EXECUTIVE SUMMARY

INTRODUCTION

Environmental Impact Assessment (EIA) is a process, used to identify the environmental, social and economic impacts of a project prior to decision-making. It is a decision making tool, which guides the decision makers in taking appropriate decisions for proposed projects. EIA systematically examines both beneficial and adverse consequences of the proposed project and ensure that these impacts are taken into account during the project designing.

PROJECT DESCRIPTION

The Bauxite deposit in Barima village, Sitapur Tehsil, District Surguja falls in Mainpat plateau. The lease area of 54.268Ha has been granted to M/s Chhattisgarh Mineral Development Corporation Ltd. (CMDC), Raipur.

As per the New MMDR (Amendment) Act, 2015, the lease period should be extended upto 07/02/20160 (50 years from the date of grant) (Refer **AnnexVI**)

As per the scrutiny comment issued by IBM, Nagpur, the validity period of earlier approved Mining Plan was 2009-10 to 2013-14, thus, the Proposal period of this Modification in approved Mining Plan is 2014-15 to 2018-19, out of this first year 2014-15 is lapse period, 2015-16 no proposal due to pending of clearances and production will be taken up only from three years, i.e. 2016-17 to 2018-19

There is no proposal for mining during the first three years, since the first three years has been a lapse period (2011-12 to 2013-14).The lessee presently has to obtain environment clearance under EIA Notification 2006 and Air and Water consent under Air (Prevention and Control of Pollution) Act 1981 and Water (Prevention and Control of Pollution) Act 1974 respectively. Thus full production of the mines can be achieved in the fifth year only.

PROJECT PROPONENT

Chhattisgarh Mineral Development Corporation (CMDC), Raipur has been allotted Mining Lease (ML) at Barima village, Sitapur Tehsil, District Surguja of Chhattisgarh State.

LOCATION OF THE PROJECT

The proposed mine is located near Barima village, Tehsil Sitapur, District Surguja, Chhattisgarh over an area of 54.268 Ha. The lease area is divided into two Blocks, eastern part (Block A) being the major block (52.277Ha) and western part (Block B), the other block (1.991Ha).

ENVIRONMENTAL SENSITIVITY

Table E 1: Sensitive Locations in the Study Area (15 km. Radius)

Environmental Sensitivity	Distance & Direction
Forests	
Barima Reserved Forest	Adjacent to ML Area, W
Kumarta Reserved Forest	3.8km S
RF near Konchira	12.5km WSW
RF near Kadamdhadhi	13.0km SW
Alora RF	13.0km SSE
Water Bodies	

Mangarda Nala	0.5km NW
Gumgata Nala	3.0km NW
Mahadevmunda River	6.0km E
Sangul Nadi	6.5km SSW
Mand River	15.0km ESE

TOPOGRAPHY

In the regional topography, general elevation of Mainpat Plateau is about 1060 m MSL. The plateau extends about 40 km in length towards east-west direction and about 14 km in width towards north-south direction and is characterized by steep scarps along its edge. At places, these scarps are dissected by steep valleys in certain places are up to 150 m deep. The plateau has acquired amoeboid shape due to deep cutting by nalas and minor streams. The lease area is a part of this belt and is divided into two Blocks, eastern part is Block A (52.277 Ha) and western part is Block B (1.991 Ha).

The topography of the lease area is a dissected plateau and sloping towards south-east. The lease area has been surveyed on a scale of 1:2,000 with contour interval of 3m. In the lease area, the highest contour level is 1075 mRL on the center to north-eastern part and gradually sloping in all directions and lowest contour level is 1069 mRL towards western and southern directions.

QUALITY OF RESERVES

The reserves and resources have been estimated as per the data given in the Prospecting Report. During prospecting, the cut-off grade of bauxite is considered as Al_2O_3 minimum 40%, 35 to 40% and 30 to 35 m(%), while for the preparation of this Mining Plan the reserve has been estimated as per two grades 30 to 40% Al_2O_3 with reactive silica below 5% and minimum 40% Al_2O_3.

61 boreholes are falling in the lease area, out of which bauxite ore is encountered only in 47 boreholes and they have been considered for the reserve estimation. The spacing of boreholes having 100 m and 50 m interval in systematic grid pattern is considered for the ore reserve. The spacing of borehole in influence area for that particular borehole has been taken 50 m or 25 m on its either side and each borehole depth is also considered for the reserve calculation in G - 1 category, based on this consideration, about 43.45 Ha area is covered by detailed exploration

Mineral reserve as per UNFC classification is presented in **Table E.2**

Table E 2: Reserve and Resource Estimation

United nations framework classification (UNFC)		***Code***	***Quantity***	***Grade***	
			(Tonnes)	Al_2O_3%	SiO_2%
A. Mineral Resources	(1) Proved Mineral Reserve	111	--	--	--
	(2) Probable Mineral Reserve	121	6,63,814	40.55	2.84
	(3) Probable Mineral Reserve	122	--	--	--
B. Remaining Resources	(1) Feasibility Mineral Resources	211	--	--	--
	(2) Prefeasibility Mineral Resources	221	41,372	40.99	2.99
	(3) Prefeasibility Mineral Resources	222	--	--	--
	(4) Measured Mineral Resources	331	--	--	--

	(5) Indicated Mineral Resources	332	--	--	--
	(6) Inferred Mineral Resources	333	--	--	--
	(7) Reconnaissance Mineral Resources	334	--	--	--
	Total Mineral Resources (A+B)		7,05,186	+30	5

PROPOSED METHOD OF MINING

There is no proposal for mining during the first year of this Scheme of Mining period and during the second year 2015-16, the lessee has to obtain environment clearance under EIA notification 2006, collecting the season-wise base line information and air and water consent under Air and Water (Prevention and Control of Pollution) Act. This may take about six to nine months and hence, the production will be start from the third year, i.e. 2016-17 taking production rate of about 1,15,000 T per annum and this rate will continue. The sequence of mining operations is as under:

- A smooth and asphalted haulage road of about 1,100 m length and 10 m width will be developed for movement of vehicles by using dozer.
- Top soil and laterite will be dozed off separately and stocked separately by excavator cum loader. The average height of the OB bench will be about 5 m (3 m top soil + 2 m laterite).
- After exposing the aluminous bauxite / bauxite zone and proper leveling by dozer for drilling and blasting, the drilling will be done by jack hammer of 32 mm dia. for maximum 1.5 m depth and with DTH drills of 100 mm dia. for more than 1.5 m depth. Thereafter, blasting will be carried out after taking all safety measures/precautions. The bauxite mineralization in the area is intermixed with clay, murrum and laterite.
- The production will be taken up considering the influence area of such boreholes to maintain the production rate and average quality of bauxite as Al_2O_3 about 40%.
- The blasted ROM will have mixed zone of bauxite + laterite. Out of these, the bauxite will be sorted out (about 65% of ROM) and reduced to marketable size (150 mm) by manual labours. The remaining rejects/waste (about 35% of ROM) in the form of clay/laterite, etc will be used for backfilling the fully exhausted mining pit concurrently.
- Thereafter, the marketable sized ROM will be loaded by 1.25 cum shovel into 10/15 T dumper/tipper for transport to the consuming plants.
- The maximum depth of bauxite mineralization is confined to about 10.30 m (W/810), the entire bauxite will be removed from these benches.
- Thereafter, the OB laterite and generated waste/rejects (35% of the ROM) will be concurrently backfilled in the mined out pit and leveled.
- Finally, the back-filled leveled areas will be covered with top soil for plantation. For this, selected fertilized types of special variety of plants will be grown in consultation with State Pollution Control Board, Forest Department and grounded after their full growth, thereby increasing the fertility of the soil and ultimately making soil suitable for agriculture.
- Since, the production rate is high, the production has been proposed simultaneously from two quarries to meet the production target.
- The proposed production rate of bauxite will be about 1,15,000 tonnes and will further continue till the end of mines.

LAND ENVIRONMENT

MINE LEASE AREA

The entire lease hold area of 54.268 Ha lies in Private-owned land. The break-up of the land use of mining lease area is given below in **Table E.3**

Table E 3:- Land Use Pattern of the Mining Area (in Ha)

Sl no	*ALL THE AREAS ARE GIVEN IN HECTARES	Existing Condition	End of the 5 year	Conceptual Period
1.	Pits & Quarries	----	14.92	----
2.	Water Reservoir	----	----	4.30
3.	Backfilled and planted Area	----	----	23.65
4.	Infrastructure (Workshop, Administrative Building)	----	0.010	0.010
5.	Roads	----	1.100	----
6.	Green Belt	----	3.650	3.650
7.	Non Utilized	54.268	34.588	22.658
	Total	**54.268**	**54.268**	**54.268**

Source: Mine Plan Prepared by Geo Solutions (P) Ltd

ANALYSIS OF ALTERNATIVES

In the proposed project, opencast mechanized mining method will be carried out. For that, no other methodology is going to be changed, depending upon the geological set up, strata of the rock, boulders and its structural behaviour. So, all the parameters of REIA/ EMP will be implemented as per the open cast mechanized mining.

DESCRIPTION OF ENVIRONMENT

This section contains the description of baseline studies of the 10-km radius of the area surrounding the site. The data collected has been used to understand the existing environment scenario around the proposed mining project against which the potential impacts of the project can be assessed.

Baseline data was generated for various environmental parameters including air, water (surface and ground water), land and soil, ecology and socio-economic status to determine quality of the prevailing environmental settings. The baseline data for study was conducted during post-monsoon (March to May, 2015) season.

METEOROLOGICAL DATA

This section makes a comparative analysis of the meteorological condition of the study area. The data used for the purpose are the last 30 years average IMD data and the on-site data recorded during the period March to May 2015.

The study area is part of tropical monsoon climate with long humid summer and short winters. The rainfall is heavy during monsoon and light in pre monsoon season.

The annual average total rainfall recorded in the region was found to be 1526.9 mm, which is quite high. The maximum average rainfall (460.9 mm) was recorded in the month of July. This month also had the maximum number of rainy days.

The average maximum temperature was recorded in the month of May at 39.5℃ and the minimum temperature was 8.8℃ in December. The high est temperature recorded in the area was 44.9℃ in June 1988 while the minimum was 0.9℃ in January 1989.

The Relative Humidity was highest during the monsoon season with the month of August recording the highest average at 88%.

The maximum average wind speed was found to be 7.8 kmph in the month of June. The predominant wind direction recorded at the IMD station was from North followed by South-west and West.

AIR ENVIRONMENT

Nine Ambient Air Quality Monitoring (AAQM) Stations were selected. Criteria used for designing the network were principally governed by the wind rose pattern for pre-monsoon seasons and the accessibility of the selected sites. The value of parameters at all the location is found within the limits prescribed by Central Pollution Control Board (CPCB). The 95th percentile value of SPM varies between 83.4µg/m^3 at Maltipur village to 113.4µg/m^3 at Kuniya. The 95th percentile value of PM10 recorded within the study area was in the range of 46.7 µg/m^3 and 59.5µg/m^3. The 95th percentile concentration of PM 2.5 varies between 14.9 µg/m^3 to 29.9 µg/m^3. SO_2 recorded within the study area was the 95th percentile ranging between 7.7µg/m^3 to 11.7µg/m^3. The 24 hourly average values of SO_2 were compared with the National Ambient Air Quality Standards (NAAQS). NO_x recorded within the study area was between 12.3µg/m^3 to 17.3µg/m^3. The 24 hourly average values of NO_x were compared with the National Ambient Air Quality Standards (NAAQS). The 95th percentile value of CO recorded within the study area was between 0.91mg/m^3 to 1.42mg/m^3.

NOISE ENVIRONMENT

The noise level in area varies from 49.0 dB (A) to 52.8 dB (A) during day time and 35.9 dB (A) to 37.1 dB (A) during night time. The only noise generated is movement of trucks. However as the movement of trucks was not much, noise level in study area was found well below to the stipulated standards.

WATER ENVIRONMENT

DRAINAGE PATTERN OF MINE LEASE AREA

Streams of the plateau exhibit a combination radial and dendritic pattern. Major streams near the ML area are flowing towards north direction and joined to Mangarda Nala which is flowing towards northern direction. No perennial nala is flowing within the lease area. There are some first order streams starting from the western boundary of ML area and flowing in west and north direction. These nalas will not be affected by mining operations.

In the buffer zone there are two rivers, viz. Sangul Nadi and Mahadevmunda River which flows away from the ML area towards the boundary of the study area. There are some major static water bodies which act as source of water for the local population during the monsoon and post-monsoon seasons.

WATER QUALITY

Three surface water and four ground water samples were collected and tested to know the water quality of study area. The water quality of the water samples collected were analysed and found well within the desirable limits as per IS: 2296 Class C & IS: 10500:2012.

The dissolved solids level in the water samples were found in the range of 418 to 442 mg/l., which is within the permissible limits. The chlorides were found to be in the range of 31.5 and 42.5 mg/l. The sulphates were found in the range of 13.5 to 25.4 mg/l. Total hardness values were in the range of 222.6 – 235.5 mg/l, which is within the permissible limits. Total alkalinity values were in the range of 224.1 and 235.1 mg/l. The values of Iron are in the range of 0.39 to

0.52 mg/l which is higher than the acceptable limit as per IS 10500:2012. All the parameters have been found to be within the permissible limits prescribed under the IS: 10500, 1991 for drinking water.

SOIL QUALITY

To understand the soil quality in the proposed study area, 6 locations were selected for soil sampling. Composite sampling of soil up to root depth (10-15 cm) was carried out at each location. The important properties of soil are bulk density, porosity, infiltration rate, pH and organic matter, kjeldahl nitrogen, phosphorous and potassium.

BIOLOGICAL ENVIRONMENT

FLORA

On the basis of distribution of flora and fauna, the study area is demarcated into agricultural land, terrestrial vegetation, forest land, and water bodies. The project site is an open scrub land devoid of thick vegetation.

The common trees observed in the study area and in the reserved forests in the study area are Babul, Haldi, Banana, Tendu, Bael, Amla, Shishom, Khair, Aam, Bila, Sal, Champa, Teak, Pakri, Kekad, Koriya, etc.

FAUNA

The mine lease area is scantily vegetated and the area is devoid of significant faunal existence. As the animal species are capable of moving from place to place either for food or shelter or mating, hence, the common check list is prepared based mainly on available secondary data and also on the basis of direct observation, indirect or circumstantial evidence such as foot and scratch marks, feathers, skin etc.

A primary field survey was conducted through random observation in the study area and data was also collected from local persons of the area and forest officials. The common mammals observed in the study area and in the reserved forests in the study area are jackal, squirrel, fruit bat, field rat, elephant, Bengal monkey, barking deer, panthar, jungle cat etc. The common birds observed in the study area are common myna, house crow, spotted dove, jangali tota etc.

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

IMPACT ON AMBIENT AIR QUALITY

The mining is proposed to be carried out by opencast mechanized method. The air borne particulate matter generated by ore and handling operations, transportation and screening of ore is the main air pollutant. The emissions of Sulphur dioxide (SO_2), Oxides of Nitrogen (NO_x) contributed by vehicles plying on haul roads are marginal. Prediction of impacts on air environment has been carried out taking into consideration proposed production and net increase in emissions.

In order to show that the the maximum incremental ground level concentration of SPM will be 2.61µg/m^3 near the project site. This shows that the adverse impact of mining outside the ML area will be marginal and will not have any adverse effect on health of human and animals and also on the flora of the area. For PM10 the incremental value is 1.41µg/m^3 and there will be no major impact on the environment

MITIGATION MEASURES FOR AIR POLLUTION

Bauxite is a hydrated oxide of aluminum. It is a mixture of two or more hydroxides corresponding to Gibsite ($Al_2O_3.3H_2O$) and Boehmite ($Al_2O_3.H_2O$). The moisture content in Bauxite is around 3% to 7%.Therefore, emissions due to mineral handling, during mining operations are not much and restricted to the lease area only. Air pollution is caused mainly due to dust generation added with gaseous emission from transportation activities along with mining operation like loading etc.

CONTROL OF FUGITIVE EMISSION

- Use of Personal Protection Equipment (PPE) like dust masks, ear plugs etc by the mine workers.
- Regular Water sprinkling on haul roads & loading points will be carried out.
- Development of green belt/plantation around the lease boundary, roads, dumps etc should be developed.
- Ambient Air Quality Monitoring conducted on regularly basis to assess the quality of ambient air.

PRESERVATION AND CONTROL OF GASEOUS POLLUTION

- In mining activities, the sources of gaseous emissions would be vehicle movements.
- Proper maintenance of machines improves combustion process & makes reduction in the pollution. Good maintenance and monitoring of fuel and oil will not allow significant addition in the gaseous emission.

IMPACT ON NOISE LEVEL

Noise generated at the mine is due to truck transportation activities. The noises generated by the mining activity will dissipate within the mine. There may be noise pollution due to drilling, blasting and movement of trucks. This may go beyond the threshold value i.e. 90dB (A), but will be momentary. No major impact of the mining activity on the nearby villages is envisaged. The pronounced effect of noise will be felt only near the active working area.

The impact of noise on the villages is negligible as the villages are located far from the proposed mine lease area or mine workings. Since there in no involvement of major machinery, the impact of noise levels will be minimal.

MITIGATION MEASURES FOR NOISE POLLUTION

The following mitigation measures are suggested for water management and water pollution control. However, priority relevance depends on the location and type of mining and minerals.

- Garland drains will be constructed on all side of quarries and external dumps. All the garland drains will be routed through adequately sized settling pits to remove suspended solids from flowing into storm water drains. The design of settling pits would be calculated on the basis of silt loading, slope and detention time required.
- The vehicle washing and maintenance wastewater will be suitably treated for suspended solids and oil & grease.

MITIGATION MEASURES FOR WATER POLLUTION

The following mitigation measures are suggested for water management and water pollution control. However, priority relevance depends on the location and type of mining and minerals.

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- The vehicle washing and maintenance wastewater will be suitably treated for suspended solids and oil & grease.

WATER CONSERVATION MEASURE

The rain collected in the pits after spell of rain will be used for plantation and dust suppression. At the end of life of mine, excavated area will be used as a rain water pit.

IMPACT ON FLORA & FAUNA

The impact on biodiversity is usually very high if the project is located close to ecologically sensitive areas such as forests. However in this case, the proposed mine lease area is away from any type of sensitive area. The impact on biodiversity is difficult to quantify because of its diverse and dynamic characteristics. Mine site preparation and construction of roads for providing access to the mining site will involve removal of vegetation cover which may impact the biodiversity of the area.

The impact on terrestrial ecology will be due to emission of gaseous pollutant like NOx from vehicles. The pollutant at a very low dose acts as an atmospheric fertilizer for the vegetation. However, at higher doses, they are injurious to both vegetation as well as animals. For the mining operations, NOx emissions are mainly due to burning of diesel in mining vehicles. As described in the baseline on air quality, the low concentrations of NOx due to operation of the mining operations will have insignificant impact on ambient air quality and NOx concentration will remain much below the NAAQ standards. Therefore, the impact of these emissions on the surrounding agro-ecosystem will be insignificant.

SOCIAL ENVIRONMENT

The mine area does not cover any habitation. Hence the mining activity does not involve any displacement of human settlement. No public buildings, places, monuments etc exist within the lease area or in the vicinity. The mining operation will not disturb/ relocate any village or need resettlement. Thus no adverse impact is anticipated.

The impact of mining activity in the area is positive on the socio-economic environment of the region. The negative impact will be limited to some sporadic health problems, which may occur due to increase in fugitive emission in the vicinity of the mines. The proposed mine project is providing employment to local population and it will be give preference to the local people whenever there is requirement of man power. The local skilled labour will have additional opportunity to enter into automobile maintenance profession to cater to the needs of the transport trucks.

OCCUPATIONAL HEALTH & SAFETY

External hazards involve injuries to human cattle and plants, which could occur during mining operations. These injuries could be due to flying stones and also when ore transport vehicle loses control, internal hazards occur due to unhygienic work conditions or carelessness of the workers involved in mining operations. Internal hazards often show their affect after a long time. The mining operation is unlikely to cause any adverse impact due to the above factors in buffer zone. The mine management will provide proper health care facilities near the mine area. This will be provided to the surrounding villages in case of emergencies. All measures to provide a safe environment will be taken by the management. The speed of dumpers/trucks will be

regulated inside and outside the mines to ensure safety of employees as well as locals. Hence adverse impact on health and safety of the workers and the local population is not expected. No accident or injury due to fly rock is expected in the mine or due to this mine.

ANTICIPATED IMPACTS AND MITIGATION MEASURES

Environmental impact assessment (EIA) of the proposed project has been carried out with reference to air, soil, water, noise, flora, fauna and socio economic.

POST-MONITORING PLAN

To evaluate the effectiveness of Environment Management Programme, regular monitoring of the important environmental parameters will be taken up. The schedule, duration, and parameters to be monitored are shown in **Table E.4**.

Table E 4: Monitoring Schedule and Parameters

Sl. No.	Description of Parameters	Schedule and Duration of Monitoring
1	**Air Quality** (SPM, PM10, PM2.5, SO_2, NO_X) monitoring in five locations • In the pit office/workshop • Two monitoring station in up wind • Two in downwind in consultation with SPCB	Will be monitored in every quarter as per norms laid down under MCDR 1988 and DGMS norms.
2	Continuous **micro-meteorological** monitoring in one location • On roof of nearby building	Continuous
3	**Water Quality** of surface and ground water around the site will be collected from 6 (3 for each) locations in consultation with SPCB • One of the locations will be in near the OB Dump • One near the active working area • One near the natural discharge point	Will be monitored in every quarter as per norms laid down under MCDR 1988 and DGMS norms
4	**Ambient Noise Level** monitoring in consultation with SPCB • Near the pit head	Will be monitored in every quarter as per norms laid down under MCDR 1988 and DGMS norms
5	Inventory of **flora** to judge the comparative status will be done in the nearest forest	Once in 2 years
6	**Soil** • One of the locations will be near OB Dump • One near the active working area	Twice in a year in reclaimed land
7.	**Biological** • Green Belt development • Block Plantation • Reclaimed Area Plantation • Hydro Reclamation • Water harvesting Schemes	Every 6 months by a core group formed from management and plantation executing agency

BUDGETARY PROVISION FOR ENVIRONMENT PROTECTION

The capital cost estimated to be incurred for environment care and protection such as equipment; PPEs, etc will be Rs 3.0 lacs. The recurring cost for monitoring, dust suppression,

green belt maintenance, and biological reclamation of land has been calculated at Rs 9.5 lacs annually.

CONCLUSION

As discussed, it is safe to say that the proposed facilities are not likely to cause any significant impact to the ecology of the area, as adequate preventive measures will be adopted to keep the various pollutants within the permissible limits. Green belt development around the area will also be taken up as an effective pollution mitigate technique, as well as to serve as biological indicators for the pollutants released from the premises of “Barima Bauxite Mining Project.