ES18N
ES19
ES19A
ES19B
ES19C
ES20
ES22A
ES22N
ES23
ES23A
ES24A
ES24B
183.08
202.43
307.88
259.39
20.71
323.1
336.7
40.71
105.37
346.27
302.72
86.6
51.93
522.53
527.17
202.75
150.08
183.32
106.68
336.58
218.03
124.91
178.89
130.44
300.61
190.29
215.84
367.18
224.69
381.43

7. Results:

The R.L. (Elevation Z) as observed during the Third Phase (III), Forth phase (IV) & Fifth phase (V) at the established control stations surrounding the well locations [ES2 (new) to ES24B] are given in Table 3, Table 4, Table 5 respectably and Fig. 2. The photographs of subsidence monitoring study conducted at RG (East) CBM block are given in Annexure-1.

Table 3: Total Latitude, longitude and ground elevation at the control stations during February 2019

SL NO.	POINT_ID	TYPE	EASTING	NORTHING	ORTHO HEIGHT
1	ES2NEW	Reference	535971.9543	2613127.421	78.0855
2	DGPS2	Measured	536011.8835	2613306.092	77.9812
3	ES3A	Measured	535895.964	2612936.978	77.1294
4	ES4	Measured	536185.1536	2612831.329	77.5271
5	ES6	Measured	536509.599	2612543.385	77.3298
6	ES5A	Measured	536258.5991	2612746.836	77.0865
7	ES5B	Measured	536257.2503	2612767.506	77.1344
8	ES6A	Measured	536540.8355	2612517.273	77.3532
9	ES4A	Measured	536437.4952	2612891.38	78.9292
10	ES11B	Measured	537079.5726	2611752.896	76.9967
11	ES7A	Measured	536756.5057	2612248.635	77.4838
12	ES13	Measured	537149.9354	2611633.037	75.686
13	ES12	Measured	537152.1329	2611691.748	76.6908
14	ES14	Measured	537634.1102	2611469.345	78.4697
15	ES15A	Measured	537860.2241	2611474.448	80.9516
16	ES15	Measured	537820.6173	2611389.821	80.6117
17	ES15B	Measured	537942.6787	2611477.142	81.7059
18	ES15C	Measured	538047.3177	2611456.367	81.8705
19	ES18N	Measured	538226.3166	2611416.822	82.6185
20	ES19	Measured	538562.8142	2611424.201	84.2948
21	ES19A	Measured	538752.4456	2611531.801	82.1911
22	ES20	Measured	539180.6002	2611492.233	82.0627
23	ES19C	Measured	539006.1463	2611531.84	82.2092
24	ES22N	Measured	539011.5765	2611740.818	81.5396
25	ES22A	Measured	539168.1963	2611848.871	78.4946
26	ES24B	Measured	539608.81	2612457.424	75.6738
27	ES23	Measured	539219.7855	2612058.453	76.6745
28	ES24A	Measured	539262.1981	2612616.636	70.5945
29	ES23A	Measured	539339.3689	2612405.618	73.96
30	ES19B	Measured	538882.0786	2611546.322	81.2674
31	ES13A	Measured	537233.7395	2611118.764	76.7189
32	ES9	Measured	536956.5858	2612029.666	77.4691
33	ES8N	Measured	536806.1786	2612341.566	78.5734

Table 4: Total Latitude, longitude and ground elevation at the control stations during July 2019

POINT_ID	EASTING	NORTHING	ORTHO HEIGHT
ES2NEW	535971.9543	2613127.421	78.0855
DGPS2	536011.8835	2613306.092	77.9809
ES3A	535895.964	2612936.978	77.0770
ES4	536185.1536	2612831.329	77.5270
ES4A	536437.4952	2612891.38	78.9289
ES5A	536258.5991	2612746.836	77.0866
ES5B	536257.2503	2612767.506	77.1338
ES6	536509.599	2612543.385	77.3280
ES6A	536540.8355	2612517.273	77.3530
ES7A	536756.5057	2612248.635	77.4795
ES8N	536806.1786	2612341.566	78.5728
ES9	536956.5858	2612029.666	77.4689
ES11B	537079.5726	2611752.896	76.9970
ES12	537152.1329	2611691.748	76.5820
ES13	537149.9354	2611633.037	75.6858
ES13A	537233.74	2611118.764	76.6140
ES14	537634.1102	2611469.345	78.4689
ES15	537820.6173	2611389.821	80.6114
ES15B	537942.6787	2611477.142	81.7046
ES15C	538047.3177	2611456.367	81.8703
ES18N	538226.3166	2611416.822	82.6179
ES19	538562.8142	2611424.201	84.2944
ES19A	538752.4456	2611531.801	82.1909
ES19B	538882.0786	2611546.322	81.1690
ES19C	539006.1463	2611531.84	82.2082
ES20	539180.6002	2611492.233	82.0624
ES22A	539168.1963	2611848.871	78.4939
ES22N	539011.5765	2611740.818	81.5385
ES23	539219.7855	2612058.453	76.6743
ES23A	539339.3689	2612405.618	73.9590
ES24A	539262.1981	2612616.636	70.5929
ES24B	539608.81	2612457.424	75.6730

Table 5: Total Latitude, longitude and ground elevation at the control stations during September, 2020

SL. NO	POINT_ID	TYPE	EASTING	NORTHING	ORTHO HEIGHT
1	ES2NEW	Reference	535971.9543	2613127.421	78.0855
2	DGPS2	Measured	536011.8835	2613306.092	77.9812
3	ES3A	Measured	535895.964	2612936.978	77.0768
4	ES4	Measured	536185.1536	2612831.329	77.5271
5	ES5B	Measured	536257.2503	2612767.506	77.1335
6	ES6A	Measured	536540.8355	2612517.273	77.3531
7	ES4A	Measured	536437.4952	2612891.38	78.9302
8	ES11B	Measured	537079.5726	2611752.896	76.9963
9	ES7A	Measured	536756.5057	2612248.635	77.4801
10	ES13	Measured	537149.9354	2611633.037	75.686
11	ES14	Measured	537634.1102	2611469.345	78.4689
12	ES15B	Measured	537942.6787	2611477.142	81.7051
13	ES15C	Measured	538047.3177	2611456.367	81.8707
14	ES18N	Measured	538226.3166	2611416.822	82.6166
15	ES19	Measured	538562.8142	2611424.201	84.2942
16	ES19A	Measured	538752.4456	2611531.801	82.1911
17	ES20	Measured	539180.6002	2611492.233	82.0624
18	ES19C	Measured	539006.1463	2611531.84	82.2088
19	ES22N	Measured	539011.5765	2611740.818	81.5385
20	ES22A	Measured	539168.1963	2611848.871	78.4936
21	ES24B	Measured	539608.81	2612457.424	75.6735
22	ES23	Measured	539219.7855	2612058.453	76.6748
23	ES24A	Measured	539262.1981	2612616.636	70.592
24	ES23A	Measured	539339.3689	2612405.618	73.9589
25	ES19B	Measured	538882.0786	2611546.322	81.1691
26	ES13N	Measured	537233.740	2611118.764	76.6138
27	ES9	Measured	536956.5858	2612029.666	77.4691
28	ES8N	Measured	536806.1786	2612341.566	78.573

Table 5.1: Comparisons of measured ground elevation at the control stations during July 2019 vs. September 2020

SL. NO	POINT_ID	TYPE	EASTING	NORTHING	ORTHO HEIGHT		DIFFERENCE	REMARKS
					JULY,2019	SEPTEMBER, 2020		
1	ES2NEW	Reference	535971.9543	2613127.421	78.0855	78.0855	0.000	
2	DGPS2	Measured	536011.8835	2613306.092	77.9809	77.9812	0.000	
3	ES3A	Measured	535895.964	2612936.978	77.077	77.0768	0.000	
4	ES4	Measured	536185.1536	2612831.329	77.527	77.5271	0.000	
5	ES5B	Measured	536257.2503	2612767.506	77.1338	77.1335	0.000	
6	ES6A	Measured	536540.8355	2612517.273	77.353	77.3531	0.000	
7	ES4A	Measured	536437.4952	2612891.38	78.9289	78.9302	-0.001	
8	ES11B	Measured	537079.5726	2611752.896	76.997	76.9963	0.001	
9	ES7A	Measured	536756.5057	2612248.635	77.4795	77.4801	-0.001	
10	ES13	Measured	537149.9354	2611633.037	75.6858	75.686	0.000	
11	ES14	Measured	537634.1102	2611469.345	78.4689	78.4689	0.000	
12	ES15B	Measured	537942.6787	2611477.142	81.7046	81.7051	-0.001	
13	ES15C	Measured	538047.3177	2611456.367	81.8703	81.8707	0.000	
14	ES18N	Measured	538226.3166	2611416.822	82.6179	82.6166	0.001	
15	ES19	Measured	538562.8142	2611424.201	84.2944	84.2942	0.000	
16	ES19A	Measured	538752.4456	2611531.801	82.1909	82.1911	0.000	
17	ES20	Measured	539180.6002	2611492.233	82.0624	82.0624	0.000	
18	ES19C	Measured	539006.1463	2611531.84	82.2082	82.2088	-0.001	
19	ES22N	Measured	539011.5765	2611740.818	81.5385	81.5385	0.000	
20	ES22A	Measured	539168.1963	2611848.871	78.4939	78.4936	0.000	
21	ES24B	Measured	539608.81	2612457.424	75.673	75.6735	-0.001	
22	ES23	Measured	539219.7855	2612058.453	76.6743	76.6748	-0.001	
23	ES24A	Measured	539262.1981	2612616.636	70.5929	70.592	0.001	
24	ES23A	Measured	539339.3689	2612405.618	73.959	73.9589	0.000	
25	ES19B	Measured	538882.0786	2611546.322	81.169	81.1691	0.000	
26	ES13A	Measured	537233.740	2611118.764	76.614	76.6138	0.000	CHANGE THE NAME FROM ES13A TO ES13N
27	ES9	Measured	536956.5858	2612029.666	77.4689	77.4691	0.000	
28	ES8N	Measured	536806.1786	2612341.566	78.5728	78.573	0.000	

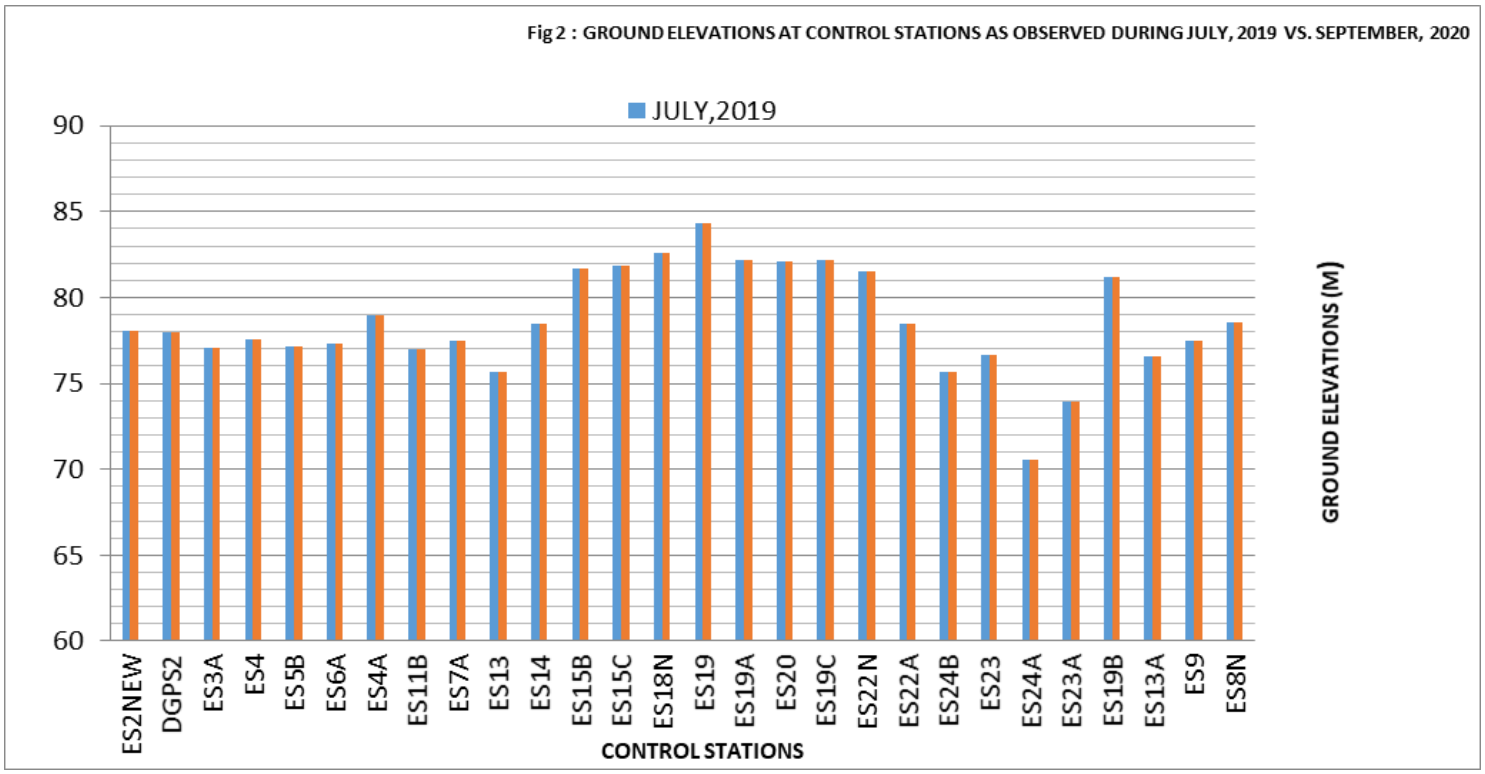


Fig.2: Ground elevations at control stations as observed during July 2019 vs. September 2020

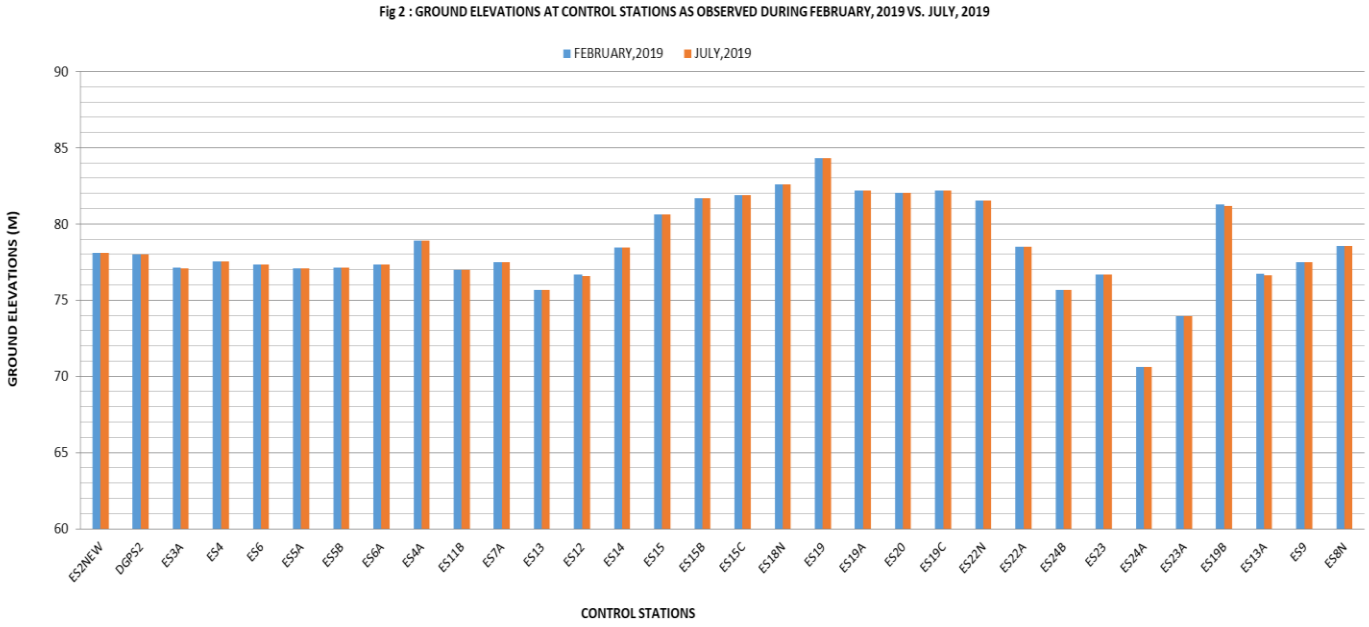


Fig.3: Ground elevations at control stations as observed during February 2019 vs. July 2019

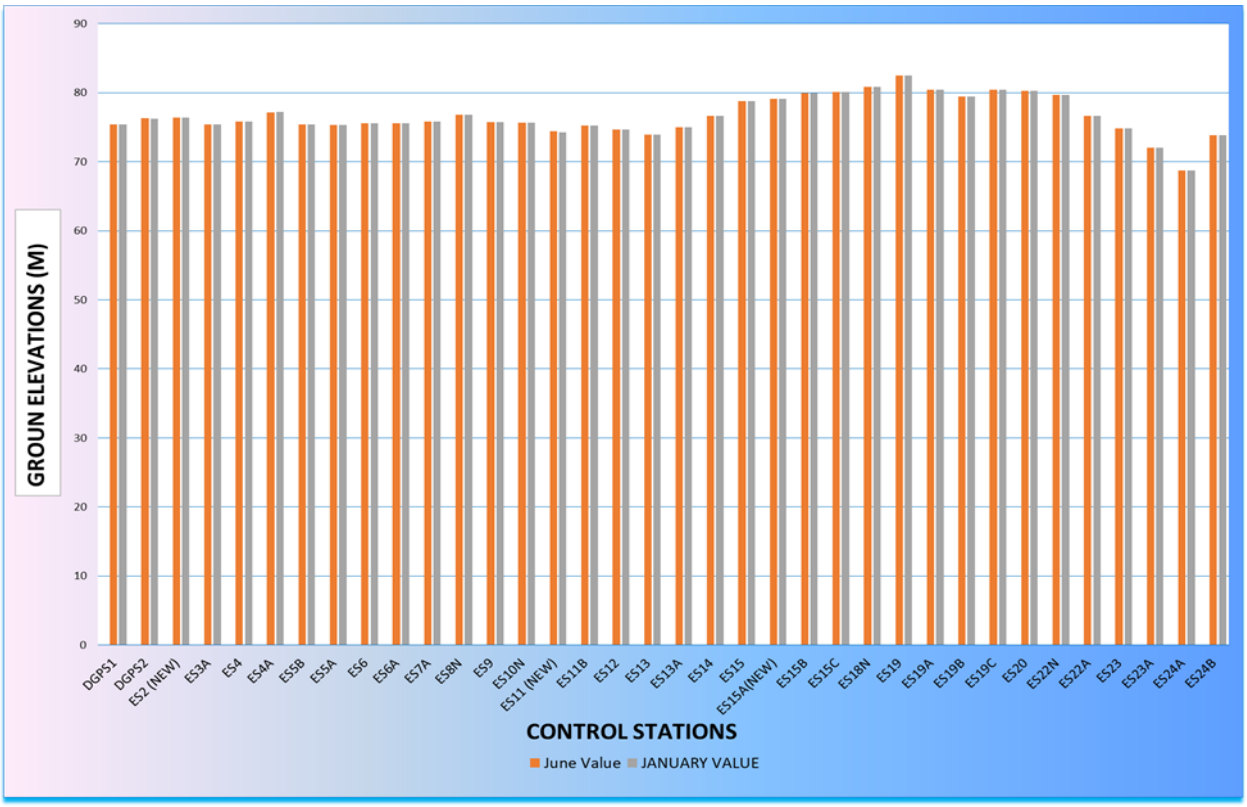


Fig.4: Ground elevations at control stations as observed during June 2016 vs. January 2017

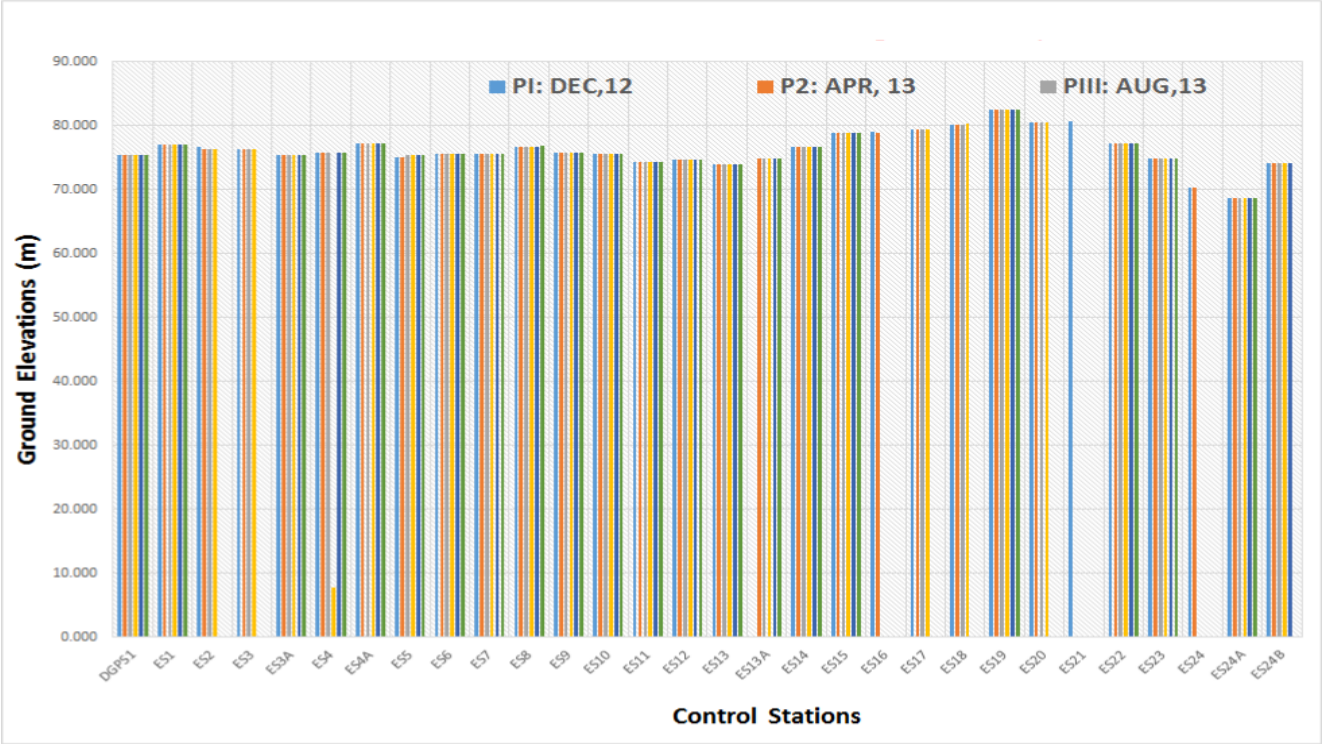


Fig.5.: Ground elevation at ESSAR Raniganj CBM Block during Dec, 12 to May, 15. Source-as per report of Department of Mining Engineering, Indian School of Mines, Dhanbad supplied by Essar Oil Limited (EOL).

8. Conclusion & Recommendation:

The R.Ls. (Elevation) of all the survey control points were measured during the present phases of subsidence survey with DGPS Instrument and also to be periodically monitored to examine the ground subsidence in the area due to compaction and collapse of overlying litho units as a result of continuous withdrawal of CBM gases and groundwater. During the subsidence monitoring for nearing two and half years (December 2012 – May 2015) at CBM block conducted by Department of Mining Engineering, Indian School of Mines, Dhanbad and the studies (June 2016- July 2019) performed by National Institute of Technology(NIT) Durgapur, no active subsidence were observed at the control stations close to the CBM Gas wells, plants site and at places of habitats.

The present phase of study carried out by NIT Durgapur in September, 2020 also witnessed no active subsidence at any control stations of the specified study area. The established control stations should be preserved carefully without causing any ground disturbance at the surroundings. However, during the study at the site, it was observed that few control stations were either disturbed or removed/broken. As a result of which measurement of ortho height at control points ES5A, ES6, ES12 and ES15 could not be carried out. The reduction of control stations affects the precision of the overall subsidence monitoring study. **However, a communication from M/S EOGEPL confirmed that the preservation of already damaged monitoring/control stations like DGPS1, ES5A, ES6, ES9, ES10N, ES11 NEW, ES12, ES13A and ES15 are beyond their control because the referred monitoring stations are not located within their property. Therefore, the above mentioned control stations may be eliminated from further monitoring. The control stations and reason for their elimination as communicated by M/S EOGEPL is given in a tabular form below.** Suitable precautionary measures should be taken to preserve rest of the control stations from any external disturbances. A very careful preservation of control stations are required because subsidence study is a long term study and comparison of time series elevation data of each control station will depict the occurrence of subsidence, if any. Proper fencing arrangements surrounding the control stations along with sign boards displaying names of subsidence monitoring stations with their elevations are recommended to be provided at control stations. The already disturbed control stations are to be repaired prior to next phase of the monitoring study.

Dr. Supriya Pal
Associate Professor
Department of Civil Engineering
National Institute of Technology Durgapur
Durgapur - 713209, W.B., India

Sr. No	Station No	Locations (as per your previous Report)	Remark
1	DGPS1	BENCH MARK. BARREN LAND NEAR GGS-1	The land owner barricaded the area and not in our control, New Base point establish inside GGS 1 **named as ES2**
2	ES5A	PAINT MARK ON EXISTING FOUNDATION NEAR DG SET AT EDD011	New pillar establish named as **ES5B**
3	ES6	ANCHOR PILLAR NEAR WATER POND AT EDD010	Temporary, On a hanging clump, permanent Pillar establish in the same location **name as ES6A**
4	ES9	CONCRETE SMALL PILLAR NEAR BOUNDARY AT ROAD SIDE NEAR NEAM TREE	Uncontrolled point inside the village, may lost in future. However reading has collected in this year.
5	ES10N	NAIL ON ROAD SIDE NEAR TEMPLE & BEDI	Both the Point lost during Road repairing and construction of surface drain by Gram Panchyat, So it's also not in our control
6	ES11 (NEW)	SURVEY PEG WITH NAIL AT ROAD SIDE NEAR TRANSFORMER	
7	ES12	BROKEN CONCRETE PILLAR AT ROAD SIDE NEAR ENTRY EDD004 (R/S)	Temporary As already one more point establish inside the well pad Named **as ES13**
8	ES13A	PAINT MARK ON EXISTING FOUNDATION NEAR DG SET AT EDD026	Temporary, New pillar establish **as ES 13N**
9	ES15	ROAD SIDE CULVERT	In between point, On the road side Calvert. Damage by public Not in our control

9. Deliverables:

- ✓ Text report - Text report explaining the procedure adopted for DGPS survey.
- ✓ Tabulated reading of the DGPS readings (in UTM and Ortho Heights).

10. Plates:

Plate 1: Subsidence monitoring station at ES8N

Plate 2: Subsidence monitoring station at ES4

Plate 3: Subsidence monitoring station at ES20

Plate 4: Subsidence monitoring station at ES19

Plate 5: Subsidence monitoring station at ES13

Plate 6: Subsidence monitoring station at ES23A

Plate 7: Subsidence monitoring station at ES24B

Plate 8: Subsidence monitoring station at ES5B

ANNEXURE VII

Expenditure towards Environmental Protection Measures at EOGEPL CBM Project, Raniganj (April' 20 to September' 20)

S. No.	Particular	Expenses (INR)
1	Installation of Reverse Osmosis Treatment System for Produced Water Treatment (Recurring)	Rs. 56,73,527.00
2	Environmental Monitoring Activities (Recurring)	Rs. 5,48,004.00
3	HDPE liners for produced water storage at site when needed (Capital)	Rs. 1,32,275.00
4	Non Hazardous Waste Disposal (Recurring)	Rs. 73,100.00
5	Green Belt Development (Recurring)	Rs. 25,000.00
6	Hazardous Waste Disposal (Recurring)	Rs. 1,16,178.00
7	Land subsidence study (Recurring)	Rs. 4,01,200.00
TOTAL		**Rs. 65,68,084.00**