ORIENT ABRASIVES LIMITED

Draft Report on: EIA/EMP for mining of 1,28,385 TPA ROM of Bauxite at Village Nandana of Taluka Kalyanpur in District Jamnagar, State Gujarat

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Environment for Development

1 EXECUTIVE SUMMARY

1.1 Introduction and Background

1.1.1 General Information

M/s Orient Abrasives Limited (OAL) was established as a venture to manufacture calcined and fused alumina products in 1974, in technical collaboration with Karborundum, Bentueky, Czechoslovakia, by the Rajgarhia Group of Industries. OAL is a multi-divisional company having their head office at New Delhi, manufacturing facilities at Porbandar (Gujarat) and Bhiwadi (Rajasthan) and distinction of being ISO - 9001 (Quality Management System) certified. The Company offers a wide range of refractory and monolithic products for the iron and steel industry and enjoys a large domestic and international clientele. An in-house R&D facility supports the division's product development initiatives.

1.1.2 Project background

The focus of this study report is the Nandana - 1 bauxite mining lease of OAL in Nandana Village of Kalyanpur Taluka of Jamnagar District, Gujarat State. Total area of the mining lease is 50.83 ha.

Location and Approach to Site

Nandana – 1 mining lease is located at Survey No. 529/P of Nandana Village. The lease under reference is ~ 3.2 km from Nandana Village which is approachable via Limdi Village. Limdi is located on Jamnagar – Okha State Highway No. 25 and is ~ 32 Kms from Khambhaliya.

1.2 Project Details

1.2.1 Reserves

1.2.2 Estimation of Reserves

As the mining is done since 1981, working pits are available in the lease area. Based on the geological data gathered from the pit, ore reserves were estimated in the mine lease. In all 36,74,862 MT geological reserves of proved and probable category have been calculated in the approved mining plan out of which 30,93,395 MT is considered under mineable reserves. The recovery of bauxite was considered as 80% of ROM.

Category of bauxite reserves has been given in ***Table 1-1***.

Table 1-1: Category of Bauxite Reserve (MT)

Area	Proved Reserves (Category 111) MT	Probable Reserves (Category 121) MT	Possible Category (Category 123) (MT)	Total (MT)
50.83 Ha	28,81,062	7,93,800	-	36,74,862

1.2.3 Mining Details

Method of mining

Mining will be carried out by semi-mechanized open cast method (using excavators and tippers) in which soil will be scrapped first and stacked nearby. Then, soil and bauxite with depth upto 1.0 m and 5.00 m respectively will be excavated by forming one bench for each, keeping the width of benches 10 m. The bauxite horizon is thick and thus drilling and blasting will be used during mining.

For the given scheme period mining will be started from the southern part of the lease covering an area of ~ 4.7 ha with a working depth of 6.0 m.

Production Details for Scheme Period

During this scheme period of five years total 5,79,757 tonnage of ROM will be excavated out of which recovery of bauxite will be 4,63,805 MT (80% of ROM). Details of yearwise production of bauxite and overburden are presented in ***Table 1-2***.

Table 1-2: Year wise production during five year scheme

Year	Volume (m^3)		Tonnage of ROM (MT)	Recovery of Bauxite 80% of ROM (MT)	Waste 20% of ROM (MT)	Production of Bauxite	
	OB	ROM				Plant Grade (10% of Production)	Non-Plant Grade (90% of Production)
2012-13	9916	56954	128147	102518	25629	92266	10252
2013-14	9514	52475	118068	94454	23614	85009	9445
2014-15	9584	51824	116604	93283	23321	83955	9328
2015-16	8325	47697	107318	85854	21464	77269	8585
2016-17	9744	48720	109620	87696	21924	78926	8770
Total	**47083**	**257670**	**579757**	**463805**	**115952**	**417425**	**46380**

The above activities will be extended till the end of the mine life assuming the same rate of mining. Lease period expiry is by 2021.

Stacking of Mineral Rejects and Disposal of Waste

As per the proposed mining scheme, OB and waste generated will be backfilled in the mined out voids in the southern and northern part of lease area, therefore, the problem of disposal of OB and waste will not be there. The soil scraped will be spread over the backfilled area. Details of backfilling are presented in ***Table 1-3.***

Table 1-3: Details of Backfilling

Year	Total backfilling material (m^3)	Area to be backfilled (m^2)	Average height of backfilling (m)
2013-13	39400	6566	6.0
2013-14	37983	6330	6.0
2014-15	22825	3805	6.0
2015-16	21013	3502	6.0
2016-17	22411	3735	6.0
Total	**143632**	**23938**	**6.0**

Sub-Grade Material Handling

In the proposed mining, there is no possibility of production of production of sub grade material. Hence, there is no need for making provisions for stacking of sub grade material.

Mineral Reject Handling

The mineral rejects generated will be lifted to an extent and after blending with high grade bauxite from OAL's other leases, will be used in manufacture of cement.

Employment Generation

The lessee is having several mining leases in this area and has employed qualified mining engineers and geologists for of these works under the Regulation 42(1)(a) of MCDR 1988. Total 49 persons will be involved in Nandana - 1 bauxite mining lease (including temporary or permanent).

Mineral Beneficiation

The different grades of bauxite occurring in this lease are associated with laterite and clay. Except manual sizing and sorting of the bauxite no other processing is proposed to be done.

1.3 Water and Wastewater management

1.3.1 Water Requirement

Total water requirement of the project is 19.81 KLD, which is mainly required for dust suppression, greenbelt development and for domestic use. Water will be supplied by the means of tanker from the well present in Mewasa village.

Wastewater Generation

There will be no wastewater generation from mining activities; however, 1.85 KLD of domestic wastewater will be generated, which will be disposed in soak pits.

1.3.2 Mine Drainage

Ground Water

The bottom of the quarry remains much above the ground water table and during mining water table will not be intersected by working, thus there is no point related with the mine drainage.

Storm Water

The rain water will get collected in the mined out pits and as a common practice is used by the mine owners for dust suppression and greenbelt development.

1.3.3 Air Emissions

Point Source Emissions

There are no D.G Sets installed for the process of mining, hence emissions of Particulate Matter (PM_{10}), Sulphur–di-Oxides (SO_2), and Oxides of Nitrogen (NO_X) will not occur from these sources. Marginal emissions will be there because of:

- Diesel consuming equipment such as earth movers, jack hammers and compressors used for drilling blast holes
- Dewatering pump (operated as and when required for short periods of time) for removing water after rains from pits that have not been completely mined out.

Area Source Emissions

Area source emissions in the form of particulate matter (PM) are likely to occur due to:

- Open pits generated during mining operations, and
- Dumps of mined out materials, due to wind

Line Source Emissions

During movement of vehicles dust emissions will be generated and this has been considered in the modeling exercise.

1.3.4 Utilities Required

Electricity

There is no electric supply (existing or proposed). The mine works in one shift (i.e. general shift) only, so no lighting arrangements will be required.

Fuel: Diesel

High Speed Diesel (HSD) is used for running equipment including earth moving equipment (excavators and tippers) compressors and water pumps and transport vehicles.

Explosives

As mentioned earlier, blasting will be required for the mining activities. However, explosives will not be stored at the mine site during mining operations. They will be stored and supplied from OAL's existing central facility at OBM I mine site.

Transportation of explosives will be done by the supplier upto mobile magazine i.e. the central facility at OBM I site, by explosive van of the supplier. When it is required for mining purposes, explosives will either be transported by bullock carts, or manually, in DGMS approved wooden boxes.

1.3.5 Programme of Afforestation

In the IBM approved mining scheme, it is proposed to carry out afforestation on backfilled area with a rate of 50 saplings / year. Additional plantation @ 510 saplings/year is proposed to be plant along statutory barrier and backfilled areas

1.4 Environmental Setting

1.4.1 Study Area

The study area is considered to be the mining lease area, and an additional area of 10 km radius from the lease boundary.

1.4.2 Climatology

As per the Indian Meteorological Data (IMD) the climate in the region shows broadly four seasonal variations, namely:

- Winter : December - February
- Summer : March – May
- Monsoon : June - September
- Post-monsoon : October - November

The area remains cloudy between June - September, which is the active period of the monsoon season. Generally cloud cover ranges from 6 to 7 OKTAS during this monsoon season. In the winter season cloud cover is predominantly 0 OKTAS and on occasions goes up to 6 to 7 OKTAS, with significant readings in the 1 to 5 OKTAS range.

1.4.3 Study Period

The study period was the winter season (Mid march 2011 – Mid June 2011).The predominant wind directions during the study period were observed to be from West-South-West, split almost equally.

1.4.4 Ambient Air Quality

Sampling was carried out at 6 locations, representing areas where maximum impact due to air emissions is likely to be felt, nearby villages and sensitive receptors. Efforts were made to cover the study area equally, as well as those areas where higher levels of air pollution are likely due to existing operations in the study area. Sampling details and results are as follows:

- The frequency of monitoring was 24 hrs twice a week at each station, spread over the season, with gaseous samples being changed six times (at 48-hour intervals).
- The parameters monitored were PM_{10}, Sulphur Dioxide (SO_2), and Oxides of Nitrogen (NO_X).
- SO_2 and NO_X readings are well within limits. PM_{10}results were also found to be within limits. However it was noted that the readings were significantly lower than the prescribed standard (100ug/m^3) at all locations

1.4.5 Land

Land use within the study area was determined with the help of satellite image and classified into relevant categories such as habitation, saline area, mud flats, beach area, water bodies, land without scrub, land with scrub, agricultural land, rocky area, sandy area, mining area, and salt pans.

1.4.6 Water Quality

Surface water quality

The main sources of surface water (other than the sea) within the study area are village ponds, village wells (belonging to villages as well as privately owned) and dug out pits within mine sites filled with

rain water. Surface water samples were collected from 4 locations namely: Nandana Site, Nandana Village, Mahadeviya Village and Mewasa Village. Analysis of the parameters revels that most of the parameters at all locations are below the permissible limits, except few.

Ground water quality

Groundwater samples were taken from a dug wells, bore wells and hand pumps present within the study area at 5 villages namely: Nandana Village, Ranjitpura Village, Mahadeviya Village, Ran Village and Mewasa Village . The samples were analyzed for parameters specified in the EIA Manual. For comparison the parameters were compared with the BIS Drinking Water Standards (BIS: 10500 – 1991) where these are specified in those Standards.

A summary of the presented results indicates that:

- TDS is found to be high at all the locations
- Chloride is found to be high at Nandana and Mahadeviya Village
- Calcium is found to be high at Nandana Village,
- Total hardness is found to be high at Nandana, Ran, Mewasa and Mahadeviya villages

1.4.7 Noise

Noise level monitoring was carried out at 6 locations, namely; At site, Nandana Village, Ran Village, Mewasa village, Mahadeviya Village and Ranjitpura Village.

1.4.8 Flora Fauna

In order to collect information about the flora and fauna of the study area, a survey was conducted by the ecological team of Kadam and the data is taken from the Department of Marine National Park (MNP) and Department of Environment, Jamnagar.

1.4.9 Soil

Soil samples were collected from 7 different locations, namely: Nandana Site, 500 m from site, Nandana Village, Mahadeviya Village, Ranjitpura Village, Ran Village and Mewasa Village. Soil sample at site contains 51.4% sand, 30.32% clay and 18.28% silt and gives texture of sandy clay loam. The sample is slightly acidic in nature with a pH of 7.12 to 7.87, with water holding capacity of 34.22% to 68.62%. The electrical conductivity ranges from 0.201 to 0.250 dS/m.

1.4.10 Population of the Study Area

- The statistics regarding the human population and the number of dwelling units of villages in the study area is sourced from the Census of India, 2001.
- There are 10 villages in the study area.
- On this basis, the population of the study area is estimated to be 38,499 in the study area i.e. within 10 km from periphery.

1.5 Impact Assessment

1.5.1 Topography

The mining lease area is a non-irrigated piece of barren land and designated as Government waste land. Upto the lease renewal period ~8.5 ha of land gets degraded with a working depth of 6.0 m, out of which ~4.7 ha of land falling in southern part will be backfilled and rest will be used as water reservoir. The mining activity will not affect the topography in a broad way because total reject produced during mining is proposed to be used for backfilling.

1.5.2 Ambient Air

- Detailed average readings indicate at all air ambient station PM_{10}, SO_2 and NO_X are within the prescribed limit of CPCB for respective categories.
- The 98th percentile value for concentration of PM_{10} in the ambient is found to be high at site and Mahadeviya Village
- Low concentrations of SO_2 and NO_X are observed at all the locations.
- The average reading at Nandana mine site is observed to be 73µg/m^3 owing to the present mining activities. In order to reduce the air pollution, it is proposed to develop greenbelt along the statutory barrier as well as in the backfilled area as reported in EIA report.
- For pit source emission, the maximum 24 hours GLC within Nandana mine is estimated to be 8.96µg/m^3. The GLC is expected at a distance of 250 m from the mine in North East direction.

1.5.3 Water Quality

Ground Water Quality

Ground water in the area is saline in general and salinity increases with passage of time after monsoon as the water level goes down. As per the mining plan water table in the area is 12 m below the general ground level during the monsoon. The mining excavation will never touch the ground water table. Even at the ultimate stage the pit will be of shallow depths of about 6m, which is above the water table. Thus, there is no likelihood intersection of ground water. So no adverse impact on ground water is anticipated

Surface Water Quality

There is no perennial surface water course or surface water body within the leasehold area due to scanty and unpredictable rainfall. The rainwater will accumulate in the mined out pits as well as in the pits created during lease period will be harvested which will be used for dust suppression.

As material coming our as waste during mining will be backfilled at the time of its generation, the probability of its stacking is reduced, this in turn reduces the chances of drainage of this material along with the rain water. Due to this, it can be safely concluded that mining activities will not have any impact on surface water of the area.

1.5.4 Noise

The impact due to blasting noise in the nearest habitation from Nandana mining site, i.e. at Nandana village at a distance of ~3280 m, is not going to be significant because the time duration for which the noise level is going to rise is very limited, i.e. up to a few minutes in the whole day. Nandana village will receive noise level of 55.96 dB (A) for a very short duration of blasting, and hence the Time-

averaged sound pressure level during the day is not likely to be affected by more than 3-4 dB(A) because of blasting.

The allowable exposure time for 85 dB(A) of Noise Level for a human ear is up to 8 hrs, i.e. if a human is exposed to less than 8 hours of continuous noise dose at 85 dB, it is not going to cause any permanent hearing damage, and hence the Noise Levels predicted in the respective villages surrounding the site are well within the limit.

Further, during blasting, all precautions will be taken for minimizing noise and vibration like optimum charge per delay, various controlled blasting techniques etc. Blasting will be carried out once in a day, for very small duration, i.e. for few seconds only. Muffling will be adopted to reduce the impacts of blasting. All PPE's will be provided to the persons working during the blasting.

1.5.5 Ground Vibrations

Ground vibration modeling is carried out by using the USBM empirical equation, and it is observed that, the maximum charge per delay will be 6.42 kg explosive/delay. In Mahadeviya village at a distance of ~2650 m from the lease, the ppv value was calculated as 0.02 mm/sec against a limit of 5 mm/sec. Ground vibration will be felt only at the time of blasting and so these vibrations will be only for few seconds per day.

1.5.6 Fly Rock

Fly rock calculations due to explosion have been modeled using USBM's vertical face fly rock model for two different break-out angles i.e. 45° and 90°. Maximum fly rock distance obtained was 43.25 m at a break out angle of 45°, with lower distances for other break-out angles.

A no-blasting zone will be enforced within the mine to ensure that blasting is carried out at a safe distance from the nearest habitated areas.

1.5.7 Flora Fauna

The baseline study, for the evaluation of the floral and faunal biodiversity of the terrestrial environment of the study area, within 10 Km radius from the proposed mining lease has been conducted during April 2011 and January 2013 and it has been observed that the major vegetation in the proposed mining area is thick patch of *Prosopis juliflora*. Dominant vegetation is *Salvidora persica, Zizyphus sp*. and small patch of hill hawk with ground cover almost dry except *scotilariya sp.* The mining site is surrounded by few agriculture fields, the major crop practiced in this region are Cotton, Ricinus and Wheat. The study area is characterized by the mostly plain area and undulating terrain with small hillocks. Few of these hillocks were with a good population of *Commiphora wightii* (Gugal), which is intermingle with the thick bushes of *Euphorbia nivulia*.

The roadside and hedge vegetation was dominated by plants like *Solanum indicum, Abutilon indicum, Opuntia elator, Calotropis giganatea, Clerodendrum phlomoides etc.*

The thorny scrub vegetation is the characteristic inland region of the study area, which includes *Prosopis juliflora, Salvadora oleoides, Zizyphus nummularis, Calotropis procera, Capparis decidua, Acacia jacquemontii, Acacia nilotica, Acacia senegal, Dichrostachys cinerea, Maytenus emarginata, and Balanitis aegyptica.*

The tree population was very less in this part of Jamnagar district. The dominant trees growing in this area are *Prosopis cineraria, Acacia nilotica, Acacia leucophloea, and Azadirachta indica*.

For the documentation of the faunal biodiversity of the study area with respect to birds, reptiles, amphibians, and butterfly species, a detailed survey had been conducted, within 10 km radius from proposed site.

1.5.8 Socio-Economic Conditions

The study area is comprises of 10 villages out of which 10 are in Kalyanpur Taluka with a total population of 38,499.

The project is on government wasteland, so resettlement and rehabilitation is not required. Therefore, compensation for the land shall not be applicable.

The mining activity will have both beneficial and adverse environmental impacts related to socio-economic in the study area.

Positive Impacts

- The mining activity would generate employment opportunities for both skilled and unskilled people.
- Several vehicles/equipments like tractors & trolleys, bulldozers, JCB, excavators shall be hired from the nearby villages hence giving business opportunities to the local people.
- Rainwater collected in mined out pits can be used by farmers for irrigation purposes
- The living standard of the people will become better with increase in earning opportunities.

Negative Impacts

- The approach road to mine is cart track. There may be wear and tear of the roads connecting the villages specially during monsoon season due to movement of heavy vehicles i.e. truck, tractors and bull dozers, jeeps etc.
- The mining dust may have negative impact on the health of local people living in the surrounding areas by the way of certain diseases such as asthma, bronchitis and other diseases related to lungs.
- The dust generated during mining activities can affect the adjacent agricultural fields and may destroy fodder (harmful for animals)
- There is probability for the loss of small patches of agricultural land due to generation of dust from the nearby mines.

Mitigation Measures

- Monitoring of Air, Water and Noise will be carried out as agricultural fields exist just adjacent to the site.
- The project proponent would arrange health check up for the vulnerable or weaker sections in the study area twice a year.
- Stationary aids would be provided to the primary schools within the study area.
- During drought, the project proponent would supply drinking water through water tankers to the villagers within the study area.
- The project proponent would take care that the truck loaded with bauxite (raw material) is covered during transportation.
- The project proponent will supply fodder to the Gausala coming within the study area

1.6 Environment Management Plan

The detailed Environmental Plan is as given in ***Table 1-4***.

Table 1-4: Environmental Management Plan

S. No.	Potential Impacts	Action	Parameters for Monitoring	Timing
1.	Air Emissions	All equipments are operated within specified design parameters	Random checks of equipment logs/ manuals	During site clearing
		Vehicle trips to be minimized to the extent possible	Vehicle logs/Increase in the capacity of vehicles	During site clearing, transportation of minerals
		Topsoil (if any) will be removed and backfilled in the void generated. Bauxite and mineral rejects are stacked properly and preventive action will be taken to minimize air emission	Quantity of top soil, bauxite and mineral reject generated. Area of backfilling, area of stacking Height of stacking	During backfilling and stacking
		Regular water spraying shall be done	Quantity of water requirement shall be monitored	During site cleaning, transportation etc.
		Ambient air quality within the premises of the proposed unit to be monitored	The ambient air quality will confirm to the standards for SPM, SO_2 and NO_x	As per GPCB requirement
2.	Noise & Vibration	Generation of vehicular noise	Maintenance records of vehicles	During trans-portation.
		Implement good working practices (equipment selection and siting) to minimize noise and also reduce its impacts on human health (ear muffs, safe distances and enclosures).	Site working practices records, noise reading	During blasting
		Noise to be monitored in ambient air near blasting shelter and at the lease boundaries.	Noise reading	As per GPCB re-quirement or quarterly whichever is lesser.
		The Noise level should not exceed the permissible limit both during day and night times.		
		All equipment operated within specified design parameters.	Random checks of equipment logs/ manuals	During mining operation
		Vehicle trips to be minimized to the extent possible	Vehicle logs	During mining operation
		Short delay in blasting of successive blast holes and use of low velocity detonators effectively reduces the vibration problems.	_____	During Blasting
3.	Water Quality & Use / Wastewater Discharge	Sewage generated will be disposed off in soak pits	Quality of treated water	During mining operations
		After extraction of mineral, rainwater will be stored in voids generated which will later	Quantity of water used for irrigation purpose	During mining operations

S. No.	Potential Impacts	Action	Parameters for Monitoring	Timing
		be used for afforestation		
4.	Waste Management	Increasing percentage of Al_2O_3 to upgrade the mineral rejects to marketable level by addition of plant grade bauxite which cannot be used as plant grade because of excess silica presence in the ore.	Quantity of mineral rejects generated	During mining operations
		Backfilling of overburden & solid waste generated	Quantity of overburden & solid waste generated	During mining operations
6.	Land Reclamation	Backfilling will be carried out on mined out area and soil will be spread on backfilled area	The mined out land will be reclaimed by backfilling	During mining operations
		Part of the backfilled area will be used for plantation. Voids left after backfilling will be used as water reservoir		
7.	Non-routine events and accidents	Plan to be drawn up, considering likely emergencies and steps required to prevent/ limit consequences	Lost time incidents, near misses and accident-incident records	During mining operations

1.7 Cost of the project

The cost of the project has been provided in ***Table 1-5.***

Table 1-5: Cost of the project

Capital Expenditure				Operational Expenditure			
S. No.	**Item**	**Cost (INR)**	**Remarks**	**S. No.**	**Item**	**Cost (INR)**	**Remarks**
1.	Mining lease application and approval	3,500		1.	Cost of mining	3,59,47,800	
2.	Lease area demarcation	2,20,000		2.	Royalty	1,54,06,200	
3.	Acquisition of lease hold rights from private land owners on which the ML has been granted	NIL	No private land is involved	3.	Transportation	4,75,02,450	
4.	Mining plan preparation and approval	1,04,500		4.	Sorting & sizing	44,93,475	
5.	Mines development expenses including approach road construction	40,000		5.	Truck Loading	51,35,400	
6.	Civil works including site office and staff quaters	2,10,000		6.	EMP	10,06,500	
7.	Weighbridge and its mechanical installation and civil works	19,80,475	Common weigh bridge installed for group of mines of OAL in Mewasa, Virpur and Ran Villages				
8.	EIA, EMP preparation and approval including GPCB Clearance and Public Hearing	5,50,000					
9.	Heavy earthmoving equipment, crusher, vibrating screens and D.G. Set and allied machinery	-	Mechanical equipment will be hired from market only				
10.	Tools and tackles including GPS	15,000	For group of mines				
11.	Vehicles	-	Common vehicle would be provided for group of mines				
12.	Misc. expenses	60,000					
13.	Margin money for working capital	-	Common money will be kept for group of mines.				
	Total	**31,83,475**			**Total**	**10,94,91,825**	

1.8 Risk Assessment and Disaster Management Plan

The methodology for the risk assessment has been based on the specific risk assessment guidance issued by the Directorate General of Mine Safety (DGMS), Dhanbad, vide Circular No.13 of 2002, dated 31st December, 2002.

1.8.1 Hazard Identification

The identification of hazards has been done considering operations

1.8.2 Risk Assessment

On the basis of the above scoring format of DGMS, and after a perusal of the resultant scores, professional judgment was exercised in selecting the following scale for assessing risk levels:

- Level 1: > 15; i.e., requiring immediate action
- Level 2: <15 but > 5; i.e., requiring management action
- Level 3: < 5; i.e., low risks requiring periodic review

In some cases personnel are only exposed to the hazard for part of the time. Hence, the more detailed analysis of the risk ranking can be carried out by taking exposure (% time personnel are present) and probability (chance that they will be harmed) into consideration. Thus:

- Risk Score = (Probability x Exposure) x Consequence

1.8.3 Hazard Analysis

The hazards cover explosive material management, working at heights, slope and bench stability, mineral transport, mineral processing and force majeure conditions (rainfall & flooding). Risk level 1 and risk level 2 are taken into consideration.

1.8.4 Control and Action Plans

To ensure that causes leading to the possible consequences are prevented from occurring, control and action plans are developed and suggested and discussed in greater details in section 6.6.

1.8.5 Disaster Management Plan

- The DMP is supposed to be a dynamic, changing, document focusing on continual improvement of emergency response planning and arrangements. A structure working on a Plan, Do, Check & Review (PDCR) cycle has been therefore suggested.
- The Environment, Health, and Safety (EHS) policies are to be made accessible to all at site and to other stakeholders.
- Possible emergency situations can broadly be classified into unintended explosions, vehicle collision, and inundation.
- Responsibilities, resources, and timeframes are allocated for implementing the objectives.
- Assembly points, liaison with state authorities, task force of essential staff, emergency control center, fire fighting etc. are discussed.

Treatment of affected persons

- Injured / Affected persons shall be provided suitable first-aid treatment and sent to Co.'s Doctor for further treatment depending on injury.
- Patients requiring further treatment shall be sent in Ambulances to Hospitals in Jamnagar
- Patients suffering from minor problems shall be discharged and sent home after preliminary treatment

Training

Regular training of all concerned personnel will be conducted to enable the Staff to face any type of Emergency be it Natural Disaster, Fire in Equipment, Building or any explosion in quarry.

DMP Audit, Non Conformance and Corrective Action and Preventive Action

Since this DMP has been designed as a dynamic document, it is required that its performance be audited at regular intervals. Ideally, persons auditing the DMP should be external auditors (i.e. not employed at the site being audited). Audits will be periodic, at intervals that are decided by the Head Office.

Review of Emergency Performance

On the basis of these, the management will record its decisions and consider modifying the DMP, as deemed appropriate.

1.9 Conclusions

- No prominent watercourses or nallah are in the leases.
- The impact on ambient air quality due to proposed activities will be within acceptable norms.
- Noise pollution is mainly due to operation of blast hole drilling, blasting and occasional plying of trucks. These activities will not cause any problem to the inhabitants of this area because there is no human settlement in close proximity to the lease area.
- Rainwater obtained during mining will be collected in mined out pits which will than used for dust suppression. As OAL will not dispose off mine drainage in surface water bodies there is no negative impact on surface water bodies.
- There is no habitation in the mining leases. Mining in these leases will give job opportunities to the local people. Several persons of the neighboring villages have been benefited with contract works, employment through contractors, running jeeps, trucks, tractors, and buses on hire, running canteens, different kind of shops and transport related business avenues. Villagers get other welfare amenities such as drinking water, foods, shed etc.

1.9.1 Environmental Assessment and Suitability of the Proposed Development

The mining activity will always result in some form of negative impact on the environment, whether impacts are mitigated or not. The idea is to match the environmental, social, and economical issues to such an extent that the overall outcome of an activity will not result in a combined lesser value for these three issues. The economic benefit and potential social up-liftment of the proposed mining project should outweigh the environmental impacts addressed in this report, through the implementation of the mitigation measures, to result in an overall positive value for the combined environmental, social, and economic issues.

It can be concluded on a positive note that after the implementation of the mitigation measures and Environmental Management Plan, activities of OAL's mine during the mining phase would have negligible impact on environment.

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