

**PRE-FEASIBILITY REPORT  
FOR  
INSTALLATION OF CRUSHING, CONVEYING &  
OTHER ASSOCIATED FACILITIES AND MINING  
EQUIPMENT/ MACHINERIES FOR PRODUCTION  
OF 3.15 MTPA BAUXITE**

**FROM**

**SOUTH BLOCK MINING LEASE AT  
PANCHPATMALI MINE  
DIST: KORAPUT, ODISHA**

**OF**

**NATIONAL ALUMINUM COMPANY LIMITED,  
A NAVRATNA PSU UNDER ADMINISTRATIVE CONTROL  
OF MINISTRY OF MINES, GOVT. OF INDIA**

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**M. N. DASTUR & COMPANY (P) LTD  
CONSULTING ENGINEERS**

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## EXECUTIVE SUMMARY

### BACKGROUND

1. National Aluminium Company Limited (NALCO), a Government of India Enterprise and a Navaratna Company, under the Administrative Control of Ministry of Mines, Government of India owns and operates a large integrated Mines-Alumina-Aluminium Complex in India.
2. Due to adherence to revised IBM guide line for threshold limit of Alumina & Silica in bauxite, available alumina content in bauxite has gone down, resulting in increase in bauxite specific consumption to a level of 3.2 T/T. However, as existing refinery streams are designed considering a specific consumption of 3.0 T/T, existing plant & machineries are not capable of handling higher mud load on account of higher specific bauxite consumption. Accordingly, plant capacity needs to be limited to total annual bauxite consumption of 6.825 MTPA. On the other hand, due to improved technology considered for the 5th stream, bauxite specific consumption is expected to remain in the range of 3.135 to 3.15 T/T. Hence, considering capacity of 5th stream as 1.0 MTPA, total annual bauxite consumption works out to (6.825 + 3.15) or 9.975 MTPA.
3. NALCO is planning to set up the 5th Stream in its Alumina Refinery at Damanjodi, Dist. Koraput, Odisha, as a part of the expansion programme (3rd phase expansion). The capacity of this Stream will be 1.0 million tons per annum (MTPA). The total capacity after expansion will increase from 2.275 MTPA to 3.275 MTPA.

## Executive summary (cont'd)

4. After 3<sup>rd</sup> phase expansion of NALCO's refinery complex, total bauxite requirement of refinery complex will be around 9.975 MTPA. Presently, 6.825 MT bauxite is being raised per annum from Central and North Block Mining lease of NALCO's captive mine at Panchpatmali. Hence, to cater the bauxite requirement of refinery complex after addition of 5<sup>th</sup> stream under 3<sup>rd</sup> phase expansion, additional 3.15 MT bauxite is required per annum. For this purpose, South Block Mining lease of NALCO's Panchpatmali mine has been identified for sourcing additional 3.15 MT of bauxite per annum. Bauxite from the lease area of the South Block Mining Lease will be utilized for the captive purpose by NALCO. It is hereby noted that the EC (Environment Clearance) is already available for raising of bauxite of 3.15 MTPA capacity from South Block mining lease of Panchpatmali Mine. So, there is no need for any additional bauxite production over the approved EC quantity from Panchpatmali Mines. Hence, the present proposal is for additional transportation of 3.15 MTPA bauxite produced from South Block mining lease of Panchpatmali Mine to Alumina Refinery. Other equipments/machineries to be installed are covered in the existing EC conditions.
  
5. Presently, bauxite from Panchpatmali mine is being transported to NALCO's refinery complex by existing over land conveyor. It is not possible to transport additional 3.15 MTPA bauxite by the existing over land conveyor. Hence, a new over land conveyor is envisaged for transportation of mined out bauxite from South Block Mining Lease to NALCO's refinery complex. Proposed over land conveyor will be routed along NALCO's existing conveyor corridor, in the land already in possession of Nalco.

## Executive summary (cont'd)

6. The proposed bauxite mine will be developed by NALCO for captive purpose. Hence, there is no such demand-supply gap. The proposed project is a mining project, where bauxite will be exclusively produced for captive use only and hence, there is no export possibility.
7. It is estimated that the total direct employment generation from the proposed mining expansion project will be about 234 personnel. Besides, there will be approx. 1000 nos. indirect employment, to be deployed through contractual temporary basis.
8. Before commencement of mining in Central & North Block mining lease and south block mining lease of Panchpatmali, M/s. Mineral Exploration Corporation Limited, Ministry of Mines, Govt. of India has estimated the geological reserve of bauxite as 310 million tonne (MT) with cut-off grade of Al<sub>2</sub>O<sub>3</sub> at (+) 40% and silica content at (-) 5%. Later on in 1992, M/s Coralis, France re-estimated the reserve based on the prevailing cut-off grade as per IBM circular. NALCO has mined out approx. 100 MT of bauxite since 1986-87 till 2014-15 and transported to Alumina refinery for captive use.
9. The balance Geological Reserve (GR) of Panchpatmali Hill Central and North Block Mining Lease as on 30/06/2015 at old cut-off grade of Alumina (+) 20% and Silica (-) 4% stands at 125 MT. Similarly, the mineable reserve of Panchpatmali Hill Central and North Block Mining Lease stands at 100 MT at old cut-off grade of Alumina (+) 20% and (-) 4%.
10. The balance geological reserve of bauxite in south block mining lease as on 30/06/2015 at old cut-off grade of Alumina (+) 20% and Silica at (-) 4% stands at 73.92 MT.

## Executive summary (cont'd)

The mineable reserve stands at 58.28 MT.

11. The balance geological reserve of bauxite in central & north block as on 30/06/2015 at new cut-off grade (IBM circular of 2009) of Alumina (+) 20% and Silica (-) 7% stands at 153.06 MT. As per this IBM circular on revised cut-off grade, the Mining Lease is left with 134.36 MT of bauxite for future Mining.
12. The balance geological reserve of bauxite in south block mining lease as on 30/06/2015 at new cut-off grade (IBM circular of 2009) of Alumina (+) 20% and Silica (-) 7% stands at 91.69 MT. MR of South Block Mining Lease is 82.05 MT as per the revised IBM guideline. Mining of bauxite is yet to be done from South block since inception.
13. Hence the total quantity of bauxite reserve available in both Central and North Block Mining Lease and South Block Mining Lease stands at 216.41 MT as per revised IBM guideline dated 16/10/2009. Thus @ 9.975 MTPA bauxite consumption w.e.f. 2020-21, it is expected that the total life of Panchpatmali Mines will be up to 2038-39.
14. As per NALCO's application for grant of ML over Pottangi Bauxite Deposit (80 MT GR) in the year 1992 and reservation of the deposit in favour of Central PSU (NALCO) by Ministry of Mines, Govt. of India, New Delhi vide gazette of India publication of April 2007 valid for 10 years, the bauxite from the Pottangi deposit shall be sourced as feedstock for the expanded capacity of the Alumina Refinery. Thus with the combined deposit from Pachapatmali and Pottangi, the expanded refinery plant shall sustain till 2045-46.

Executive summary (cont'd)

### **PROJECT DESCRIPTION**

15. It has been planned that the entire quantity of 3.15 MTPA will be sourced from the virgin South Block Mining Lease of NALCO's Panchpatmali mine. The existing Environmental Clearance (EC) vide MOEF, Govt. of India, New Delhi order no. J-11015/78/2010 -IA-II (M) dated 28<sup>th</sup> February 2011 for mining in South Block Mining Lease stands at 3.15 MTPA. However, bauxite production from the South Block has been proposed to be commenced from the year 2019-20 as indicated in the letter granting the above EC. This PFR is prepared for the purpose of obtaining amended terms of reference (ToR) for installation of additional overland conveyor, apron feeder, crusher etc for additional transportation of 3.15 MTPA bauxite from Panchpatmali central & south block Mining Lease.
16. The mining infrastructure and other new facilities, apart from the proposed overland conveyor, will be installed within the existing lease area of NALCO. The alignment of the proposed overland conveyor will be finalized during engineering stage. However, it is confirmed that the new overland conveyor corridor will come up in the acquired land patch and no additional private or Govt. or forest land acquisition/alienation/diversion is envisaged.
17. South Block Mining Lease of Panchpatmali bauxite mine will be a fully mechanised opencast mine. Based on the morphology of the block, trench method of mining operation is proposed. This method consists of digging a service road and a number of nearly parallel and slightly ascending trenches with staggered faces and floors at progressively

## Executive summary (cont'd)

lower levels. Each set of trenches spreads out, wherever possible on either side of Central Axis. A peripheral barrier/safety zone of 7.5 m width will be maintained around periphery of the bauxite deposit along the edge of the plateau.

**Design Basis**

18. The basis considered for calculations with regard to different aspects of mining operation and subsequent crushing and transportation of bauxite are indicated below:

**Bauxite requirement:** 3.15 MTPA

**Average stripping ratio (Bauxite: Over Burden (OB)):**  
1:0.127 (ton/ton)

**Basis of equipment selection:** Equipment are selected based on the above average stripping ratio of the mine.

**Working duration:** The annual effective working duration envisaged approximately 3,564 hours based on certain assumptions.

**Average raising rate:** Considering the above working hours, the average raising rate of excavated material works out to about 997 tons per hour comprising about 885 tons of bauxite and approximately 112 tons of overburden/waste. However, the throughput capacity of the crusher will be about 885 tons per hour based on 3564 hours of annual operation.

Bulk density of bauxite	.. 1.5 t/cum
Specific gravity of bauxite	.. 2.1
Bulk density of OB	.. 2.1 t/cum
Specific gravity of OB	.. 3

## Executive summary (cont'd)

The list of equipment for mining as well as crushing and transportation of bauxite are furnished in Chapter-2 (Project Description).

**Excavation of Overburden**

19. The overburden consists of top soil and laterite. The average thickness of top soil is about 0.8 m and that of lateritic overburden is 2.0 m. The following sequence will be followed for excavation of top soil and overburden:
- (a) Removal of top soil with the combination of Dozers and Wheel Loaders and transportation of the same to a designated place for reclamation of the mined out area at a later stage.
  - (b) Excavation of hard laterite will be done by mainly drilling and blasting, and partly with ripper dozers.
  - (c) Loading of overburden into the dumpers by wheel loaders.
  - (d) Hauling of lateritic overburden (OB) to mined out areas for back-filling.

In the initial stages of excavation, only overburden (Top soil + Laterite) will be excavated, and it will be stacked at suitable places which will be rehandled later for backfilling of the mined out area in South Block. About 4.00m to 6.00m height benches will be maintained for overburden dump yard.

NALCO through its actual mining experience has observed, drilling/blasting to be a more effective method for excavation of about 40 percent of its overburden layers. The remaining 60 per cent of thin layers are generally ripped with rippers.

Executive summary (cont'd)

### **Mining of Bauxite**

20. The mineralisation being quite uneven, mining of bauxite will be done in two stages to minimise the loss/dilution. The first slice of bauxite shall be taken as top bauxite and the next slice shall be taken as bottom bauxite. Top bauxite, being relatively harder, will be loosened by deep hole drilling and blasting. However, selective mining process shall be adopted for excavation of the bottom slice/bottom bauxite. The detail process of mining is described below:

#### **i) Excavation of Top Bauxite Layers**

The excavation of relatively hard Top Bauxite layer consists of the following steps:

- a) Drilling of 150 mm dia blast holes.
- b) Charging the holes with booster and ANFO Explosives and Blasting.
- c) Loading of blasted ores into the dumpers by wheel loaders.
- d) Hauling of ore to the primary crusher using dumpers.

The average height of the top bauxite bench will be maintained at about 8 m.

#### **ii) Excavation of Bottom Slice/Bottom Bauxite**

The stepwise processes to be involved are as follows:

- a) Selective mining with hydraulic backhoes.
- b) Hauling of ore to primary crusher using dumpers.

Thus, the entire bauxite layer will be removed in two layers as indicated above.

## Executive summary (cont'd)

As such, around 40 per cent of bauxite will be mined by deep hole drilling and blasting and the remaining 60 per cent will either be ripped or simply scooped by backhoes from the bottom layers.

Equipment selection will be based on the deposit characteristics and simulation studies at different stages of activities.

**Power Requirement**

21. The estimated power requirement for mining in South Block is given below:

Annual energy consumption in million kWh, 15-min. maximum demand in MW and 1-min. peak demand in MW are 15.65, 4.41 and 4.63 respectively.

**Source of power:** The total power requirements of existing Panchpatmali bauxite mine, existing conveying system, proposed bauxite mine at South Block area and new conveying system will be met from the following sources, namely:

- i) Existing 33kV overhead transmission line-1 coming from central distribution substation (CDS) at Alumina Refinery plant, Damanjodi. To meet the additional power requirement along with existing loads, the existing transformer will be replaced by one (1) No. new 132/33kV, 12.5 MVA transformer. Associated CBs, CTs, protection, metering, etc. will also be replaced for the above feeder, as required.
- ii) Existing 33kV overhead transmission line-2 coming from CDS at Alumina Refinery plant, Damanjodi. To meet the additional power requirement along with existing loads,

## Executive summary (cont'd)

the above transformer will be replaced by one (1) no. new 132/33kV, 12.5 MVA transformer. Associated CBs, CTs, protection, metering, etc. will also be replaced for the above feeder, as required.

22. Following communication facilities are envisaged for reliable and quick communication within the Panchpatmali mine as well as with outside agencies:
- Telephone system
  - Wireless communication system
23. Fire detection and alarm system (FDA) will be provided for safety of life and property of mine's area and electrical substations by early detection and acknowledgement of unwanted fire condition.

**Water Supply System for Mine Area**

24. It is estimated that total water requirement for the proposed mining area will be 700 cu m/day, out of which 585 cu m/day will be raw water and 115 cu m/day will be filtered water. For this purpose, raw water shall have to be drawn from the water source, i.e. from Jholaguda natural stream. 1000 meters long pipe line has been considered along the valley surface to transfer the raw water from Jholaguda intake to mines. The proposed mining area is situated at an elevation of 550 meters from Jholaguda intake pump house.

Source of water for supply to South Block Mining Lease of Panchpatmali Mine is Jholaguda natural stream.

25. **Plant water system:** Plant water system will consist of the following:

## Executive summary (cont'd)

- Raw water storage reservoir and distribution pump house.
- Water clarification and filtration unit.
- Drinking water distribution system.
- Fire Fighting system for Fuel Filling Unit.
- High pressure fogging system.

**Utility system**

26. **Diesel storage:** Diesel will be used as fuel for light and heavy vehicles within the mine and plant premises. To meet the requirement, over ground diesel storage system has been envisaged. Diesel will be obtained by means of road tankers. The same will be drawn by pumps and stored in on-ground tanks after filtration. During the day, the distribution pumps shall ensure required quantity of diesel to the consumers. Total storage capacity of the diesel distribution system will be of 180 Kilo Litre (KL) consisting of two (2) Nos. of diesel storage tanks of capacity 100 KL each.

27. **Compressed air station:** Compressed air will be required for air filling in the tyres of vehicles, cleaning and washing of the vehicles in the respective service bay. Compressed air will also be required for drying the washed cars in the wash ramp area. Dry compressed air will be required for instruments and controls, to be used in the workshop.

Requirement of plant grade compressed air and dry instrument grade compressed air will be met from one number centralised compressed air station with two Nos. screw compressors (one working + one standby) along with required numbers of air receivers of requisite capacities. The pressure of the available compressed air will be around 7-8 kscg.

## Executive summary (cont'd)

Two Nos. refrigerated air dryers (one working + one standby) along with required nos. air receivers of requisite capacities have been envisaged to meet the requirement of dry instrument grade compressed air. The pressure of the available dry instrument grade compressed air will be around 5-7 kscg.

28. ***Air-conditioning and ventilation systems:*** The air-conditioning systems are proposed to be designed to maintain maximum room inside bulb temperature of 30 deg C for switchgear rooms, control rooms, control pulpits, computer rooms, lab, training centre, PLC rooms and other premises under consideration. In order to meet the above requirement, package type/split type/window type air-conditioners complete with standard accessories may be adopted.

**Waste Management and Disposal**

29. There will be a temporary dump of overburden material in the initial stages after starting of mining activity. The dumping will be carried out in retreating pyramid method. The slope angle of the individual terrace will be maintained at 30 deg with overall slope of the dump will be of 22 deg. After these initial years, the overburden material from the temporary dump will be used for backfilling of mined out area.

**SITE ANALYSIS**

30. The proposed expansion will occur within the existing mining area (having Mining Lease) of NALCO in their owned land. The present lease area is 528.262 Ha. The land use/land cover comprises of mainly mining area along with infrastructure and road connectivity.

## Executive summary (cont'd)

The Mining Lease (ML) area is a part of Panchpatmali hill which is characterised by an N-S trending bauxite capping surrounded by Khondalite on the slopes. Highest and lowest altitudes inside the ML area are at 1366 m and 880m approximately above mean sea level (msl). The land use is assessed based on the satellite imagery (IRS P6, Liss4 mx) and the area statistics.

**Drainage**

31. There are neither perennial nor seasonal nala on the plateau of lease area. Seasonal nalas originate from the periphery of the plateau and flow along the slopes towards the toe to meet the perennial sources. A perennial nala exists on the western side and flows towards Jhulaguda River which is dammed to have a storage capacity of 1,500 cu m water.

**Soil**

32. The subsoils are of good quality. It is characterised by stiff to very stiff/hard, silty clay/clayey silt followed by weathered rock layer and that layer continues up to the terminating depth of some boreholes. The standing water table is around an average depth of 7.00m below ground level.

**Climatic Conditions**

33. The area has a dry, humid and hot climate. The summers have a good deal of rainfall, while the winters are normally dry. The average annual temperature is 23.1°C in Koraput. The rainfall averages to about 1550 mm (IMD data of Koraput district).

Executive summary (cont'd)

### **PLANNING BRIEF**

34. The estimated population of the study area in the years 2001 and 2011 are 30114 & 35440 respectively. The decadal growth is of 17.69 %. Thus the projected population of the study for the year 2015 is around 37950.

Out of the total ML area of 528.262 hectares of South Block, the proposed land use will consist of mainly the Mining area, OB dump, mineral storage, infrastructure, greenbelt, etc.

35. **Assessment of Infrastructure Demand (Physical & Social)**
- The local population emphasizes upon strong environmental measures to be undertaken by the Project Proponent to combat environmental pollution, if any, for this proposed mining at South Block.
  - The most common diseases in the area are malaria, diarrhea and fever. The primary health care centres in the study area are inadequate and under equipped.
  - Approach road to peripheral villages need to be constructed/improved upon. Additionally regular transportation and connectivity services have to be emphasized upon.

### **PROPOSED INFRASTRUCTURE**

36. The present total mining lease area of South Block of Panchpatmali is 528.262 Ha. The proposed mining activities will take place within this leasehold area. The total mining quantity of bauxite will be 3.15 MT, for which Environmental clearance is already available with NALCO.

The existing township at Damanjodi has approximately 3,000 dwelling units (DU). The present township is self sufficient in all respect with all services and amenities.

A new township is envisaged to accommodate additional manpower of different categories for bauxite mining at Panchpatmali mine.

Executive summary (cont'd)

37. **Proposed Social Infrastructure**

- Along with strong environmental measures, NALCO will undertake use of water sprinklers to combat dust in the area for the proposed mining at South Block.
- NALCO will undertake measures to strengthen the existing medical facilities and engage in further development of mobile health camps with special emphasis on preventive and promotive health care. Additionally ambulance van for this mining project of South Block will be organised. Nalco envisages setting up better hospital facility to cater to the need of local community.
- Roads to all villages will be improved under peripheral development scheme. Additionally jeeps and pick up vans will be provided for transport of supervisory staff to work stations and to facilitate inspection and supervision of work. Buses will be provided for transport of workers from mine colony to work sites.
- A central canteen will be located besides the administrative building to serve snacks and refreshments to the workmen, supervisory and office staff working in the administrative building and other areas. In addition, a canteen van will be provided to supply snacks to the workers and supervisory staff working in mine and the crushing plant.

**Review of Pollution Sources**

38. The opencast mechanised mining involves ripping, drilling, and blasting, sizing of r.o.m minerals, overland conveyor transportation of sized r.o.m and handling of the same. It therefore, involves significant emission of fugitive dusts (FD) to the air environment. The sources of such fugitive dust emissions within the ML area are as under:

- i) Drilling and blasting operations
- ii) Movement of dumpers on the haul roads
- iii) Wind borne dust emissions from dumps and stockpiles

## Executive summary (cont'd)

**Air pollution control measures:** For drilling and blasting operations in open areas, wet drilling will be preferred by water injection and controlled blasting will be done to minimise the FD emissions in air.

**Water pollution control measures:** The mine discharge water will be collected in a catch pit for settling of the sediments. The water after the settling will be used for dust suppression on haul roads.

**Drinking and service water system:** To meet the drinking water and sanitation requirement of plant personnel, filtered and chlorinated water from filtration unit will be pumped to the drinking water overhead storage tank by means of drinking water transfer pumps.

**Solid Waste Management and Disposal**

39. **Overburden management:** It is estimated that the average capacity for overburden removal will be approx 0.40 MTPA. The overburden consists of top soil and ferruginous laterite. Fertile topsoil will be stacked separately on the ground earmarked for top soil, subsequently; lateritic overburden thus removed will be stacked on ground, along with material stacked during pre-mining development. Later fresh raisings of overburden along with part of the material stacked on ground will be used directly for backfilling of the mined out areas. Top soil will be spread over the backfilled/reclaimed area for growing trees and vegetation.
40. **Work zone pollution control measures:** Mine will have various noise emitting activities/sources like drilling and blasting operations, rotary equipment, crushing, etc. Mobile diesel powered machineries like bulldozers, front-end loaders, etc will have noise proof operator's cabin. Providing silencers at the exhaust and control of diesel engine

## Executive summary (cont'd)

vibration will be essential for controlling the noise. The administrative control is maintained in suitable rosters of mine workers with the aim of not allowing any one to have noise exposure of 85 dB (A) for more than 8 hrs. Personnel working in high noise prone area will be provided with Personal Protective Equipments (PPE) like earmuffs and earplugs.

Blasting the rock bed for loosening causes blast induced ground vibration. Thus, it requires effective blast design and practices with the optimisation of multitude of variables like borehole diameter, borehole depth, spacing burden, geology, etc so as to have desired result without affecting the residential structure and safety of the people.

**Mine Safety**

41. Mine safety is a statutory requirement for all the mines. Workers' safety will be of prime of concern so as to avoid any injury or accident. Continuous updation of mine safety standards and practice is necessary to minimise the production loss.

**REHABILITATION & RESETTLEMENT**

42. This mining project of Panchpatmali South Block to cater the additional requirement of bauxite for the Alumina Refinery does not entail displacement of any human settlement. Hence there are no issues relating to Resettlement and Rehabilitation (R&R).

**IMPLEMENTATION SCHEDULE**

43. The preliminary overall implementation schedule for the project, indicating the time required to complete the major activities of engineering, procurement of equipment,

## Executive summary (cont'd)

construction, erection, test, trial run and commissioning of the various plant facilities along with external and internal facilities has been developed in the form of a bar chart. The schedule has been developed on the basis of the estimated quantum of work, expected delivery and installation period of plant and equipment and the need to commission the plant facilities in the shortest possible time. The schedule envisages a total project implementation period of 47 months from date of 'Go-ahead'.

**COST ESTIMATE**

44. The plant cost and capital cost estimates are summarized below respectively:

**PLANT COST ESTIMATE**

Description	Amount
	Rs. Crore
Land & Site development	137.4
Civil and structural steelwork	112.8
Plant and equipment including erection	689.0
Township	35.8
Design, engineering, consultancy and ADC	36.7
Contingency	50.6
<b>Total plant cost</b>	<b>1062.3</b>

**CAPITAL COST ESTIMATE**

Description	Amount
	Rs. Crore
Plant cost	1,062.3
Pre-project activities	3.4
Interest during construction	141.4
<b>Total</b>	<b>1,207.1</b>

Executive summary (cont'd)

**RECOMMENDATION**

45. The Mining Plan for the capacity of 3.15 MTPA of Panchpatmali bauxite mine (South Block ML) of 528.262 ha was approved by IBM vide letter No. 314(3)/2009-MCCM (CZ)/MP-35 dated 24.05.2010, with projection of mining of bauxite beyond 2019. NALCO has also got the Environmental Clearance (EC) vide MoEF Letter No. J-11015/78/2010-IA-II (M) dated 28<sup>th</sup>, February 2011 for the production of 3.15 MTPA bauxite from the Mining Lease (ML) area of South Block, which will be operative from 2019-20. The Mining Project of Panchpatmali South Block ML is envisaged to cater to the additional crushing and transportation requirement of 3.15 MTPA bauxite for the Alumina Refinery at Damanjodi and will require EC from MoEFCC, 001, New Delhi.

## 1 - INTRODUCTION

### PROJECT PROPONENT AND IDENTIFICATION OF THE PROJECT

National Aluminium Company Limited (NALCO), a Government of India Enterprise and a Navaratna Company under the Administrative Control of Ministry of Mines, owns and operates a large integrated Mines-Alumina-Aluminium Complex in India. It has multi-location operations as follows:

- Mines and Alumina Refinery, Damanjodi, Dist: Koraput, Odisha
- Aluminium Smelter and Captive Power Plant, Dist: Angul, Odisha
- Port Handling Facilities, Visakhapatnam, Andhra Pradesh (for alumina export and caustic soda import)

The Greenfield Alumina-Aluminium Complex was set up with an initial installed capacity of 0.8 million tons per annum (MTPA) of alumina and 0.230 MTPA of metal. The refinery was based on bauxite from Panchpatmalli bauxite deposits; the smelter and a coal-based captive power plant were located in Angul. The project was started up in 1987 with technology supplied by Aluminium Pechiney, France (now Rio Tinto Alcan). The 1<sup>st</sup> phase expansion of the integrated complex was started in 1997 which included capacity augmentation of the two alumina plant streams, and addition of another line for the refinery as well as the smelter. The implementation of 2<sup>nd</sup> Phase expansion of the integrated complex started in October 2004. The 2<sup>nd</sup> phase included addition of another line (4<sup>th</sup>) in the refinery as well as smelter, and is now operational.

1 – Introduction (cont'd)

Further, capacities of bauxite mines and 4<sup>th</sup> Stream of Alumina Refinery have been augmented through de-bottlenecking.

As a part of the future expansion programme (3<sup>rd</sup> phase expansion), NALCO is planning expansion by addition of 5<sup>th</sup> Stream in its Alumina Refinery at Damanjodi based on Panchpatmali Bauxite Deposits.

After 3<sup>rd</sup> phase expansion of NALCO's refinery complex, total bauxite requirement of refinery complex will be around 9.975 MTPA, which has been arrived at based on the following:

- Original bauxite specific consumption was 3 T/T of Alumina.
- Revised bauxite consumption for the existing streams due to degradation of quality on adhering to latest IBM guideline is considered as 3.2 T/T of Alumina.
- Specific bauxite consumption for the 5<sup>th</sup> stream is 3.15 T/T.
- Maximum bauxite which can be consumed in existing 4 streams is 6.825 MT.
- Bauxite requirement for the 5th stream is 3.15 MT.

Hence, total bauxite consumption after 3<sup>rd</sup> phase expansion will be 9.975 MTPA (6.825 + 3.15).

EC is already available for raising 6.825 MTPA bauxite from North Block and Central Block and 3.15 MTPA from South Block of NALCO's captive mine at Panchpatmali. Accordingly, EC is required only for additional transportation of 3.15 MTPA bauxite with installation of about 11 KM long overland conveyor, crusher and other accessories.

## 1 – Introduction (cont'd)

The ML for South Block was granted and extended in favour of BALCO on 20<sup>th</sup> July 1979. Thereafter, it was transferred to NALCO on 3rd July 1982. NALCO surrendered part of the ML, i.e. 1268.695 ha vide Government of Odisha Order dated 1<sup>st</sup> May 2002 and reduced the lease area to 1243.995 ha. During the application for first renewal of ML in the year 2008, NALCO reduced the lease area to 528.262 ha. The ML has been extended up to 31<sup>st</sup> March 2020 by Government of Odisha. A copy of the letter granting renewal in mining lease over an area of 528.262 ha is attached as Appendix 1A-1. Approval letter for scheme of mining is attached as Appendix 1A-2

**BRIEF DESCRIPTION OF THE NATURE OF THE PROJECT**

The proposed mining project in South Block is envisaged for production of 3.15 MTPA of bauxite which will cater the additional bauxite requirement of NALCO's alumina refinery complex at Damanjodi. Mechanised open cast method of mining will be adopted. Total mineable reserve for South Block is around 82.05 million tonnes. Presently, bauxite from Panchpatmali mine from Central and North Block ML is being transported to NALCO's refinery complex by existing overland conveyor. It is not possible to transport additional 3.15 MTPA bauxite by the existing overland conveyor. Hence, a new over land conveyor is envisaged for transportation of mined out bauxite from South Block to NALCO's refinery complex. Proposed over land conveyor will be routed along with NALCO's existing conveyor system in the approved corridor. The r.o.m bauxite proposed to be raised from South block of Panchpatmali mines will be crushed to -150 mm ( $d_{80}$ ) size with the help of a 1100 tons per hour (tph) capacity (rated) crusher to be installed at the South block. The crushed bauxite will be fed to a belt feeder which, in turn, will feed to the overland

1 – Introduction (cont'd)

conveyor through a transfer hopper equipped with an apron feeder.

**NEED FOR THE PROJECT**

For Alumina/Aluminium, the most commercially available ore is bauxite, as it has the highest content of the base metal. India has the fifth largest bauxite reserves with deposits of about 3 billion tonnes. India with its abundant supply of quality bauxite and low cost labour has established itself as a low cost producer of primary aluminium which is produced by electrolysis of alumina in aluminium smelter. As per demand supply analysis of alumina, the domestic as well as global scenario strongly favours creation of new capacities in alumina. In this background, NALCO has a uniquely advantageous position and is planning alumina refinery expansion by addition of 5th Stream in its Alumina Refinery at Damanjodi. Bauxite from the lease area of the south block of Panchpatmali Mines will be utilised for the captive purpose by NALCO.

**DEMAND-SUPPLY GAP**

Proposed bauxite mine will be developed by NALCO for captive purpose. Hence, there is no such demand-supply gap

**IMPORT VS. INDIGENEOUS PRODUCTION AND EXPORT POSSIBILITY**

The proposed project is a mining project where bauxite will be produced exclusively for captive use and hence, there is no export possibility.

**DOMESTIC/EXPORT MARKET**

The proposed bauxite mine will be developed by NALCO for captive purpose only.

**EMPLOYMENT GENERATION DUE TO THE PROJECT**

It is estimated that the total direct employment generation

## 1 – Introduction (cont'd)

from the proposed mining project will be about 231 personnel.

The mining organisation for the expansion is proposed to be headed by a General Manager (GM). The GM (Mines) will be the overall in-charge of the mine. He will be responsible for the production, planning, maintenance & services and safety of the bauxite mine. The GM (Mines) will report to the existing ED (M&R). It is estimated that the total manpower requirement will be about 234 for the mines on payroll. The summary of manpower is given in Table 1A-1.

**TABLE 1A-1 - MANPOWER REQUIREMENT FOR MINE**

Admin Dept.	Category							Total on Pay Roll
	M	E	S	HSK	SK	SSK	O	
<b>Mines</b>								
- Administration	7	2	1	0	3	0	7	20
- Works management	3	4	3	3	5	1	2	21
- Maintenance & services	0	7	6	2	36	42	0	93
- Production	0	4	3	6	61	26	0	100
<b>Total</b>	<b>10</b>	<b>17</b>	<b>13</b>	<b>11</b>	<b>105</b>	<b>69</b>	<b>9</b>	<b>234</b>

(M-Management staff, E-Engineers and officers, S-Supervisory staff, HSK- Highly skilled staff, SK-Skilled staff, SSK- Semi skilled staff, O-Office staff)

Indirect employment opportunities for people from nearby villages will be created in the form of contractual work. There will be wide variety of contractual work like transportation, sanitation, supply of goods and services to the project and other community members.

**AUTHORISATION**

National Aluminium Company Limited (NALCO) vide its Letter Reference No. P&T/CONT/61 dated 9<sup>th</sup> February 2015 commissioned M. N. Dastur & Company (P) Ltd, Consulting Engineers, Kolkata to prepare a Pre-Feasibility Report on mining

1 – Introduction (cont'd)

expansion project.

**ACKNOWLEDGEMENT**

CONSULTING ENGINEERS gratefully acknowledge the co-operation and assistance extended by NALCO in preparation of this Pre-Feasibility Report.

## 2 - PROJECT DESCRIPTION

This Chapter gives an elaborate description of the enhancement of the bauxite transportation from 6.825 MTPA to 9.975 MTPA bauxite mining from South Block ML in NALCO's existing Panchpatmali bauxite mine along with its auxiliaries and necessary enablers. The entire quantity of 3.15 MTPA will be sourced from the virgin South Block of NALCO's Panchpatmali mine. The existing Environmental Clearance (EC) for mining in South Block also stands at 3.15 MTPA. However, production of from the South Block has been proposed to be commenced from the year 2019-20 as indicated in the letter granting the above EC. This PFR is prepared for the purpose of obtaining amended terms of reference (ToR) for installation of additional overland conveyor, apron feeder, crusher etc for additional transportation of 3.15 MTPA bauxite from Panchpatmali central & south block Mining Lease.

Covering letter for EC for 3.15 MTPA bauxite mine is presented as Appendix 2A-1

### **Type of Project including Interlinked Project**

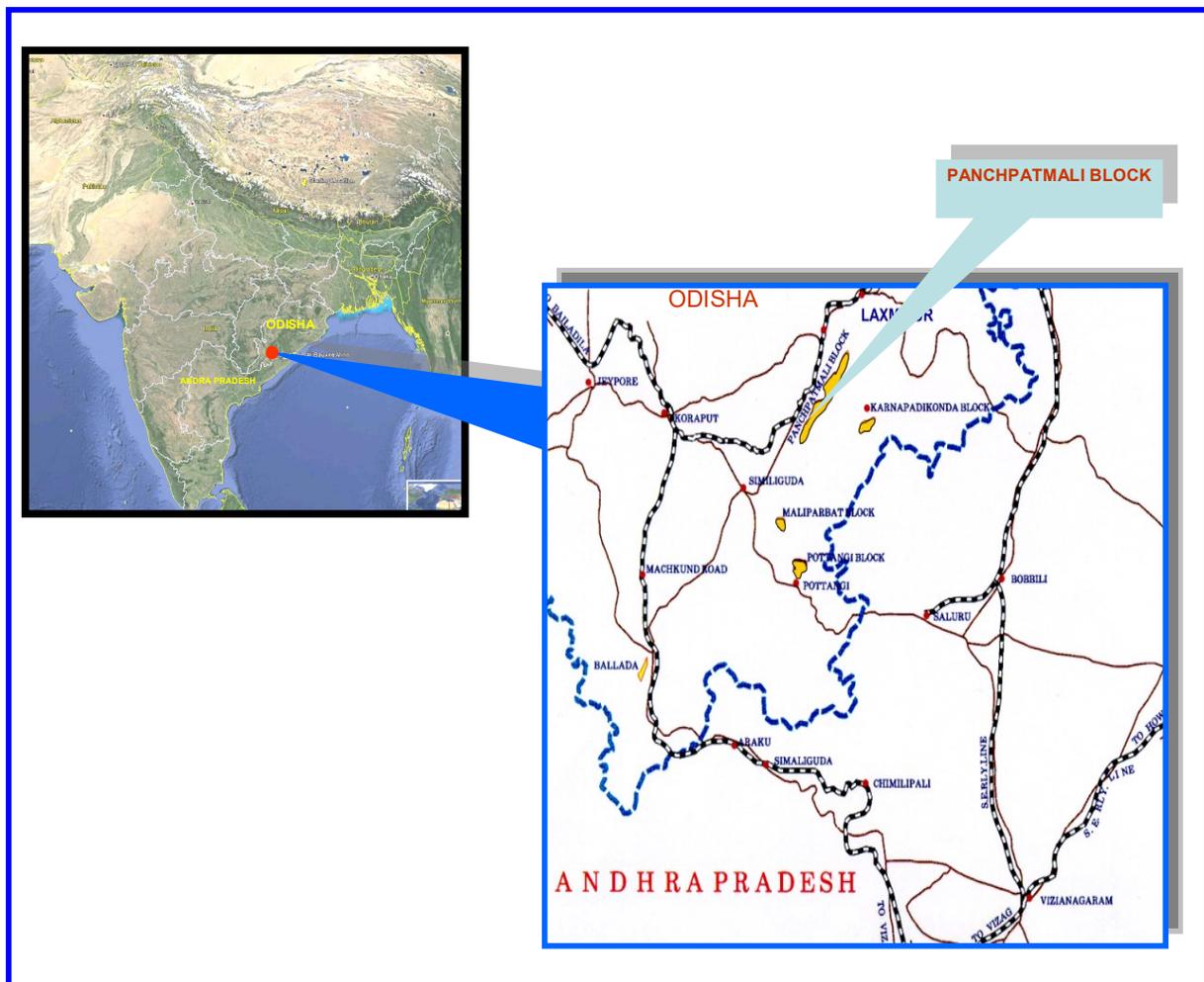
This project is linked with the proposed 3<sup>rd</sup> phase expansion plan of NALCO's alumina refinery at Damanjodi in Koraput District of Odisha. Mined out bauxite from the South Block will be transported by a new over land conveyor to alumina refinery complex at Damanjodi for captive use.

### **Location**

NALCO intends to increase the production capacity of its Panchpatmali bauxite mine by exploiting South Block within existing Mining Lease area. South Block of Panchpatmali bauxite mine is located in Koraput District of Odisha State, India. The latitude of the Lease area falls from 18° 46'32.60" N to 18°

## 2 – Project description (cont'd)

49°04.71" N. The longitude of the Lease area falls from 82°57'42.69" to 82°59'51.65" E. The location of the plant is shown in Fig. 2A-1 on the next page.



**FIG. 2A-1: SITE LOCATION MAP**

#### **Details of Alternative Site Considered**

This proposed project of production enhancement of Panchpatmali mine is included in 3<sup>rd</sup> phase expansion plan of NALCO Alumina Refinery as a risk mitigation measure till Pottangi Mines is allotted to NALCO. 3<sup>rd</sup> phase expansion of NALCO includes expansion of Refinery capacity from present 2.275 MTPA

## 2 – Project description (cont'd)

to 3.275 MTPA Alumina production by addition of 5<sup>th</sup> stream (1.0 MTPA) in its Alumina Refinery at Damanjodi along with additional transportation of 3.15 MTPA bauxite from South Block Mining Lease. As already stated, the entire 3.15 MTPA is proposed to be mined from South Block ML of NALCO's existing Panchpatmali mining lease area and therefore, no other alternate sites are considered. The mining plan including scheme of mining (SOM), Environment Management Plan (EMP), Progressive Mine Closure Plan (PMCP) and Final Mine Closure Plan (FMCP) of Panchpatmali South Block for 3.15 MTPA bauxite mining was initially approved by IBM, Nagpur on 24.05.2010 vide Letter No. 314(3)/2009-MCCM (CZ)/MP-35 for the RML area over 528.262 hectares under Rule 24A of MCR-1960 for the period 2009-2014. Now, the Mining Plan along with Scheme Of Mining for the period 2014-2019, which includes excavation of overburden and production of bauxite, has been approved by Regional Controller of Mines (RCOM), IBM, Bhubaneswar Region on 27<sup>th</sup> August 2015 vide letter No. MS/FM/58-ORI/BHU/2014-15/ 1717 dated 27<sup>th</sup> August 2015.

**Layout**

The mining infrastructure and other new facilities, apart from the proposed overland conveyor, will be installed within the existing lease area of NALCO. Proposed conveyor will be routed through existing conveyor corridor. The alignment of the proposed overland conveyor will be finalized during engineering stage. Mine general layout showing the proposed facilities, is presented in drawing Nos. 11253-A-02-0001 and 0002. A schematic flowchart is also enclosed with this report as drawing No. 11253-A-02-0003 for representation of flow of material to different units.

**Magnitude of Operation**

After 3<sup>rd</sup> phase expansion of NALCO's refinery complex,

## 2 – Project description (cont'd)

total bauxite requirement of refinery complex will be around 9.975 MTPA. Presently, 6.825 MT bauxite is being raised per annum from Central and North Block ML of NALCO's captive mine at Panchpatmali hill. Hence, to cater the bauxite requirement of refinery complex after 3<sup>rd</sup> phase expansion, additional 3.15 MT bauxite is required per annum. Mining activity for the above additional bauxite requirement will be confined to South Block ML of Panchpatmali bauxite mine (captive mine of NALCO) and will have to be geared up for this scale of operation.

**Project Description with Process Details**

South Block of Panchpatmali bauxite mine will be a fully mechanized opencast mine. Based on the morphology of the block, trench method of mining operation is proposed. This method consists of digging a service road and a number of nearly parallel and slightly ascending trenches with staggered faces and floors at progressively lower levels. Each set of trenches spreads out, wherever possible on either side of Central Axis. A peripheral barrier/safety zone of 7.5 m width will be maintained around periphery of the bauxite deposit along the edge of the plateau.

The bauxite will be crushed with the help of a primary crusher before transporting the same through a new overland conveyor to the alumina refinery at Damanjodi.

**Basis of Design**

The basis considered for calculations with regard to different aspects of mining operation and subsequent crushing and transportation of bauxite are indicated below:

***Bauxite requirement:*** 3.15 MTPA

***Average stripping ratio (Bauxite : Over Burden (OB):***  
1:0.127 (ton/ton).

## 2 – Project description (cont'd)

**Basis of equipment selection:** The capacity of mining in South Block *will* be 3.15 MTPA Bauxite and 0.4 MTPA OB. Equipment are selected based on the above capacity of the mine.

**Working duration:** The annual effective working hours for mining and crushing plant have been computed on the basis of following assumptions:

- Annual shutdown of fifteen (15) days per year.
- Weekly shutdown of half ( $1/2$ ) shift per week amounting to total thirteen (13) days of shutdown annually.
- Two (2) days off annually due to IR and other related issues, like safety week celebration etc.
- Annual working days *will* be 330.
- There will be eight (8) months dry days and 4 months monsoon days at a ratio of 2:1.
- Two operating shifts per day, each of 8 hours duration.
- Effective working hours at 12 per day during dry season whereas, during monsoon, the effective crusher capacity would be 70% of that of the dry season.

Based on the above assumptions, the annual effective working duration work out to approximately 3564 hours.

**Average raising rate:** Considering the above working hours, the average raising rate of excavated material works out to about 997 tons per hour comprising about 885 tons of bauxite and approximately 112 tons of overburden/waste. The average throughput rate of the crushing plant comes to about 885 tph.

## 2 – Project description (cont'd)

However, as desired by NALCO, crushing plant with rated capacity of 1100 tph is proposed to be provided based on the experience of present operation. The design capacity of the crushing plant will be at least 25%-33% over and above the rated capacity.

Bulk Density and Specific gravity of bauxite and OB are as follows:

Bulk density of bauxite	.. 1.5 t/cum
Specific gravity of bauxite	.. 2.1
Bulk density of OB	.. 2.1 t/cum
Specific gravity of OB	.. 3

**Feed ore characteristics for crushing plant:** The feed ore characteristics considered for selection of equipment of the crushing plant are as follows:

Top size, mm	.. 1600 (1% to 2%)
Moisture content, per cent	.. 7 to 13, average 10
Bulk density, tons/cu m	.. 1.5
Specific Gravity	.. 2
Angle of repose, degree	.. 35 to 37
Uniaxial compressive strength, mpa	.. 80 to 100
Hardness, Mohs scale	.. 2.5 to 3.5
Material quality and structure	.. The material is soft, porous, friable, pitted and earthy having clay intercalations, fine to medium grained, having indistinct/imperfect cleavage.

## 2 – Project description (cont'd)

Mineral composition .. Mostly gibbsite, in association with minerals like goethite, kaolinite, boehmite etc.

Average chemical composition:

- Al <sub>2</sub> O <sub>3</sub> , %	.. 42.37
- SiO <sub>2</sub> , %	.. 3.88

**Excavation of Overburden**

The overburden consists of top soil and laterite. The average thickness of top soil is about 0.8 m and that of lateritic overburden is 2.0 m. The following sequence will be followed for excavation of top soil and overburden:

- a) Removal of top soil with the combination of Dozers and Wheel Loaders and transportation of the same to a designated place for reclamation of the mined out area at a later stage.
- b) Excavation of hard laterite will be done by mainly drilling and blasting, and partly with ripper dozers.
- c) Loading of overburden into the dumpers by wheel loaders.
- d) Hauling of lateritic overburden (OB) to mine out areas for back-filling.

In the initial stages of excavation, only overburden (Top soil + Laterite) will be excavated, and it will be stacked at suitable places which will be rehandled later for backfilling of the mined out area in South Block. About 4.00m to 6.00m height benches will be maintained for overburden dump yard.

NALCO through its actual mining experience has observed, drilling/blasting to be a more effective method for excavation of

## 2 – Project description (cont'd)

40 per cent of its overburden layers. The remaining 60 per cent of thin layers are generally ripped with rippers.

**Mining of Bauxite**

The mineralization being quite uneven, mining of bauxite will be done in two stages to minimize the loss/dilution. The first slice of bauxite shall be taken as top bauxite and the next slice shall be taken as bottom bauxite. Top bauxite, being relatively harder, will be loosened by deep hole drilling and blasting. However, selective mining process shall be adopted for excavation of the bottom slice/bottom bauxite. The detail process of mining is described below:

## i) Excavation of Top bauxite layers:

The excavation of relatively hard Top Bauxite layer consists of the following steps:

- a) Drilling of 150 mm dia. blast holes
- b) Charging the holes with booster and ANFO Explosives and Blasting.
- c) Loading of blasted ores into the dumpers by wheel loaders.
- d) Hauling of ore to the primary crusher using dumpers.

The average height of the top bauxite bench will be maintained at about 8 m.

## ii) Excavation of bottom slice/bottom bauxite:

The stepwise processes to be involved are as follows:

- a) Selective mining with hydraulic backhoes.

## 2 – Project description (cont'd)

- b) Hauling of ore to primary crusher using dumpers.

Thus, the entire bauxite layer will be removed in two layers as indicated above.

As such, around 40 per cent of bauxite will be mined by deep hole drilling and blasting and the remaining 60 per cent will either be ripped or simply scooped by backhoes from the bottom layers.

Equipment selection will be based on the deposit characteristics and simulation studies at different stages of activities.

**Dump Re-handling (for the purpose of recovery of mineral)**

At the initial stages, only overburden will be excavated to expose bauxite and it will be dumped in the suitable places at South Block. After initial OB removal, bauxite excavation will start and gradually mined out area will be created after the complete excavation of bottom bauxite. The overburden will be dumped directly in the mined out area without dumping at any other places inside the mine. Thus the lateritic overburden which shall be excavated from the trenches will be simultaneously dumped in the mined out area for backfilling and the top soil shall be spread over the backfilled area. The area shall be further levelled by dozers and plantation shall be carried out over the reclaimed area. This shall be a continuous process till the end of life of the mine.

**Equipment/Machineries to be Deployed**

As discussed above, opencast mechanized method of mining will be adopted for mining at South block of Panchpatmali mine. The list of mining equipment proposed to be deployed for mining is presented in Table 2A-1 on the next page.

## 2 – Project description (cont'd)

**TABLE 2A-1 - LIST OF EQUIPMENT FOR MINING**

Sl. No.	Description	Quantity
1.	Backhoe Hydraulic Excavator, 6.3 cu m.	2
2.	Front End Loader, 13.5 cu m.	2
3.	Dumper, 55 ton	6
4.	Dumper, 100 ton	6
5.	Crawler mounted Drill with Compressor, 150 mm dia	4
6.	Ripper Dozer, 890 hp	2
7.	Crawler Dozer, 443 hp	2
8.	Wheel Dozer, 498 hp	1
9.	Motor Grader, 160 hp	1
10.	Backhoe Hydraulic Excavator, 3 m <sup>3</sup>	2
11.	Diesel Tanker, 10 kL	2
12.	Water Sprinkler, 28 kL	2
13.	Vibratory Compactor	1
14.	Explosive Van, 9 ton	2
15.	ANFO Mixer cum Charger, 5 ton	2
16.	Vacuum Suction Drill- ED 2000 Series	2
17.	Fire Tender	2
18.	Tyre mounted Diesel Generator Set	7
19.	Ambulance Van	1

A primary crushing plant of 1100 tph (rated) capacity will also be installed at the South block. An r.o.m hopper of 250 tons

## 2 – Project description (cont'd)

capacity will be provided above the primary crusher for dumping of bauxite by hauling units. An articulated rock breaker will be provided in the r.o.m hopper to break the boulders that are lodged inside the hopper discharge chute. This will be helpful in breaking the bridging of hopper openings to lodging of multiple smaller boulders. The crushed product will be conveyed by belt feeder and the same will be stored in a 250 ton capacity surge hopper equipped with an apron feeder at the bottom of hopper. The material from the transfer hopper will be fed to the overland conveyor with the help of a belt conveyor system. Bauxite feeding facility from new crushing plant to existing over land conveyor is also envisaged under the proposed material handling system. All the chutes must be made with smooth profile, lined with non-sticky abrasion resistant material, and designed considering maximum moisture content and for a flow rate of 120% of design capacity. The list of equipment for crushing plant is given in Table 2A-2.

**TABLE 2A-2 - LIST OF EQUIPMENT FOR CRUSHING PLANT**

Sl. No.	Description	Quantity
1.	Heavy duty apron feeder, 1100 TPH (rated)	2
2.	Vibrating Grizzly, 1100 TPH (rated)	1
3.	Toothed double roll crusher, 1100 TPH (rated)	1
4.	Belt conveyors system (1800 tph rated capacity)	lot
5.	Belt scale	1
6.	Suspended magnet	2
7.	E.O.T crane, 40/5 ton	1
8.	Mechanical hoist, 2 ton/3 ton	2
9.	Rack and pinion gate	1
10.	Flap gate	2
11.	Articulated rock breaker	1

## 2 – Project description (cont'd)

**Over Land Conveyor**

A new over land conveyor system of capacity 1800 tons per hour (tph) is envisaged for transportation of crushed bauxite from South Block to Alumina refinery. Proposed conveyor will be routed through the existing conveyor corridor, within the land area under possession by Nalco.

**Requirement of Raw Materials and Probable Sources**

As this Report is concerned with additional production of bauxite from South Block of NALCO's Panchpatmali bauxite mine, there is no requirement of any raw material. Panchpatmali bauxite mine of NALCO is a captive source of bauxite for its alumina refinery at Damanjodi.

Mined out bauxite will be crushed in the primary crusher at the mine site and will be transported to the alumina refinery by a new overland conveyor.

**Power Requirement**

The estimated overall power requirements of the mine are given in Table 2A-3.

**TABLE 2A-3 - ESTIMATED POWER REQUIREMENT FOR MINING IN SOUTH BLOCK**

Annual energy consumption, kWh x 10 <sup>6</sup>	..	15.65
15-min. maximum demand, MW	..	4.41
1-min. peak demand, MW	..	4.63

**Source of power:** The total power requirement of existing Panchpatmali bauxite mine, existing conveying system, proposed bauxite mine at South Block ML area and new conveying system as well as other proposed facilities to come up for additional mining etc will be met from the following sources, namely:

## 2 – Project description (cont'd)

- i) Existing 33kV overhead transmission line-1 coming from Central Distribution Sub-station (CDS) at Alumina Refinery plant, Damanjodi.
- ii) To meet the additional power requirement along with existing loads, the existing transformer will be replaced by one (1) No. new 132/33kV, 12.5 MVA transformer. Associated CBs, CTs, protection, metering, etc will also be replaced for the above feeder, as required.
- iii) Existing 33kV overhead transmission line-2 coming from CDS at Alumina Refinery plant, Damanjodi.
- iv) To meet the additional power requirement along with existing loads, the above transformer will be replaced by one (1) No. new 132/33kV, 12.5 MVA transformer. Associated CBs, CTs, protection, metering, etc. will also be replaced for the above feeder, as required.

**Instrumentation, Automation and Communication Systems**

The Instrumentation and Automation system for the proposed Panchpatmali bauxite mine at South Block area including overland conveyor will be designed based on the latest technology available in the country and conforming to the relevant standards and norms. Availability, after sales support, flexibility and inter changeability will form the basis of the selection of instrumentation items, in addition to the specific requirement for the instrument to work satisfactorily under the stipulated process condition.

All design manufacturing, workmanship, testing and erection/installation will conform to the relevant acts, laws, rules

## 2 – Project description (cont'd)

and regulations and safety codes of the jurisdiction within which the project is located, and to current edition of the International and National standards and codes.

The design of the control systems and related equipment will adhere to the principle of "fail safe" operation at all system levels. "Fail Safe Operation" signifies that the loss of signal, loss of power or failure of any component will not cause a hazardous and unsafe condition for plant equipment and/or operating personnel, and at the same time prevent occurrence of false trips.

**Communication System**

Following communication facilities are envisaged for reliable and quick communication within the Panchpatmali mine as well as with outside agencies:

- Telephone system
- Wireless communication system

**Fire Detection and Alarm System**

Fire detection and alarm system (FDA) will be provided for safety of life and property of mine's area and electrical substations by early detection and acknowledgement of unwanted fire condition.

The fire detection and alarm system will be intelligent, microprocessor based, automatic addressable type and with self-checking type network. The system will be designed and installed in accordance with NFPA, TAC and IS-2189 standards.

The system will comprise of fire alarm control panel (FACP) with different of types of detectors and interfacing modules as per requirement. Required numbers of hooters, strobe lights, etc will be provided to warn people in case of emergency. The FDA system will have necessary interfacing with different types of fire protection/fighting systems and interlocking with HVAC system

## 2 – Project description (cont'd)

using control modules. Required numbers of manual call points will also be provided for initiating alarms manually in case of fire or any other emergency.

The FDA system will be UPS powered or provided with battery back-up and will include telephone auto dialer to notify concerned authorities about a possible emergency situation through telephone network. The FDA system will also have facility to allow monitoring of fire alarm system status from a FDA monitoring PC.

**Water Supply System for Mine Area**

It is estimated that total water requirement for the proposed mining area will be 700 cum/day, out of which 585 cu m/day will be raw water and 115 cu m/day will be filtered water. For this purpose, raw water shall have to be drawn from the water source, i.e. from Jholaguda natural stream. 1000 meters long pipe line has been considered along the valley surface to transfer the raw water from Jholaguda intake to mines. The proposed mining area is situated at an elevation of 550 meters from Jholaguda intake pump house. The break-up of water requirement for various consumers is given in Table 2A-4 below:

**TABLE 2A-4 - MAKE UP WATER REQUIREMENT**

<b>Consumer</b>	<b>Raw Water</b>	<b>Filtered Water</b>
	Cu m/day	cu m/day
Mines road sprinkling	525	-
Industrial use	-	75
Horticulture	60	-
Drinking and sanitation	-	40
Total	585	115

The water balance diagram for the proposed mining project is shown in Drawing No. 11253-A-02-0004

## 2 – Project description (cont'd)

**Source of Water**

Source of water for supply to South Block of Panchpatmali Mine is Jholaguda natural stream.

For existing mining operation at Panchpatmali, water is being fed from Jholaguda intake pump house. For proposed water requirement at South Block, a new intake pump house adjacent to the existing intake water reservoir and existing intake pump house is envisaged to be built, and raw water shall be drawn from existing reservoir. Approval exists for drawal of additional 0.4 MGD of water from Jholaguda water source. In-principle permission granted for 0.5 MGD in the 57th meeting of the Water Allocation Committee of State Water Resources Department, Govt of Odisha held on 2.5.2011. Approval letter issued by Water Resource Department is presented as Appendix 2A-2

**System Description**

The water supply system described in this report covers the following:

- Intake water system.
- Plant water system.
- Dry fog dust suppression system for the additional junction houses in refinery area.

**Intake water system:** A new intake water system for this assignment is to be considered for transferring the water drawn from the natural stream to the mine's raw water reservoir. A new intake pump house adjacent to the existing intake water reservoir and existing intake pump house has been envisaged.

**Plant water system:** Plant water system will consist of the following:

## 2 – Project description (cont'd)

- Raw water storage reservoir and distribution pump house.
- Water clarification and filtration unit.
- Drinking water distribution system.
- Fire fighting system for fuel filling unit.
- High pressure fogging system.
- Raw water reservoir to store 15 days' requirement of water will be provided inside the mines boundary. This reservoir will be located at an elevation of 550 meters from the Jholaguda intake pump house. The capacity of the reservoir will be 10,500 cu m. A distribution pump house will be located adjacent to the raw water reservoir.
- Raw water stored in the reservoir will be passed through lamella clarifier. The clarified water shall be stored in a clarified water storage sump. The capacity of clarified water storage sump shall be so selected so as to have retention capacity of 30 minutes. From the clarified water storage sump, the clarified water shall be transferred to the pressure sand filters for removal of suspended solids. The water clarification unit shall be supplied completely with lamella clarifier, flocculation tank, chemical dosing unit, clarified water storage sump, clarified water transfer pump, necessary sludge handling facility along with interconnecting pipes and valves. The filtered water from pressure sand filters will be collected in filtered water storage tank of 115 cum storage volume. Filtered water storage tank will be located adjacent to the distribution pump house. From filtered water tank the filtered water will be pumped to the drinking water overhead storage tank by means of one set of pumps. Sodium hypo chlorite dosing is envisaged through on-line electro-chlorinator system for disinfection purposes prior pumping into the overhead drinking water storage tank.

Another set of pumps will pump the filtered water to the mines industrial use. Both of these pump sets will be located inside the distribution pump house.

- To meet the drinking water and sanitation requirement of mine and plant personnel, filtered and chlorinated water from filtration unit will be pumped to the drinking water overhead storage tank by means of drinking water transfer pumps. The overhead storage tank shall have the capacity of 80 cu m (two days' storage capacity) and shall be located in service centre facilities at an elevation of 30 m,

## 2 – Project description (cont'd)

where from the drinking water will be supplied to all consuming points.

- Dedicated fire water reservoir and fire fighting pump house is envisaged in the plant water systems area to cater to fire water requirement for hydrant system as well as MVWS system for Fuel Filling Unit.

The Fire water reservoir will have the effective storage capacity of 840 cu m (4 hours pumping capacity). The filling of fire water reservoir will be done from the drinking water transfer pump (Gr. P5 pump).

Combined fire water pumping system is envisaged for both hydrant system and MVWS system. Fire water pumping system will comprise of main fire water pump – motor driven, main fire water pump-diesel driven, jockey pump, necessary distribution network with required nos. of landing valves, hosebox, etc.

- High pressure fogging system will be provided for primary crusher house to eliminate dust generation.

**Utility System**

Diesel storage, plant grade compressed air, dry compressed air, etc are envisaged for production and maintenance of different units of the mine and plant. The air conditioning and ventilation system and fire fighting system for the plant are also discussed herein.

**Diesel storage:** Diesel will be used as fuel for light and heavy vehicles within the mine and plant premises. The requirement of diesel during plant operation has been worked out based on the fuel consumption rate of different vehicles, equipment and machineries. To meet the above requirement, over ground diesel storage system has been envisaged. Diesel will be obtained by means of road tankers. The same will be drawn by pumps and stored in on-ground tanks after filtration. During the day, the distribution pumps shall ensure required quantity of diesel to the consumers. Total storage capacity of the diesel

## 2 – Project description (cont'd)

distribution system will be of 180 Kilo Litre (KL) consisting of two (2) Nos. of diesel storage tanks of capacity 100 KL each.

The design of the system will be such that continuous supply of diesel can be carried out from one (1) tank while the other is being filled from the road tanker.

**Protection system for diesel storage:** In case of fire/leakage of diesel, the electrical power system of diesel station will get switched off except the emergency lighting.

The diesel storage and pumping area will be protected against outbreak of fire by medium velocity water spray (MVWS) system in addition to fire hydrant system. The hydrant points projected above ground will be connected to the network at regular intervals in the strategic locations as per hazard category to combat any outbreak of fire.

**Compressed air station:** Compressed air will be required for air filling in the tyres of vehicles, cleaning and washing of the vehicles in the respective service bay. Compressed air will also be required for drying the washed cars in the wash ramp area. Dry compressed air will be required for instruments and controls, to be used in the workshop.

Requirement of plant grade compressed air and dry instrument grade compressed air will be met from one No. centralised compressed air station with two Nos. screw compressors (one working + one standby) along with required nos. of air receivers of requisite capacities. The pressure of the available compressed air will be around 7-8 kscg.

Two Nos. refrigerated air dryers (one working + one standby) along with required numbers of air receivers of requisite capacities have been envisaged to meet the requirement of dry instrument

## 2 – Project description (cont'd)

grade compressed air. The pressure of the available dry instrument grade compressed air will be around 5-7 kscg.

**Fire protection system:** The facilities envisaged for the fire protection systems for the above units are as follows:

- Fire hydrant system for diesel storage and distribution area.
- Supplementary protection of the diesel storage and distribution area by Medium Velocity Water Spray (MVWS) system.
- Fire extinguishers (dry powder, carbon dioxide and foam type) and sand buckets will be installed at the point of access to the diesel storage installation, compressed air station and at all other premises as per the regulations of IS: 2190.
- The diesel storage and distribution system will be designed as per stipulation of Oil Industry Safety Directorate (OISD) and Tariff Advisory Committee (TAC) regulations, as applicable.

**Air-conditioning and ventilation systems:** The ventilation systems proposed to achieve desired ambience in different areas at different period of the year are as follows:

- Cable basement, cable vault, pump house: Mechanical ventilation system using fan-filter units for supply and exhaust fans.
- Workshop building: Natural ventilation by roof monitors, as necessary.

The ventilation air quantity will be selected either to maintain room inside room temperature at 5 deg C over outside ambient temperature or to have fifteen air changes per hour in the ventilated areas, whichever is higher. However, for battery rooms, small plant rooms and toilet blocks, ventilation system will be designed on the basis of air change only.

## 2 – Project description (cont'd)

The air-conditioning systems are proposed to be designed to maintain maximum room inside bulb temperature of 30 deg. C for switchgear rooms, control rooms, control pulpits, computer rooms, lab, training centre, PLC rooms and other premises under consideration. In order to meet the above requirement, package type/split type/window type air-conditioners complete with standard accessories may be adopted:

**Overhead yard pipe work:** Plant will have a piping network for distribution of diesel, plant grade compressed air, dry compressed air, etc. The yard portion of the pipework for all services (except water) will be laid on towers and trestles with a clear height of 7 m above finished ground level (FGL). Shop internal pipework will generally be routed in multiple rows through building columns taking support from buildings and girders.

**Resource Optimisation/Recycling and Reuse**

- Fully mechanized mining shall be adopted for mining in South Block of Panchpatmali bauxite mine.
- OB dumped inside the ML area during the initial stages of the mine shall be re-handled and backfilled in the exhausted portions of the mine pit. Once sufficient exhausted area is available, all the OB will be dumped in the exhausted areas of the mine pit.
- Energy efficient electrical equipment has been envisaged to minimise loss of electrical energy.
- The rain water collected in the mining area will be diverted to sedimentation pits inside mined out area for settling of the sediments. The water will percolate into the ground thus recharging the ground water table.
- The oil waste water from the repair shop will be collected in a concrete basin with oil separation device. The oil free water will be reused for dust suppression in the haul road.

## 2 – Project description (cont'd)

**Waste Management and Disposal**

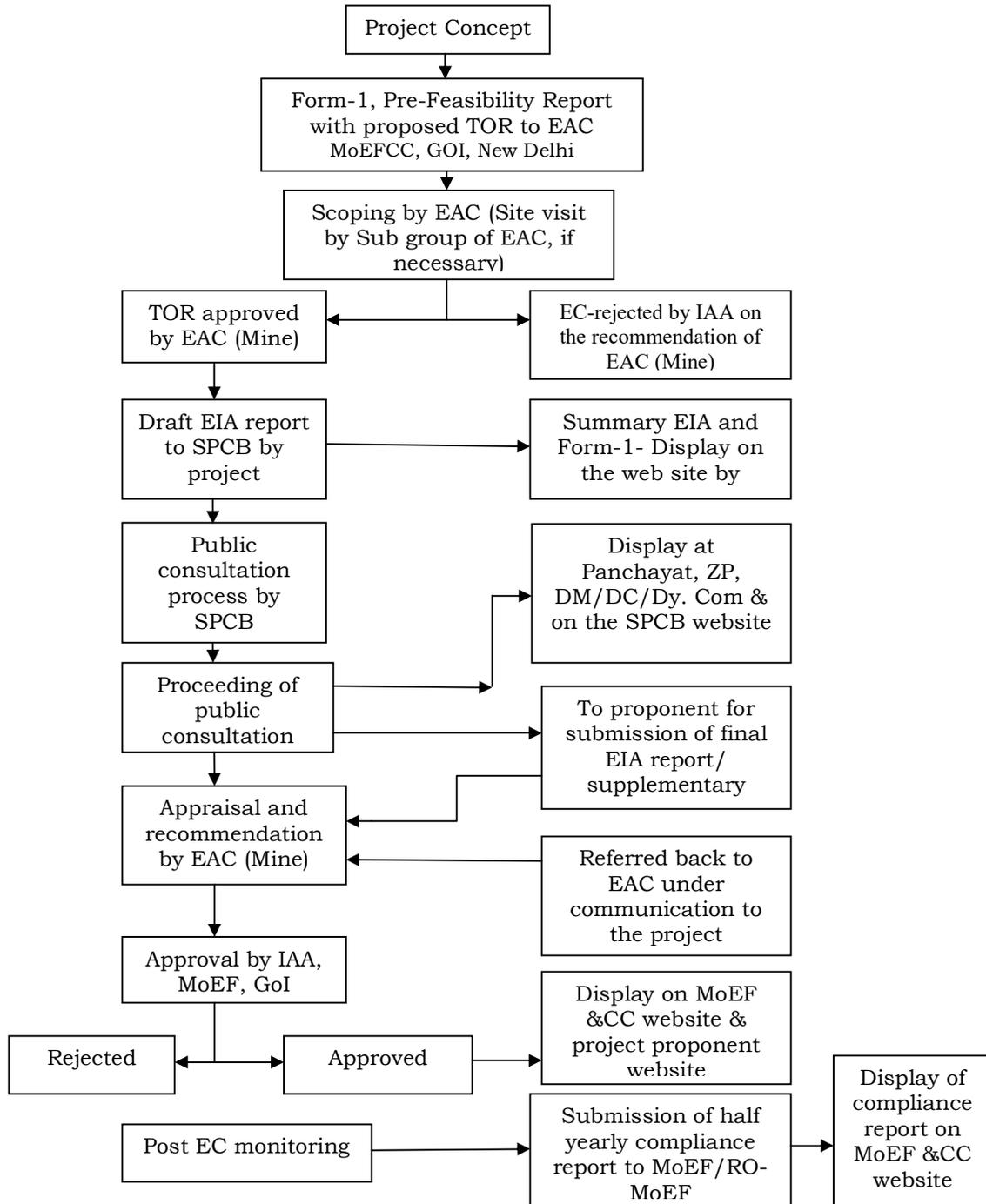
There will be a temporary dump of overburden material in the initial stages after starting of mining activity. The dumping will be carried out in retreating pyramid method. The slope angle of the individual terrace will be maintained at 30 deg. with overall slope of the dump will be of 22 deg.

After these initial years, the overburden material from the temporary dump will be used for backfilling of mined out area.

However, during the initial years of existence of the temporary dump, adequate care will be taken to arrest surface run-off during rainy season. A retaining wall will be provided all around the dump at the base of the dump. A garland drain will be provided adjacent to the retaining wall all around the dump to collect runoff and guide it to the sedimentation basin (sump). The run-off water collected will percolate into the ground thereby recharging the ground water. The dump will be planted with suitable species of local grass to arrest soil erosion. Trees need not be grown since the dump will be excavated to take out the overburden material for backfilling of mined out area.

A Schematic representation of the EIA steps is given in Fig. 2A-2 on the next page.

2 – Project description (cont'd)



**FIG. 2A-2 – SCHEMATIC FLOW DIAGRAM OF EIA STEPS**

### 3 - SPECIFIC CONSUMPTION AND TOTAL BAXUITE REQUIREMENT

#### BACKGROUND

In order to obtain Environmental Clearance, NALCO had applied for TOR for raising its mines capacity by 0.505 MTPA (From 9.975 to 10.48 MTPA) to EAC Non-Coal Mining and Refinery capacity by 1.0 MTPA (from 2.275 to 3.275 MTPA) to EAC Industry. Refinery and mines expansion was shown as interlinked project. The TOR was issued by EAC Industry on 30<sup>th</sup> November 2015.

#### BASIS OF ARRIVING AT ADDITIONAL BAXUITE REQUIREMENT

The requirement of 0.505 MTPA bauxite was arrived at considering the following:

Capacity of the existing alumina refinery	: 2.275 MTPA
Sp. Bauxite consumption with earlier IBM guidelines on cut off	: 3.0 T/T
Sp. Consumption due to adherence to latest IBM guidelines on cut off	: 3.2 T/T
Bauxite requirement for the existing capacity	: 7.28 MTPA
Additional bauxite requirement for 1.0 MTPA expansion	: 3.2 MTPA
Total bauxite requirement for the expanded capacity	: 10.48 MTPA
Mining lease available with NALCO	: 0.505 MTPA

#### REVIEW OF EXISTING PLANT DESIGN AND THE IMPACT OF REVISED IBM GUIDELINES ON CUT OFF

The existing plant was designed for a specific bauxite consumption of 3.0 T/T and its corresponding mud load of 1.2 – 1.3 T/T. All the equipment were also designed accordingly. With increased bauxite specific consumption of 3.2 T/T and increased

## 3 – Specific consumption (cont'd)

mud load to a level to 1.4 – 1.5 T/T, the existing equipment are not capable of handling the additional bauxite and mud load. Thus, the capacity of the existing plant is limited by the bauxite and mud to be handled, the maximum limit of which is 3.0 T/T (Specific Consumption) or 6.825 MTPA (Total). Accordingly, the additional bauxite of 0.455 MTPA envisaged for the existing streams of the refinery cannot be used by the plant unless the design aspect is reviewed in the light of the present bauxite quality with latest IBM guidelines and existing equipment are modified suitably. This is a long drawn project and may take years to complete. In absence of desired modification of equipment & machineries, the additional bauxite of 0.455 MTPA will be of no use and hence NALCO may drop the same for the time being.

**ANALYSING THE NEED FOR ADDITIONAL BAUXITE FOR EXPANSION IN THE LIGHT OF CHANGED TECHNOLOGY**

It may be seen that once the additional bauxite requirement for the existing refinery is dropped, the additional bauxite requirement for the proposed 1.0 MTPA refinery is only 3.15 MTPA.

It may be mentioned here that, as compared to the existing streams of alumina refinery, where atmospheric digestion along with conventional settling-washing has been adopted in three out of four streams, the proposed 1.0 MTPA stream considers medium pressure digestion, along with high rate decanters and deep cone washers for mud settling-washing. With this improved technology, bauxite will be digested at a temperature of 1450°C as compared to 1050°C in the present case and retention period of mud across settling unit will reduce manifold. Hence, bauxite digestion efficiency and overall recovery will be better by 1.5 – 2.0% as compared to the existing streams, resulting in a drop of specific Bauxite consumption to a level to 3.135 - 3.15 T/T and yearly consumption to 3.135 – 3.15 MTPA.

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**3 – Specific consumption (cont'd)**

As 3.15 MTPA bauxite is already available from the existing South Block mining lease of Panchpatmali mines, NALCO may drop the application for EC which has been submitted for raising additional 0.505 MTPA bauxite from South Block mining lease. However, the EC for laying of 10.5 KM long distance conveyor connecting mines & refinery and other equipment at South Block ML area required for crushing and conveying of bauxite from mines to refinery will have to be pursued. Accordingly, NALCO may submit application to MoEF & CC for suitable amendment.

**CONCLUSION AND RECOMMENDATION**

From the above analysis it could be concluded that for the proposed expansion of the refinery by 1.0 MTPA, NALCO do not need any additional bauxite over and above 3.15 MTPA, for which ML & EC is already available. Accordingly, it is recommended that NALCO may approach MoEF & CC to amend the requirements, which were indicated in the application submitted earlier.

## 4 - SITE ANALYSIS

The technical details of the proposed mine of capacity 3.15 MTPA bauxite is described in the preceding chapter. This Chapter mainly focuses on the location of the proposed expansion.

### **Connectivity**

The Panchpatmali bauxite deposit is located on Panchpatmali hills near Damanjodi in Koraput district of Odisha. Koraput, the district Head Quarter, is situated at a distance of about 60 km via Damanjodi and Semiliguda. Public transport by bus is available to Koraput, Jeypore, the township of Sunabeda and many other major towns and cities of the state of Odisha. The nearest rail head is at Damanjodi, on the Rayagada-Koraput broad gauge rail section of East Coast Railways. The nearest airport and seaport is Visakhapatnam, about 200 km from the mine. Panchpatmali mine is connected with Damanjodi by mine approach road.

### **Land Form, Land Use and Land Ownership**

The proposed expansion will occur within the existing mining area (having Mining Lease) of NALCO in their owned land. The present lease area is 528.262 Ha. The land use/land cover comprises of mainly mining area along with infrastructure and road connectivity.

### **Topography**

The Mining Lease (ML) area is a part of Panchpatmali hill which is characterized by a N-S trending bauxite capping surrounded by Khondalite on the slopes. Highest and lowest altitudes inside the ML area are at 1,366 m and 880 m approximately above mean sea level (msl). Bauxite occurs mainly on the flat portions of the plateau from 1,266 m msl to 1,185 m

4 – Site analysis (cont'd)

msl. Bauxite formation is layered with a thin cover of soil at some places and a fairly thick cover of lateritic overburden. The bauxite bearing flat areas are almost devoid of vegetation. Grass and bushy palms are seen at places. The broad topographic features of M.L area can be seen from Fig 4A-1 below:

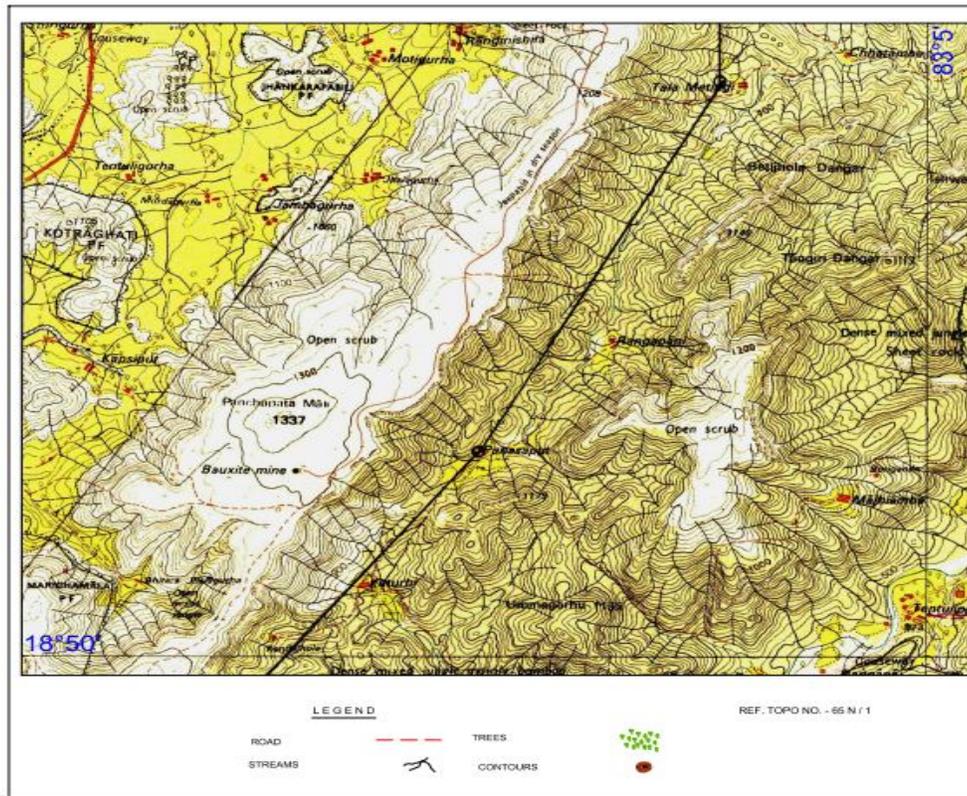
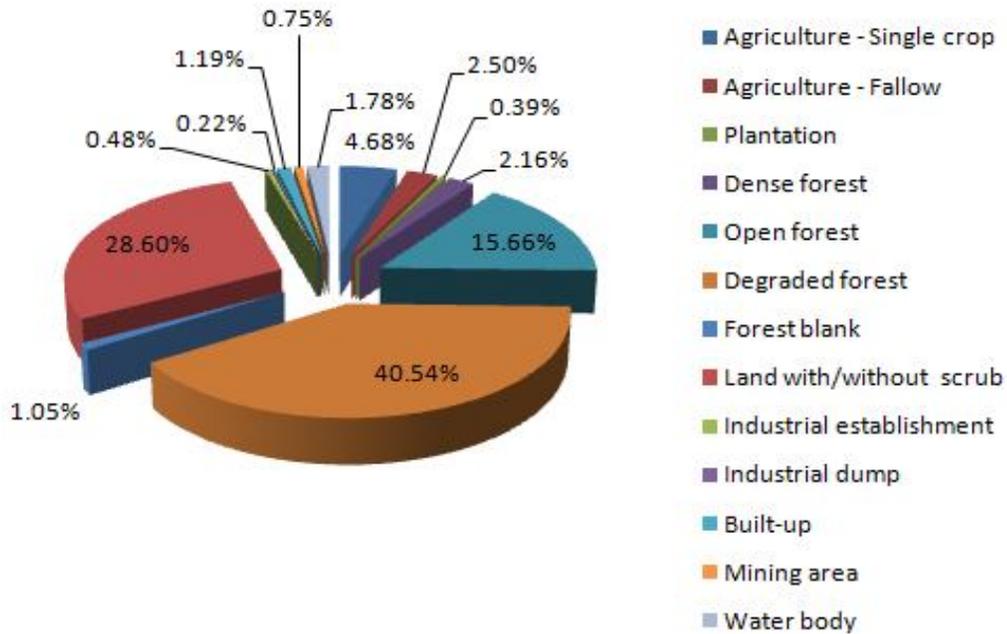


FIG. 4A-1 - TOPOGRAPHY OF PANCHPATMALI MINING AREA

Existing Land Use Pattern

The land use is assessed based on the satellite imagery (IRS P6, Liss4 mx) and the area statistics.

4 – Site analysis (cont'd)



**FIG. 4A-2 - EXISTING LAND USE**

The study area mainly consists of degraded forest (40.54%) and land with/without scrub land (28.60). Open forest consists of about 15.66% of the total land use. Single crop agriculture land consists of about 4.7% of the total land use. Water bodies take up about 2% of the total area. Industry and other built-up area consist of only 1.67% and mining area about 0.75% of the total land area.

**Drainage**

There are neither perennial nor seasonal nallah on the plateau of lease area. Seasonal nallahs originate from the periphery of the plateau and flow along the slopes towards the toe to meet the perennial sources. A perennial nallah exists on the western side and flows towards Jholaguda stream, which is dammed to have a storage capacity of 1,500 cu m water.

The Panchpatmali hill work as a water shed for the north-westerly and easterly flowing drainage. The numerous brooks

#### 4 – Site analysis (cont'd)

springing from its western flanks culminate into the major drainage system comprising the 'Deogiri Nadi' and the 'Muran Nadi', feeders to river Indravati, which is an important tributary to the Godavari. The courses that rise from the eastern slopes of the hill mass weave their course through the rugged terrain form the Janjhavati River, which empties itself into the river Nagavali. The tiny streams from the southern slopes of Panchpatmali hill join the Kolab River.

#### **Soil**

The sub-soils are of good quality. It is characterized by stiff to very stiff/hard, silty clay/clayey silt followed by weathered rock layer and that layer continues up to the terminating depth of some boreholes. The standing water table is around an average depth of 7.00m below ground level.

#### **Climatic Conditions**

The area has a dry, humid and hot climate. The summers have a good deal of rainfall, while the winters are normally dry. The average annual temperature is 23.1°C in Koraput. The rainfall averages to about 1,550 mm (IMD data of Koraput district).

#### **Existing Infrastructure (Physical, Social, Economic and Environmental)**

The project influence area comprises of villages and census towns thereby encompassing both rural and urban populations. The available infrastructure in the study area is as follows:

- With regard to educational institutions, there are around fifty five (55) Schools in the four (4) blocks of the study area. The female teachers under employment are equally distributed. Seven (7) Cooperative Stores catering to students of the area are functional.
- With regard to health care facilities, NALCO organizes health camps, family planning camps, eye camps, dental camps and rehabilitation camps (for the specially disabled members) on a regular basis. They also organize for

## 4 – Site analysis (cont'd)

outdoor medical facilities. In the study area two (2) Ayurvedic treatment centers are also functional.

- With regard to financial institutions, five (5) Agricultural Credit Cooperative Societies of total working capital of Rs. 1,17,37,000/- (Rupees One crore seventeen lakhs and thirty seven thousand only) is in operation. Furthermore eight (8) Non-Agricultural Credit Cooperative Societies catering to four thousand five hundred and five (4,505) members and of total working capital of Rs. 3,86,17,000/- (Rupees Three crore eighty six lakhs and seventeen thousand only) are also in operation. Additionally, two (2) Central Cooperative Banks catering to fortysix (46) members are functional.
- With regard to drinking water, there are several tube wells and open wells. The project proponent under peripheral development had undertaken piped water supply schemes and invested in development of ponds in the peripheral villages of the study area.
- Transport network in the study area encompasses public and private bus facilities and private truck carriers. Railway communication is available but rural movement of people and goods are mostly by road carriers. The project proponent has developed several culverts and approach roads in and around the project areas.
- With regard to recreation facilities, the project proponent has developed community centres, provided financial assistance towards cultural competitions and functions. Additionally, NALCO has distributed several television sets in the study area.

With regard to environment, NALCO has engaged in distribution of seedlings and engaged in social forestry schemes. The ecological state of the land at Panchpatmali is substantially improved by suitable plantation, lush green vegetation on the backfilled and plantation area. With regard to training, NALCO organizes 'Krishi Melas' for tribal villagers to adapt to modern agricultural techniques. NALCO also organizes for animal health camps to cater to welfare of the livestock of the villagers.

## 5 – PLANNING BRIEF

### Nearby Existing Industries

The major industries identified near the Panchpatmali Mining area are NALCO Alumina complex at Damanjodi, Hindusthan Aeronautics Limited (HAL)-Engine Division at Sunabeda and Odisha Timber and Engineering Works, also at Sunebeda.

### Population Projection

The estimated population of the study area in the years 2001 and 2011 are 30,114 and 35,440 respectively. The decadal growth is of 17.69 %. Thus the projected population of the study for the year 2015 is around 37,950.

### Land Use Planning

Out of the total mining lease (ML) area of 528.262 hectares of South Block ML, the proposed land use will consist of mainly the mining area, OB dump, mineral storage, infrastructure, greenbelt, etc. The post project mining land use will be as per Table 5A-1.

**TABLE 5A-1- THE POST PROJECT MINING LAND USE**

Sl. No.	Proposed Land Use Category	Area (Hectares)
1	Mining	335.436
2	OB Dump	2.000
3	Mineral storage	2.000
4	Infrastructure (crushing, screening, repair shop, mine general office etc)	54.839
5	Road connectivity	20.000
6	Greenbelt	102.547
7	Effluent treatment plant	0.500
8	Safety zone	10.940
	<b>Total</b>	<b>528.262</b>

## 5 – Planning brief (cont'd)

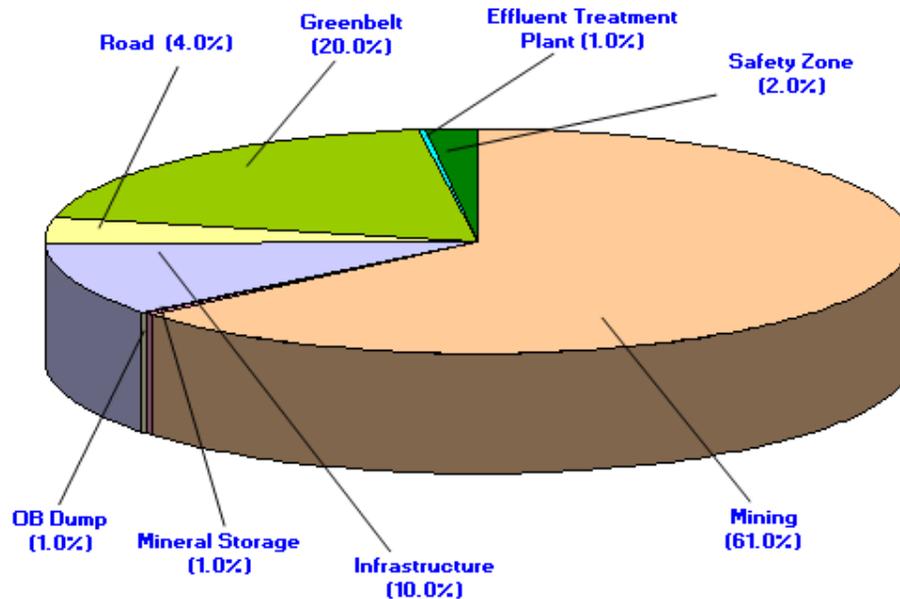
**FIG 5A-1 - LAND USE PLANNING OF ML AREA (528.262 HA)**

Fig. 5A-1 shows land use planning of ML area. It may be seen from the above figure that out of the core zone of 528.262 Ha, about 61.0% is the mining area, 20.0% is covered by greenbelt and plantation, infrastructure such as crushing, screening, repair shop, etc. occupies around 10.0% and balance is covered under OB dump, mineral storage, safety zone etc.

**Assessment of Infrastructure Demand (Physical and Social)**

- The local population emphasize upon strong environmental measures to be undertaken by the Project Proponent to combat environmental pollution, if any, for this proposed mining at South Block.
- The most common diseases in the area are malaria, diarrhea and fever. The primary health care centres in the study area are inadequate and under equipped.
- Approach road to peripheral villages need to be constructed/improved upon. Additionally, regular transportation and connectivity services have to be emphasized upon

5 – Planning brief (cont'd)

- The region in and around Panchpatmali hill is characterized by low density of population. The population was dependent mainly on agriculture earlier. With growth of industrial employment, agricultural sources of livelihood are reducing. In order to raise the employability quotient with regard to industrial work, the demand is that of development of vocational and technical training institutes in the study area with special emphasis on local youth
- The electricity supply needs to be emphasized upon. The electricity facilities reach remote villages. However, in the tribal settlement areas, the power distribution is irregular. Additionally, the tribal communities are also unable to adapt to electric household equipment due to their low income status.

## 6 – PROPOSED INFRASTRUCTURE

This Chapter gives an outline of the social infrastructure, principle types of pollution and highlights the proposed environmental pollution control measures in compliance with the prevailing Acts and Rules and its amendments thereafter.

### **Industrial Area**

The present total mining lease area of South Block of Panchpatmali is 528.262 Ha. The proposed mining activities will take place within this leasehold area. The total mining quantity of bauxite will be 3.15 MT, for which environmental clearance is already available with NALCO.

### **Residential Area**

The existing township at Damanjodi has approximately 3,000 dwelling units (DU). The present township is self sufficient in all respect with all services and amenities.

Additional dwelling units will be constructed in the existing township for the employees.

The basic needs of a township with respect to service facilities pertaining to water supply, electricity and telecom network; drainage and sewerage system will be suitably augmented.

### **Proposed Social Infrastructure**

- Along with strong environmental measures, NALCO will undertake use of water sprinklers to combat dust in the area for the proposed mining at South Block.

**6 – Proposed infrastructure (cont'd)**

- NALCO will undertake measures to strengthen the existing medical facilities and engage in further development of mobile health camps with special emphasis on preventive and promotive health care. Additionally, ambulance van for this mining project of South Block will be organized. Nalco envisages setting up better hospital facility to cater to the need of local community.
- Roads to all villages will be improved under peripheral development scheme. Additionally, jeeps and pick up vans will be provided for transport of supervisory staff to work stations and to facilitate inspection and supervision of work. Buses will be provided for transport of workers from mine colony to work sites.
- The project proponent aims to enhance the social infrastructure of the school set up and offer financial assistance in the area of education. The focus is on rural literacy and training of local girls and boys. A training centre will be set up inside the service centre compound to render vocational training to the persons working in the mine, in accordance with the Mines Vocational Training Rules, 1966.
- NALCO will emphasize on electricity supply and promote alternative sources of energy like installation of solar lights.
- Rest shelters at convenient locations at the mine head will be constructed.
- A central canteen will be located beside the administrative building to serve snacks and refreshments to the workmen, supervisory and office staff working in the administrative building and other areas. In addition, a canteen van will be provided to supply snacks to the workers and supervisory staff working in mine and the crushing plant.

**Connectivity**

The Panchpatmali bauxite deposit is located on Panchpatmali hills in Koraput district of Odisha. Koraput, the district Head Quarter, is situated at a distance of about 60 km via Damanjodi and Semiliguda. Public transport by bus is available to Koraput, Jeypore, the township of Sunabeda and many other major towns and cities of the state of Odisha. The nearest rail head is at

## 6 – Proposed infrastructure (cont'd)

Damanjodi, on the Rayagada-Koraput broad gauge rail section of East Coast Railways. The nearest airport and seaport is Visakhapatnam, about 200 km from the mine. Panchpatmali mine is connected with Damanjodi by mine approach road.

**Review of Pollution Sources**

The opencast mechanized mining involves ripping, drilling, and blasting, sizing of r.o.m minerals, overland conveyor transportation of sized r.o.m and handling of the same. It therefore, involves significant emission of fugitive dusts (FD) to the air environment. The sources of such fugitive dust emissions within the ML area are as under:

- i) Drilling and blasting operations.
- ii) Movement of dumpers on the haul roads.
- iii) Wind borne dust emissions from dumps and stockpiles.

Mineral sizing plant and conveyor transportation of the sized minerals are the sources of closed work zone FD emissions.

The mechanised opencast mining requires various types of mining machineries and equipment, which will generate noise when in operation. The work zone pollutions are due to dust, noise and heat.

Water pollution due to mining activities may be from discharge of mine water and occasional discharge of repair shop effluent.

***Air pollution control measures:*** For drilling and blasting operations in open areas, wet drilling will be preferred by water injection and controlled blasting will be done to minimise the FD (Fugitive Dust) emission in air.

## 6 – Proposed infrastructure (cont'd)

The air borne dust arising during movement of dumpers, dozers, trucks on haul roads will be suppressed by sprinkling water on the road surfaces and tyre washings of the trucks/dumpers etc at regular interval of time.

Mineral sizing plant, which will be housed in a separate building, will be provided with dry fog (DF) system for control of FD emission.

All the conveyors carrying the sized materials will be of covered type. The conveyor transfer points will be provided with DF system to minimize the air pollution. The sized products will be stored in a covered bin or silo with air tight discharge chute.

***Water pollution control measures:*** The rain water collected in the mining area would be diverted to sedimentation pits inside mined out area for settling of sediments. The water would percolate in to the ground thus recharging the ground water table.

Cleaning of mining machineries will generate some amount of waste water containing oil and dirt. The quantity generated will not be a significant one and the discharge will be intermittent. The oily waste water from the repair shop will be collected in a concrete basin with oil separation device. The oil free water will be reused for dust suppression. The waste water generated from canteen will be treated in a biological treatment unit and after that, the treated water will be re-used for dust suppression.

***Drinking and service water system:*** To meet the drinking water and sanitation requirement of plant personnel, filtered and chlorinated water from filtration unit will be pumped to the drinking water overhead storage tank by means of drinking water

## 6 – Proposed infrastructure (cont'd)

transfer pumps. The overhead storage tank will have the capacity of 40 cu m (one day storage capacity) and will be located in service centre facilities at an elevation of 25 m, where from the drinking water would be supplied to all consuming points.

**Solid Waste Management and Disposal**

**Overburden management:** It is estimated that average capacity for over burden removal will be approx. 0.4 MTPA. The overburden consists of top soil and ferruginous laterite. In the initial years of operation, the solid waste (OB) generated for development of mine faces shall be stacked in a designated place within ML area. The solid waste/OB materials shall be systematically used for back-filling of mined out area as generated from mining of bauxite ore. Later fresh raisings of overburden along with part of the material stacked on ground will be used directly for backfilling of the mined out areas. Top soil will be spread over the backfilled/reclaimed area for growing trees and vegetation.

**Work zone pollution control measures:** Mine will have various noise emitting activities/sources like drilling and blasting operations, rotary equipment, crushing, etc. Mobile diesel powered machineries like bulldozers, front-end loaders, etc will have noise proof operator's cabin. Providing silencers at the exhaust and control of diesel engine vibration will be essential for controlling the noise. The administrative control is maintained in suitable rosters of mine workers with the aim of not allowing any one to have noise exposure of 85 dB (A) for more than 8 hrs. Personnel working in high noise prone area will be provided with Personal Protective Equipment (PPE) like earmuffs and earplugs.

Blasting the rock bed for loosening causes blast induced ground vibration. Thus, it requires effective blast design and practices with the optimization of multitude of variables like

**6 – Proposed infrastructure (cont'd)**

borehole diameter, borehole depth, spacing burden, geology, etc so as to have desired result without affecting the residential structure and safety of the people.

**Mine Safety**

Mine safety is a statutory requirement for all the mines. Workers' safety will be of prime concern so as to avoid any injury or accident. Continuous updation of mine safety standards and practice will be followed to minimize the production loss.

Explosives and accessories will be stored in an explosive magazine and records will be maintained as per the rules made under Indian Explosives Act, 1884, and under the act and under the regulations, rules, byelaws and orders made thereunder. Explosive vans will be used for transportation of explosive and accessories to the blasting site. Explosive storage, transport and blasting operation will be carried out by authorized statutory personnel in accordance with the prevailing rules and regulations pertaining to the same.

**Power Requirement and Supply/Source**

The power requirement for this Mining Project at South Block of Panchpatmali Mine along with its source is described in Project Description (Chapter 2).

## **7- REHABILITATION AND RESETTLEMENT**

This mining project of Panchpatmali South Block to cater the additional requirement of bauxite for the Alumina Refinery does not entail displacement of any human settlement. Hence, there are no issues relating to Resettlement and Rehabilitation (R&R).

## **8 - IMPLEMENTATION SCHEDULE AND COST ESTIMATE**

This Chapter deals with implementation schedule and estimated capital cost of the Project.

### **IMPLEMENTATION SCHEDULE**

The preliminary overall implementation schedule for the project, indicating the time required to complete the major activities of engineering, procurement of equipment, construction, erection, test, trial run and commissioning of the various plant facilities along with external and internal facilities has been developed in the form of a bar chart presented in Appendix 8A-1. The schedule has been developed on the basis of the estimated quantum of work, expected delivery and installation period of plant and equipment and the need to commission the plant facilities in the shortest possible time. The schedule envisages a total project implementation period of 47 months from the date of 'Go-ahead'.

Project implementation period for various units from the 'Go-ahead' is given below:

### **PROJECT IMPLEMENTATION PERIOD**

<b>Unit</b>	<b>Months from 'Go-ahead'</b>
Mining facilities ..	44
Overland conveyor ..	47

It has been assumed that prior to commencement of the project, following activities will be completed by NALCO:

- i) Finalizing arrangements for obtaining the requisite finance as per the projections and matching with the implementation schedule
- ii) Obtaining relevant statutory clearances

## 8 – Implementation schedule and cost estimate (cont'd)

**COST ESTIMATE**

The capital cost has been estimated based on the quotations from various vendors for equipment/materials, data taken from the past similar projects at 2013-14 price level etc. The figures are tentative and may vary during actual implementation to some extent. A more pragmatic estimation can be worked out only after detailed engineering.

The capital cost estimates of the mine is presented under the following heads:

- Plant cost
- Pre-project activities
- Interest during construction (IDC)

**Plant Cost**

The plant cost comprises cost of land and site development, civil work and structural steelwork, plant and equipment and erection, design, engineering, consultancy services and administration during construction (DE & ADC) and provision for contingency are also included.

**Land and Land Development**

The item-wise break-up of the same is shown below:

<b>Land &amp; site development cost</b>	<b>Amount</b>
	<b>Rs. crore</b>
Exploration work for mining & survey work	7.4
Soil investigation	0.1
Pre-mining development cost	1.9
Road and drainage	69.1
Watch tower, gate house, paver block and barbed wire fencing	0.6
Horticulture, earthen raw water reservoir, land management and green belt development	58.3
<b>Total</b>	<b>137.4</b>

## 8 – Implementation schedule and cost estimate (cont'd)

**Civil and Structural Steelwork**

The total cost of civil and structural steelwork will be about 112.9 Crore for the mines as shown below:

<b>Item</b>	<b>Amount</b>
	<b>Rs. Crore</b>
Civil work	44.9
Structural work	68.0
<b>Total</b>	<b>112.9</b>

**Plant and Equipment**

The cost estimates for major plant and equipment are based on the indicative prices received for similar equipment from reputed suppliers. The cost estimates for the balance equipment are based on information available with Consulting Engineers. Charges for erection of equipment including foreign supervision of erection have also been considered at normative basis.

**Township**

This includes cost of developing separate townships (dwelling units) for the mine.

**Design, Engineering, Consultancy Services and Administration during Construction (DE & ADC)**

A provision of about Rs.36.7 crore has been kept at 4 per cent on supply price of equipment together with civil and structural to take care of expenses towards design, engineering, consultancy services and administration during construction for the mines.

## 8 – Implementation schedule and cost estimate (cont'd)

**Contingency**

A contingency provision has been kept to cover expenses towards any unforeseen item. This provision does not cover any exchange rate variation and escalation during the construction period.

Total plant cost including the above items are estimated at about Rs. 1062.3 Crore for mines and is summarized in Table 8A-1.

**TABLE 8A-1 - PLANT COST ESTIMATE**

Description	Amount Rs. Crore
Land & Site development	137.4
Civil and structural steelwork	112.8
Plant and equipment including erection	689.0
Township	35.8
Design, engineering, consultancy and ADC	36.7
Contingency	50.6
<b>Total plant cost</b>	<b>1062.3</b>

**Pre-project Activities**

The pre-project activities include cost for construction power and water and have been considered for mine.

**Interest during Construction**

Interest during construction is calculated based on the following assumptions:

- Debt-equity ratio of 2:1
- Phasing of expenditure as per implementation schedule.
- Equitable drawl of fund.

**Total Capital Cost**

The capital cost thus worked out on the above basis for all the facilities are presented in Table 8A-2 on the next page.

## 8 – Implementation schedule and cost estimate (cont'd)

**TABLE 8A-2 - CAPITAL COST ESTIMATE**

<b>Description</b>	<b>Amount</b>
	<b>Rs. Crore</b>
Plant cost	1,062.3
Pre-project activities	3.4
Interest during construction	141.4
<b>Total</b>	<b>1,207.1</b>

Mining lease has been granted by Government for captive consumption only and mined out bauxite from the South Block will be utilised to cater the additional bauxite requirement of NALCO's alumina refinery complex. For this reason, the proposed mining project is not a standalone profit centre. However, due to captive mining, overall profitability of the expansion project will be attractive. Proposed mining project will enhance the economic viability of refinery expansion project to be undertaken by NALCO as a part of its 3<sup>rd</sup> phase expansion.

## 9 – ANALYSIS OF PROPOSAL

### FINANCIAL AND SOCIAL BENEFITS

The main inhabitants of Koraput District are tribals, constituting 50.66 per cent of total population. The main Scheduled Tribes (ST's) are Bondas, Kondhs, Koyas, Gond, Gadabas etc.

The region in and around Panchpatmali area was characterized by low income and low employment opportunities. Consequently, facilities such as education, health, potable water, electric power and commercial opportunities were inadequate. Development in agriculture could not take place due to poor irrigation facilities and low knowledge of modern techniques. However, in the last 30 years the CSR activities of NALCO have facilitated direct and indirect means of livelihood. Subsequently, the purchasing power of people and the socio-economic status of the region have improved.

Additionally, NALCO is disseminating their peripheral development fund towards various projects like development of community hall, supply of electricity, provision of medical facilities, drinking water, etc in the neighboring tribal villages of Panchpatmali hill. NALCO is already certified under SA-8000 compliance.

The social benefits envisaged from this mining project are as follows:

- Improvement in the socio-economic status of the region by generation of direct and indirect employment opportunities (NALCO has a strong policy against child labour).

9 – Analysis of proposal (cont'd)

- Development of ancillary small and medium industries, trade and commercial establishments and local entrepreneurship
- Improved purchasing power and living standards
- Improved transport and communication facilities
- Improved medical and educational facilities
- Inflow of financial and material resources
- Additional revenue , royalty and taxes for the State
- Increased land prices and rents in the peripheral areas

NALCO under their peripheral community development fund undertake continued and intensive measures for the local population. They aim at continued social commitment towards the local community. The organization carries out their social benefit plan for:

- Promotion of education with special emphasis on young women.
- Eradication of poverty by promoting livelihood and income generating activities.
- Promotion of health and sanitation.
- Protection of environment, water and energy resources and sustainability.
- Building community infrastructure.
- Providing relief measures for redressal of calamities, disasters.
- Enhancing vocational skills.
- Reaching out to socially marginalized sections with special emphasis on differently-abled persons in the society.
- Promoting cultural activities of local community.

## 9 – Analysis of proposal (cont'd)

NALCO, to facilitate their social responsibility, operates on a defined agenda and undertakes a participatory and inclusive approach. They consistently exceed the stipulated guidelines and requirement of Department of Public Enterprises (DPE) with regard to the funds spent on the CSR activities. Additionally, their social commitment measures extend beyond the ten (10) kms radius of the study area. It takes a long time to notice appreciable changes in socio-economic set up of any community. Nevertheless, the project proponent has set the process of development in motion in the region with better infrastructural facilities.

With the proposed mining at the Panchpatmali South Block Mining Lease, the peripheral development fund will be enhanced and the development measures will be further augmented.

**FINAL RECOMMENDATION**

The Mining Plan of Panchpatmali bauxite mine (South Block) of 528.262 ha was approved by IBM vide letter No. 314(3)/2009-MCCM (CZ)/MP-35 dated 24.05.2010, with projection of mining activities beyond 2019. The revised mining plan was approved by 28<sup>th</sup> August'2015. The Mining Project of Panchpatmali South Block is envisaged to cater the additional requirement of 3.15 MTPA bauxite for the Alumina Refinery at Damanjodi. NALCO has also got the Environmental Clearance (EC) vide MOEF Letter No. J-11015/78/2010-IA-II (M) dated 28<sup>th</sup> February 2011 for the production of 3.15 MTPA bauxite from the Mining Lease (ML) area of South Block, which will be operative from 2019-20. The present proposal is for amendment of TOR issued by MoEF vide letter No. J-11015/350/2015-IA-II(M) dated 30/11/2015 (NALCO's previous proposal No. IA/OR/MIN/31161/2015) and the Mining Project of Panchpatmali South Block ML is envisaged to cater to the additional crushing and transportation requirement of 3.15 MTPA bauxite for the Alumina Refinery at Damanjodi and will require EC

## 9 – Analysis of proposal (cont'd)

from MoEFCC, 001, New Delhi. There is no enhancement of production capacity over the approved EC quantity of 3.15 MTPA. The earlier proposal for enhancement of bauxite production capacity from 3.15 MTPA to 3.655 MTPA, is dropped because of limitation with the existing equipment capacity to handle higher specific consumption (3.0 to 3.2 T/T) in the existing streams and the improvement in specific consumption of bauxite from 3.20 to 3.15 tonne per tonne of Alumina in 5<sup>th</sup> Stream