RECLAMATION AND REHABILITATION OF MINED OUT AREA AT PANCHPATMALI BAXITE MINE OF M/S NALCO - A CASE STUDY
BRIEF DETAILS OF THE MINE

- PANCHPATMALI BAUXITE MINE OF NALCO IS THE ASIA’S LARGEST BAUXITE MINE.

- A CAPTIVE BAUXITE MINE FOR SUPPLY OF BAUXITE ORE TO ALUMINA REFINERY OF NALCO.


- THE PRESENT PRODUCTION CAPACITY OF THE MINE IS 6.825 MIL TON PER YEAR.

- LOCATED OVER PANCHPATMALI HILL IN KORAPUT DISTRICT OF ODISHA.
North Block

**Panchpatmali Bauxite Deposit**

**NB-I:** Bxt Reserve **- 46.74 Mil Ton**
(Cut off +20% Al2O3, SiO2: -7%)

Present Working area

**NB-II:** Bxt Reserve **- 17.29 Mil Ton**
(Cut off +20% Al2O3, SiO2: -7%, as on 31.03.2016)

Back filled/ Reclaimed

Central Block

**SMCP**

**FLDC**

**CB Sec-I:** Exhausted

**CB Sec-II:** Bxt Reserve **- 63.31 Mil Ton**
(Cut off +20% Al2O3, SiO2: -7%)

**South Block:**
Bxt Reserve **- 82.05 Mil Ton**
(Cut off +20% Al2O3, SiO2: -7%)

- Total Bxt. Reserve: 317.72 Mn T
- Consumed: 107 Mn T (till 31st March 2016)
- Left Out reserves (mineble) after IBM Guideline: 210.72 MT (as on 31st March 2016)
<table>
<thead>
<tr>
<th>LEASE NAME</th>
<th>LEASE VALIDITY</th>
<th>TOTAL AREA (HA)</th>
<th>FOREST AREA (HA)</th>
<th>NON-FOREST AREA (HA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CENTRAL AND NORTH BLOCK</td>
<td>16-11-2032</td>
<td>1315.264</td>
<td>1294.283</td>
<td>20.981</td>
</tr>
<tr>
<td>SOUTH BLOCK</td>
<td>19-07-2029</td>
<td>528.262</td>
<td>189.552</td>
<td>338.71</td>
</tr>
<tr>
<td><strong>LOCATION</strong></td>
<td><strong>1100M above MSL TO 1266M above MSL, 300 M ABOVE SURROUNDING VALLEY AREA.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TEMPERATURE</strong></td>
<td>WINTER- (7°C TO 30°C), SUMMER UPTO 40°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AVERAGE YEARLY RAINFALL</strong></td>
<td>1600-1800 MM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>WIND SPEED</strong></td>
<td>15 KM/HOUR (AVG.), SW-NE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HUMIDITY</strong></td>
<td>40% TO 90%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PRE MINING VEGETATION</strong></td>
<td>GRASS &amp; HERBS (No Tree Growth)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LOCATION OF SENSITIVE ZONES LIKE RESERVE FORESTS, SANCTUARIES, ETC.</strong></td>
<td>NOT WITHIN 100KM RADIUS OF THE MINE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FEATURES OF PANCHPATMALI BAUXITE MINE

- FULLY MECHANIZED, OPEN CAST MINE (CAPTIVE USE)
- CAPACITY - 68.25 LAKH TPY OF BAUXITE ORE
- CERTIFIED UNDER ISO 9001, ISO 14001, OHSAS 18001 & SA 8000
KEY PARAMETERS

Top soil - 0 - 1 mtr.

OB thickness - 2 - 4 mts.

Bxt. thickness - 14 mtr. Avg.

CROSS-SECTIONAL VIEW OF PANCHAPATMALI BAUXITE DEPOSIT
PROCESS OF MINING AT PANCHPATMALI BAUXITE MINE

- **OVERBURDEN (TOP SOIL & ALUMINOUS LATERITE) STRIPPING**

- **BAUXITE EXCAVATION IN TWO PHASES**  
  (TOP BAUXITE & BOTTOM BAUXITE)

- **SIZE REDUCTION BY PRIMARY CRUSHERS FROM BAUXITE LUMPS OF MAX 1 M X 1M X 1M SIZE TO -150 MM SIZE AND IN-PIT TRANSPORTATION THROUGH A BELT CONVEYOR**

- **TRANSPORTATION OF CRUSHED BAUXITE (MAX. LUMP SIZE -150 MM) TO ALUMINA REFINERY PLANT THROUGH CABLE BELT CONVEYOR SYSTEM**

- **RECLAMATION & REHABILITATION OF THE MINED OUT AREA BY USE OF LATERITIC OVERBURDEN AND TOP SOIL. FOLLOWED BY PLANTATION**
Method of Mining: Schematic View of Trench Mining
TOP BAUXITE MINING
RIPPING & DOZING IN TOP BAUXITE
BOTTOM BAUXITE MINING BY BACKHOE EXCAVATOR
MINED OUT AREA
CRUSHING AND CONVEYING SYSTEM

TWIN 900 TPH PRIMERY CRUSHERS

One 900 TPH semi-mobile crusher with 4.5 km long conveyor to main crusher

Fully covered 14.6 km long single flight cable belt conveyor from mine to Alumina Refinery plant
THE CONCURRENT MINED OUT AREA REHABILITATION PLAN HAS GOT THE FOLLOWING FIVE COMPONENTS-

• BACK FILLING OF MINED OUT AREA WITH DUMPING OF LATERTIC OVER BURDEN
• DOZING & LEVELLING OF DUMPS TO FORM BENCHES (1M TO 4M) AND TERRACES.
• DUMPING AND SPREADING OF TOP SOIL IN THICKNESS OF 0.3Mtr.
• AFFORESTATION WITH SUITABLE PLANT SPECIES.
• MAINTENANCE OF THE PLANTATION (WITH SOIL WORKING & APPLICATION OF MANURE, FERTILIZER, INSECTICIDES & PESTICIDES) FOR THREE YEARS INCLUSIVE OF YEAR OF PLANTATION.
• WATCH & WARD COVERAGE FOR ENTIRE PLANTATION.
THE AFFORESTATION PLAN IS PREPARED KEEPING IN VIEW THE FOLLOWING OBJECTIVES

- TO PROVIDE A GREEN BELT AROUND THE PERIPHERY OF THE MINING AREA TO COMBAT THE DISPERSAL OF DUST & NOISE IN THE ADJOINING AREAS.

- PROTECT THE EROSION OF THE SOIL.

- CONSERVE MOISTURE FOR INCREASING GROUND WATER RECHARGING.

- RESTORE AESTHETIC BEAUTY OF THE LOCALITY.
BACK FILLING OF MINED OUT AREA WITH LATERITIC OVER BURDEN.
SPREADING OF TOP SOIL
SPECIES SELECTED FULFIL THE FOLLOWING SPECIFIC REQUIREMENTS OF THE AREAS:

1. AVAILABILITY OF SEED MATERIAL.

2. CAPACITY TO ENDURE WATER STRESS AND CLIMATIC EXTREMES

3. ADAPTABILITY & RATE OF GROWTH.

4. CANOPY FOR SHADES AND FRUITS.
PLANTATION SUPPORT GIVEN BY A HIGH ALTITUDE NURSERY:

AREA - 3 ACRES

CAPACITY - 2,00,000 SEEDLINGS PER ANNUM
PITTING PRIOR TO PLANTATION

PIT SIZE - 30CMX 30 CM X60CM
SPACING - 2.5 M
DENSTY - 2500 PITS PER HA
PLANTATION CARRIED OUT BY PANCHPATMALI BAUXITE MINE

A) AREA

- PLANTATION IN BACK FILLED AREA
- PLANTATION OVER PERIPHERAL BARRIER
- PLANTATION OVER VACANT SPACES IN HILL SLOPES
- PLANTATION IN CONVEYOR CORRIDOR & ALONG MINE ACCESS ROAD.

B) DOMINATING PLANT SPECIES

- SILVER OAK
- ACACIA
- KARANJ
- PINE
- BAMBOO
- ROSE APPLE
- JAMUN
## IMPLEMENTATION OF PROGRESSIVE MINE CLOSURE PLAN (STATUS AS ON 30.11.2016)

<table>
<thead>
<tr>
<th>LEASE AREA (HA)</th>
<th>OPENED UP AREA (HA)</th>
<th>RECLAIMED AND REHABILITATED AREA (HA)</th>
<th>AREA UNDER ACTIVE MINING INCLUSIVE OF PERMANENT HAUL ROADS (HA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1315.264</td>
<td>472.77</td>
<td>295.64</td>
<td>177.13</td>
</tr>
</tbody>
</table>
PLANTATION IN BACKFILLED AREA WITH THE PERMANENT HAUL ROAD
PINE PLANTATION IN RECLAIMED AREA
JAMUN PLANTATION IN RECLAIMED AREA
AVENUE PLANTATION ALONG MINE ACCESS ROAD
SILVER OAK PLANTATION ON PERIPHERAL BARRIER
ACACIA PLANTATION OVER VACANT SPACES ON HILL SLOPES
DISTRIBUTION OF SEEDLINGS TO VILLAGERS TO CREATE GREEN BELT AROUND THE MINE

(11,100 nos distributed during 2016-17)
LANDSCAPING SHOWING ADMN.BUILDING OF PANCHPATMALI BAUXITE MINE IN THE BACKGROUND
DETAILS OF PLANTATION CARRIED OUT BY PANCHPATMALI BAUXTITE MINE SINCE INCEPTION

(STATUS AS ON 30.11.2016)

<table>
<thead>
<tr>
<th>TOTAL AREA COVERED (IN BACK FILLED AREA, PERIPHERAL BARRIER AND HILL SLOPES)</th>
<th>TOTAL PLANTATION IN MINED OUT AREA</th>
<th>TOTAL PLANTATION OUTSIDE MINING AREA</th>
<th>TOTAL PLANTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1088.94 HA</td>
<td>11,22,709 NOS</td>
<td>21,82,745 NOS</td>
<td>33,05,454 NOS</td>
</tr>
</tbody>
</table>

- OVERALL SURVIVABILITY- APPX. 70%
- GAP FILLING IS USUALLY CARRIED OUT TO IMPROVE THE DENSITY OF PLANTS
COST OF PLANTATION PER TON OF BAUXITE PRODUCTION DEPENDS ON THE FOLLOWING FACTORS:

- BAUXITE PRODUCTION ACHieved DURING THE FINANCIAL YEAR
- OPERATING AND MAINTENANCE COST OF HEAVY EARTH MOVING EQUIPMENTS
- THICKNESS OF THE DEPOSIT AND AREA AVAILABLE FOR LAND RECLAMATION AND PLANTATION

THE COST OF PLANTATION VARIES BETWEEN RS10 TO RS15 PER TON OF BAUXITE PRODUCED.
ROSE APPLE PLANTATION

JAMUN PLANTATION
GRASS TURFING ON SLOPES TO PREVENT SOIL EROSION
SUSTAINING ECOSYSTEM BY PROVISION OF WATER HARVESTING STRUCTURES

CONSTRUCTION OF PONDS AND SEDIMENTATION BASIN WITHIN MINE AREA
LAND BEFORE AND AFTER MINING

BEFORE

AFTER
AWARDS FOR ENVIRONMENT PROTECTION & PLANTATION

- **INDIRA PRIYADARSHINI VRKSHAMITRA AWARD BY MOEF&CC – 1994**

- **POLLUTION CONTROL EXCELLENCE AWARD BY SPCB, ODISHA-1998**

- **GEM GRANITE ENVIRONMENT AWARD BY FIMI-2013**

- **SITARAM RUNGTA SOCIAL AWARENESS AWARD BY FIMI-2014**

- **POLLUTION CONTROL EXCELLENCE AWARD BY SPCB, ODISHA-2015**
THANK YOU
## EXPENDITURE INCURRED TOWARDS LAND RECLAMATION & PLANTATION IN LAST 3 YEARS

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Activity</th>
<th>2013-14</th>
<th>2014-15</th>
<th>2015-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Backfilling and land reclamation (Rs)</td>
<td><strong>10,53,57,667</strong></td>
<td><strong>8,12,73,516</strong></td>
<td><strong>5,21,25,970</strong></td>
</tr>
<tr>
<td>2.</td>
<td>Plantation and Horticulture (Rs)</td>
<td><strong>57,48,011</strong></td>
<td><strong>56,73,359</strong></td>
<td><strong>66,90,762</strong></td>
</tr>
<tr>
<td>3.</td>
<td>Production (MT)</td>
<td><strong>62,92,677</strong></td>
<td><strong>57,39,120</strong></td>
<td><strong>63,40,142</strong></td>
</tr>
<tr>
<td>4.</td>
<td>Expenses (Rs) / Tonne of bauxite produced</td>
<td><strong>17.66</strong></td>
<td><strong>15.15</strong></td>
<td><strong>9.28</strong></td>
</tr>
</tbody>
</table>