

नालको  **NALCO**  
**NATIONAL ALUMINIUM COMPANY LIMITED**

**MINING PLAN**  
**FOR**  
**UTKAL-E OPENCAST PROJECT**  
**(2.00 MTY)**

**Talcher Coalfield**  
Dist.: Angul, Orissa

**Volume - I (Text)**

**JUNE, 2006**

**RQP : UDAYA KUMAR MOHANTY, NO. 13016/8/2004 CA Dtd.1.9.2004**

**Under Rule 22(C) of Mineral Concession Rules 1960**

**CONSULTANTS**

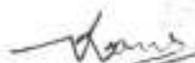
**CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED**

*(A Subsidiary of Coal India Ltd.)*

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Ministry of Coal  
Govt. of India  
New Delhi

  
**Udaya Kumar Mohanty**  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 13016/8/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC & M. Govt. of India

**REVISED MINING PLAN  
FOR  
UTKAL-E OCP, 2.00 MTY**

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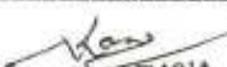
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 ज. राणा / J. RANA  
 स. स. विभा. / Under Secretary  
 को. - बंगलूर / Ministry of Coal  
 सरकार / Govt. of India

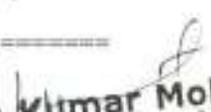
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**A. B. BANA**  
 Under Secretary  
 Ministry of Coal  
 Govt. of India  
 New Delhi

  
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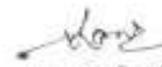
Plans  
 V.S. DANA  
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 Ministry of Coal  
 Govt. of India  
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## ANNEXURE

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### GENERAL INFORMATION

- 1 NAME AND ADDRESS OF THE APPLICANT : NATIONAL ALUMINIUM COMPANY LIMITED (NALCO)  
NALCO BHAWAN,  
P/O, NAYAPALLI,  
BHUBANESWAR-751013  
(ORISSA) (ODISHA)
- 2 STATUS OF THE APPLICANT : COMPANY REGISTERED UNDER COMPANIES ACT
- 3 MINERAL WHICH THE APPLICANT INTENDS TO MINE : Coal
- 4 NAME, ADDRESS OF PERSON WHO PREPARED MINING PLAN : SRI UDAYA KUMAR MOHANTY  
No.13016/8/2004 CA, DTD.1.9.2004,
- 5 NAME AND ADDRESS OF PROSPECTING AGENCY : Central Mine Planning & Design Institute Limited,  
Regional Institute - VI,  
At & PO : Jayant,  
Dist.: Sindhi (MP),  
PIN - 486890.

*[Handwritten signature]*  
 Director  
 National Aluminium Company Limited  
 Bhawan, Nayapalli  
 Bhubaneswar, Orissa

*[Handwritten signature]*  
**Udaya Kumar Mohanty**  
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No. 13016/8/2004-CA  
 Government of India  
 Ministry of Coal & Mines  
 Department of Coal

New Delhi, dated the 1<sup>st</sup> September, 2004.

To

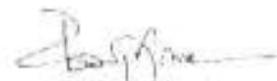
Shri Udaya Kumar Mohanty,  
 1903 Ratnakar Bagh-2,  
 Tankapani Road,  
 Bhubaneswar.

Subject: Grant of recognition to Shri U.K. Mohanty as competent person to prepare mining plan.

Sir,

I am directed to refer to your letter No. CMPDI/R1-VII/RD/3285 dated 05.01.2004 on the subject mentioned above and to convey the grant of recognition of the Central Government under Rule 22C of Mineral Concession Rules, 1960 in favour of Shri Uday Kumar Mohanty, son of shri Jagadananda Mohanty, resident of 1903, Ratnakar Bagh-2, Tankapani Road, Bhubaneswar, as competent person to prepare mining plan for any coal/lignite block for a period of 10 (ten) years from the date of issue of this letter.

Yours faithfully,

  
 (S.K. Kakkar)

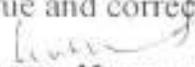
Under Secretary to the Government of India

  
 Mans  
 Secretary  
 Ministry of Coal  
 Government of India  
 New Delhi

Udaya Kumar Mohanty  
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 Vide letter No. 13016/8/2004 CA,  
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## CERTIFICATE

1. Certified that the provisions of Mineral Conservation and Development Rules, 1988 and MCR, 1960 have been observed in the preparation of "Mining Plan for Utkal-E Opencast Project, of NALCO" and wherever specific permissions are required, the applicant will approach the concerned authorities.
2. Certified that provisions of Mines Act, 1952 and of the Rules and Regulations made their under have been observed in the preparation of this Mining Plan and that wherever specific permission is required the applicant will approach Director General of Mines Safety in the matter.
3. Certified further that the information furnished in this Mining Plan is true and correct to the best of my knowledge.

  
**Udaya Kumar Mohanty**  
Recognised Qualified Person  
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Vide letter No. 13016/8/2004 CA,  
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MOC & M. Govt. of India

UDAYA KUMAR MOHANTY  
(RQP No.13016/8/2004 CA dt.1.9.2004)

Place: Bhubaneswar

Date:

  
Secretary  
Ministry of Coal  
Govt. of India  
New Delhi

  
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**REVISED MINING PLAN  
FOR  
UTKAL-E OCP (2.00 MTY)**

**EXECUTIVE SUMMARY**

## 1.0

**Introduction**

The National Aluminium Company (NALCO) incorporated in 1981 is one of the country's largest aluminium production facilities consisting of Bauxite Mines, Alumina Refinery, Aluminium smelter and captive power plant, all located in the state of Orissa. The port facility for import and export is at Vizag Port Trust area, Vishakapatnam, Andhra Pradesh. The corporate headquarters is located at Bhubaneswar

A major expansion programme (1<sup>st</sup> phase) was started in 1997 and the same has already been completed for Bauxite Mines and Alumina Refinery by March,2002 while Aluminium Smelter expansion has been completed in 2003.

The capacity of various facilities after phase-1 expansion are given in table-1 :

Table-1

Sl. No.	Unit	Capacity
1	Bauxite Mines	4.8 Mty
2	Alumina Refinery-3streams	1.575 Mty
3	Aluminium Smelter-3 pot lines	0.345 Mty
4	Captive Power Plant-120MWx8	960 MW
5	Port facility	0.912 Mty

**Phase-2 Expansion**

Considering the growth in demand for primary aluminium, NALCO has taken up the further expansion of various facilities under phase-2. The additional capacities envisaged under 2<sup>nd</sup> phase are as given below:

  
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### Communication

The Utkal-E block is well approachable from village Rajjharan located towards east at a distance of about 3 km on Angul-Chhendipada state highway. Jarpada Tahsil HQ is around 10km south-west of the block and approachable by unmetalled road. The district HQ Angul is about 26 km from the block towards south-east on National Highway No.42 i.e. (Bhubaneswar-Sambalpur) and is connected with all weather metalled road. Nearest rail head is Angul at a distance of about 26 km on Sambalpur-Talcher-Bhubaneswar rail line of East Coast Railway. The block is well connected with State capital Bhubaneswar which is around 170 km from the block.

### Physiography and Drainage

The Utkal-E block exhibits a gentle undulating topography with general slope towards north. The minimum & maximum elevations above mean sea level of the block are 140m (near borehole CSUE-009) on the north and 185m (near borehole CMTU-94) on the south respectively. Surface soil is generally sandy containing quartz pebbles and boulders. Southern part of the block is represented mainly by rough, rigid and hilly terrain and is under forest cover whereas central and northern parts are being utilized for agricultural purposes. Patches of forest and open shrubs also occur along seasonal nala & Singadha jhor.

Drainage of the block is mainly controlled by easterly flowing Singhadha jhor which forms the northern boundary of the block and maintains the base flow even during the dry summer. Gundijeri nala and few other seasonal nalas traversing the area drain into Singadha jhor which ultimately meets the Brahmani River towards north-east of the area. There are only two ponds in the block area and mainly used for domestic & irrigation purposes.

### Climate

Area experiences warm & humid tropical to sub-tropical climate. Temperatures ranges from 6.7°C (during winter) to 46.7°C (during summer season). Annual

Job No.:780004

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 V. S. IRANA  
 Joint Secretary  
 Ministry of Coal  
 Govt. of India  
 New Delhi

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rainfall varies from 932mm to 1588mm (average being 1270mm) Humidity varies from 25% to 88%. Annual mean wind speed is 3.24 km/hour. Wind direction is mainly east during pre-monsoon season and during post-monsoon period it changes towards north-west and north-east.

### 3.0 Marketing and Justification

Government of India allotted Utkal-E block to M/s NALCO to meet the future requirements of power to their CPP under 2<sup>nd</sup> phase of expansion at Angul, Orissa.

#### Demand and Availability

Aluminium smelter plant is located at Angul in Angul district of Orissa. The captive power plant with an installed capacity of 960MW is also located at Angul, close to Talcher coalfield. The present demand of about 5 Mty is being met from Bharatpur opencast mine of Mahanadi Coalfields Limited.

The additional demand for 2 units of 120MW is projected as about 2 Mty and the mine is also being developed with production capacity of 2 Mty to meet this entire requirement. Utkal-E block has enough reserves to produce the coal at this capacity for about 32 years.

#### Demand and Production

Under the phase-2 expansion scheme, 9<sup>th</sup> unit of 120 MW is scheduled to be commissioned in May 2008 while 10<sup>th</sup> unit is scheduled to be commissioned in December, 2008.

Based on the above schedule of commissioning of generation units, following coal production schedule is proposed and given in table-2:

Table-2

Year	Production
2007-2008	NIL
2008-2009	1.32 Mty
2009-2010	2.00 Mty

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of lower split sections are undeveloped in the block. Seam-XI though well developed in its area of occurrence, is of very poor quality and mostly falls under ungraded category. Seam-IX is the most potential seam contributing about 44% of total net geological reserves. Characteristics of individual coal seams and their quality are explained in detail in Chapter-IV.

Details of seam wise effective thickness and quality are given below in table-3.

Table – 3

Coal Seams/ Parting	Thickness (m)		Depth of occurrence (roof)		Proximate analysis for 1 <sub>00</sub> samples on 60% RFI & 40° C				Gross CV K.cal/kg	UHV K.cal/kg	Grade on IITV
	Stratigraphic	Effective	From(m)	To(m)	M%	A%	VAP%	UVM%			
XI	1.15-9.56	1.15-6.89	18.52	65.28	5.9-7.3	43.3-54.7	21.8-25.2	46.1-48.4	2425	510-1917	UG-G
Parting	7.15-11.87										
X	0.40-3.40	0.40-3.40	15.05	82.60	5.5-7.3	41.4-53.9	21.6-25.8	37.4-48.8	2500	703-2304	UG-G
Parting	30.37-53.50										
IX	25.19-34.52	19.30-32.22	18.12	139.50	5.0-7.3	38.7-49.2	24.8	45.8-46.6	4350	1310-2552	G-F
Parting	0.28-4.70										
VIII Top	1.32-6.53	1.32-5.90	19.30	171.45	6.0-9.1	19.5-46.1	24.0-32.2	42.4-45.9	3580-5330	1696-4967	G-C
Parting	0.50-15.85										
VIII Bot	0.00-3.35	0.00-3.35	17.86	178.40	5.0-8.7	30.1-56.4	22.6-29.0	43.4-47.2	3630-4370	427-3601	UG-F
Parting	2.72-10.61										
VIII	0.40-4.95	0.40-4.95	12.05	184.60	5.6-10.0	23.1-47.8	23.2-32.2	36.9-51.3	3015-4870	1503-4760	UG-D
Parting	3.02-6.60										
VIA	0.00-2.10	0.00-2.10	20.70	192.57	3.2-6.0	45.7-55.5	20.0-23.4	36.5-44.5	2510-3270	525-1765	UG-G
Parting	9.15-20.45										
VII	0.00-0.96	0.00-0.96	111.80	208.80	4.6	53.0	21.0	42.3	N.A.	951	UG
Parting	5.80-19.70										
VI	0.00-4.84	0.00-4.84	12.15	219.50	4.5-6.9	37.7-51.5	20.6-34.1	39.9-68.1	2960-3940	1172-2745	UG-F
Parting	1.79-6.65										
VA	0.00-2.48	0.00-2.48	16.90	225.83	4.6-6.9	38.4-53.9	21.0-31.2	37.0-53.3	2000-3800	827-2738	UG-F
Parting	1.71-7.16										
IVH	0.00-3.64	0.00-3.64	27.70	231.15	4.3-5.9	43.1-56.1	21.5-26.6	40.9-46.8	3310-3640	565-2262	UG-G
Parting	3.50-11.91										
III Top	0.00-4.90	0.00-4.90	17.46	239.00	3.7-7.1	33.7-52.1	20.2-29.6	37.9-47.0	2975-4010	1020-3325	UG-F
Parting	0.78-8.19										
III Bot	0.00-5.30	0.00-5.30	25.87	243.90	4.2-6.8	33.9-49.1	20.5-26.4	36.0-45.6	3150-4110	1434-3283	G-F
Parting	0.65-19.03										
IIID	0.00-10.90	0.00-10.90	29.41	251.00	4.7-7.6	27.6-50.8	20.8-28.3	35.9-46.8	2980-4160	1275-4042	UG-F
Parting	0.40-8.65										
IIIA Top	0.00-2.05	0.00-2.05	37.50	262.30	4.6-7.5	29.0-58.4	18.7-27.5	37.0-46.8	2150-4260	178-3863	UG-E
Parting	0.80-7.02										
IIIA Bot	0.00-4.60	0.00-3.15	19.35	266.00	4.7-7.0	26.4-46.0	23.7-31.2	35.0-44.9	3180-4940	1903-4291	G-D
Parting	0.40-12.40										
II	0.00-3.15	0.00-3.15	32.00	271.20	3.6-6.4	33.7-52.8	22.6-29.2	43.0-46.6	3290-4220	1117-3360	UG-D
Parting	26.25-42.23										
IC	0.00-0.70	0.00-0.70	67.10	300.45	4.9	46.6	24.8	45.0	3400	1793	G

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श्री एस. रामा/ S. RAMA  
 अख्य सचिव/Under Secretary  
 कोयला विभाग Ministry of Coal  
 संसद भवन East of India  
 नई दिल्ली New Delhi

Coal Seam/ Parting	Thickness (m)		Depth of occurrence (roof)		Proximate analysis for 100 samples on 60% RH & 40° C				Gross CV K.cal/kg	UHV K.cal/kg	Grade on UHV
	Stratigraphic	Effective	From(m)	To(m)	M%	A%	VM%	UVM%			
Parting	3.36-18.72										
IIB	0.00-3.22	0.00-3.22	80.85	305.00	3.5-6.6	32.9-59.1	19.2-30.0	41.3-55.8	2280-4630	261-3725	UG-I
Parting	0.56-17.14										
IIA	0.00-1.46	0.00-1.46	95.63	306.60	4.2-7.8	27.0-50.9	22.0-34.3	37.5-50.6	3550-3810	1296-4098	UG-E

Details of seam-wise, grade-wise net geological reserve are given in the table-4 below. Seams IIC and VIB have not been considered in Geological Report. In Mining Plan, "Ungraded Coal" has not been considered for mining purpose.

Table - 4

Seam-wise and grade-wise coal reserves, Utkal-E block, Talcher Coalfield

Coal seam	Net proved reserves in Mt.						Ungraded
	Grade C	Grade D	Grade E	Grade F	Grade G	Total	
XI					0.3206	0.3206	4.2566
X				0.0143	0.6696	0.6839	1.4812
IX				1.3948	48.6369	50.0317	
VIII Top	0.0010	0.0776	0.4332	4.3129	3.8936	8.7183	
VIII Bottom			0.0462	1.0049	1.3172	2.3683	0.2362
VIIIB		0.2614	1.0575	5.3242	1.2342	7.8773	
VIIA				0.00	0.1023	0.1023	0.6615
VII				0.0143	0.5942	0.6085	0.3705
VA			0.0111	0.7651	1.4953	2.2715	0.0434
IVB				0.00	0.6079	0.6079	0.8520
IIIE Top			0.0005	0.4629	5.9037	6.3671	0.8395
IIIE Bottom			0.0661	2.6940	6.9604	9.7205	
IIID			0.9316	4.3874	7.7641	13.0831	0.1506
IIIA Top			0.1652	1.1139	0.6317	1.9108	0.1202
IIIA Bottom		0.0463	1.3023	3.0767	0.2767	4.702	
IIIE			0.0338	0.3982	0.6114	1.0434	0.0184
IIB			0.0115	0.4607	1.8857	2.3579	0.0599
IIA				0.1028	0.5151	0.6179	0.0016
Total	0.0010	0.3853	4.0590	25.5270	83.4205	113.3928	9.0616
% of total reserves	-	0.32	3.31	20.84	68.11		7.42

Seams IIA, IIB & IIE are also not quarryable. Net proved reserve excluding these seams is 109.3736 Mt.

## 5.0

## Mining Technology

Area within block boundary contains 15 workable seam sections, from youngest seam XI to oldest seam III-A Bottom. Seams II-A, II-B and II-E are not developed within quarry area and hence not considered. General dip of seams is towards north, with seams incropping in the south. General topography is undulating, sloping towards north with many small ravines which finally drain

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to Singhada Jhor by two main nallas. The area is traversed by two minor faults in east-central part with maximum throw of 10 m. The dip is varying from 5-6°.

Singhada Jhor forms northern limit of Utkal-E block. HFL was not readily available. HFL has been determined by survey from road bridge about 1.5 km downstream. Embankment in the south bank along northern limit of the block has been provided so as to have level 1.5 m above estimated HFL.

Durgapur reserve forest occurs along the entire width of block on the south. There are patches of village forest all over the block and a village named Gopiballpur is situated at north central part.

An area from VIII Top incrop to VII B incrop included in the quarry has high stripping ratio, but so included keeping conservation in view.

#### Mine Boundaries

##### Mine Floor:

Floor of **seam IIIA Bottom** has generally been considered as the mine floor. However, in the southern part where the seam is less than 1 m thick, **seam III D** has been taken as mine floor.

##### Surface Boundaries:

**North:** Quarry surface boundary is drawn after provision of embankment, 5 m away from southern bank of Singhada Jhor and 5 m safety width from toe of the embankment. Thus the width of barrier on surface from Singhada Jhor varies from 18.15 m to 28.43 m.

**East:** Quarry surface boundary is 15 m away from the block boundary to accommodate service road, power line and fencing.

**South:** Quarry surface boundary is surface projection of quarry slope to fully excavate seam VII-B and extending down to seam III-D.

**West:** About 30m barrier is kept to accommodate nala diversion, statutory barrier & safety distance.

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### Mineable Reserves

Within the mine boundaries detailed in the previous para, the mineable coal is estimated as 67.49 Mt with corresponding overburden of 205.96 Mcum. The overall stripping ratio works out to 3.05 cum/t. Mine life works out to 36 years at the target capacity of 2.0 Mty with build-up and tapering of production in initial and closing years of mining activity.

In view of multi seam deposit and coal quality, mine depth, opencast mining is envisaged. <sup>Surface mining</sup> Shovel-dumper system which offers great flexibility is suggested.

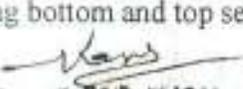
The Geo-mining characteristics are given in table-5.

**Table - 5**  
**Geo-mining characteristics**

Sl. No.	Particulars	Unit	Value
1.	Quarry floor area	ha	110.59
2.	Quarry surface area	ha	211.18
3.	Mineable reserve	Mt	67.49
4.	Overburden	Mcum	205.96
5.	Stripping ratio	cum/t	3.05
6.	No. of seams/sections*	No.	15
7.	Capacity	Mty	2
8.	Life (including construction)	Years	36
9.	Average seam gradient	degrees	5.86
10.	Strike length (along floor)		
	Maximum	m	875
	Minimum	m	792
11.	Strike length (along surface)		
	Maximum	m	1399
	Minimum	m	1220
12.	Quarry depth		
	Maximum	m	227.50
	Minimum	m	99.50
13.	Quarry perimeter	m	6458
14.	Dip-rise length		
	Along floor	m	1275
	Along surface	m	1750

\* including bottom and top sections of seams.

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## Requirement of HEMM

Table-7

## STATEMENT SHOWING THE REQUIREMENT OF HEMM WITH PHASING

SL. NO.	EQUIPMENT NAME	SIZE/ SPECIFICATIONS	TOTAL REQUIREMENT	YEAR WISE PHASING				
				Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
<b>A:</b>	<b><u>OVERBURDEN</u></b>		<b>NO.</b>	<b>NO.</b>	<b>NO.</b>	<b>NO.</b>	<b>NO.</b>	<b>NO.</b>
1	HYDRAULIC SHOVEL	6-6.5 cum	4	1	1	1	1	
2	REAR DUMPER	50 T	44	7	11	11	13	2
3	RBH DRILL	150-170 mm	5	1	3	1		
4	DOZER	410 HP	4	2	2			
5	RIPPER		2	1		1		
<b>B:</b>	<b><u>COAL</u></b>							
1	HYDRAULIC SHOVEL	6-6.5 cum	1		1			
2	REAR DUMPER (COAL BODY)	50 T	7		4	2	1	
3	RBH DRILL	150-170 mm	1		1			
4	WHEEL DOZER	300 HP	2		1		1	
<b>C:</b>	<b><u>COMMON</u></b>							
1	HYDRAULIC BACKHOE	0.9-1.2 cum	1	1				
2	HYDRAULIC MOBILE CRANE	20 T	1	1				
3	SERVICE CRANE	8 T	1	1				
4	FRONT END LOADER	3.5cum	1		1			
5	GRADER	280 HP	1	1				
6	WATER SPRINKLER	28 KL	2	1	1			
7	MAINTENANCE VAN		1	1				

6.0

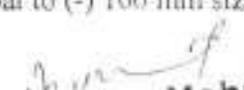
**Coal Handling plant**

The coal handling plant is planned to handle 2.00 Mtpy and shall have the following facilities (Plate ENG-I):

- 2 nos. of receiving pits to receive ROM coal brought by dumpers envisaged.
- 1 no. rock breaker to break coal/stone over (+) 1200 mm size.
- 2 nos. of slow moving belt conveyors to remove big lumps of shale and stone pieces by a trolley mounted grab running over a monorail across the above conveyors.
- 2 nos. of 2 stage 4 roll crushers to reduce size of coal to (-) 100 mm size.

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- The coal crushed to (-) 100 mm size will be fed to 2 nos. of vibrating screen to separate coal into (-) 75 and (+) 75 mm fractions.
- Manual picking of shale and stone pieces shall be carried on (+)75 mm size of coal.
- Both (-) 75 and (+) 75 mm size coal shall be elevated and stored in a 6000t over ground coal storage bunker.
- Coal from the over ground coal storage bunker shall be reclaimed by vibro feeders and shall be fed into the out bye coal transport system.
- Either pre-weigh hopper or volumetric system of loading shall be provided if rail transport from the mine is envisaged.
- Other facilities like dust control, industrial and drinking water supply, fire fighting and plant cleaning, tramp iron and metal detector cum removers, coal sampler etc are also envisaged.
- Rejects from screening and picking plant shall be carried and stored in a reject hopper for further disposal by tipping trucks.
- Shunt-back system of railway has been proposed along the eastern block boundary. This arrangement will minimize requirement of land in Durgapur Reserve Forest.

7.0

#### Power-supply, Automation and Telecommunication

The project will receive power at 33 kV from CESCO through double circuit overhead line. The 33 kV power shall be tapped at a suitable point approved by CESCO near the project from the 33 kV CESCO Jharpada-Chhendipada overhead line. The above 33 kV overhead line is passing near the project. The proposed 33/6.6 kV Substation shall be constructed near the south eastern side of mine entry.

Taking demand and diversity factors into account, the maximum demand has been estimated as 6420 kVA with a power factor of 0.95.

It is proposed to have one main sub-station for the project. The main sub-station is proposed to be installed near the mine entry for efficient and reliable power distribution and control. Three nos. of 3150 kVA, 33/6.6kV transformers

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 33/6.6 kV Substation  
 33/6.6 kV Transformer  
 33/6.6 kV Transformer  
 33/6.6 kV Transformer

will be installed in this substation. This substation will cater to the need of the entire project viz. CHP, workshop, colony, quarry lighting, quarry equipment, pumping etc.

Adequate provisions for protective measures, illumination, internal & external communications and automation have been made.

#### 8.0 Mine Facilities and services

Following facilities and services would be provided.

- Workshop.
- Project store.
- Appropriate mine drainage system.
- Service Buildings.
- Residential and welfare buildings.
- Various types of haul roads within and outside quarry.
- Water supply to industrial and residential areas.
- Effluent treatment plants for domestic and industrial sewage.

#### 9.0 Environmental Management

##### Air quality

Baseline air quality data are being generated as per the guidelines of CPCB for all the four seasons starting from April, 2005. The analytical results (April, 2005 to June, 2005) indicate that the ambient air quality is within the limit of the extant standards.

##### Water quality

Water quality has been studied in details from tube well water of Gopiballavpur and Korada villages, dug well water of Gopiballavpur and Jhintipal villages and pond water of Rajjharan and Durgapur villages. Except Gopiballavpur all other villages are located in buffer zone of the project.

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water fish found in the area are *Channa jachua* (Cheng), *Ophicephalus marulius* (Murrel), etc.

Though *Varanus salvator* (Monitor lizard) and *Rana tigrina* (Indian Bull Frog) are threatened species, these are found in other parts of the district as well as the state. Besides the above, no endangered species are found in the area. The area is not the migratory route for any wild animals

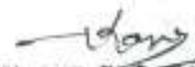
### Hydrogeology

Stream flow data available from the previous studies, indicate that the maximum and minimum daily discharges are 17,809 m<sup>3</sup>/sec and 0.0046 m<sup>3</sup>/sec. respectively.

#### • Hydrogeological set-up of Gopalprasad Block falling within the buffer zone of Utkal-E Block

Project specific sub-surface information like aquifer disposition and characteristics are not available for this block. A detailed hydrogeological study was carried out by the Directorate of Mining and Geology, Department of Steel and Mines, Govt. of Orissa for Gopalprasad Block which falls in the buffer zone of this proposed mining project. Geological exploration of the block reveals that all the formations established to occur in the eastern part of Talcher coalfield are likely to be preserved in the block with coal seams in Karharbari and Barakar formations. Barakar formation covers the entire blocks and is capped by moderately thick soil cover ranging from 2m to 17 m thick. The weathered rock thickness ranges from 5.0 m to 26.0m in this block. Therefore, the sub-surface information collected in the Gopalprasad block can be considered for this block as the geological formation of this block is contemporaneous. Ground water occurs in both unconfined and confined hydraulic conditions in this blocks in this block.

Present ground water condition of the area is being monitored by establishing hydrograph stations in and around the present. The ground water recorded during the period April to June, 2005 from the open dug wells ranges from 3.60

  
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to 12.50 m bmp (below measuring point) in the buffer zone of the project. In the core zone, the ground water level varies from 8.60 to 8.85 m bmp during the above mentioned period.

## 10.0 Land requirement & Mine Lease Area

Out of block area of 4.60 sq.km (459.60 ha), total mine excavation area of Utkal-E OCP is 211.18 ha. Total requirement of land for various purposes is detailed in table-8.

**Table -8  
Mine Lease Area & Land Requirement**

Figures in hectares

	Within Utkal-E Block				Outside Utkal-E Block Non-forest	Grand Total
	Reserve Forest	Revenue Forest	Non-Forest	Total		
Quarry Excavation		47.43	163.75	211.18		211.18
External Dump-I		101.77	35.32	137.09		137.09
External Dump-II				0.00	115.75	115.75
Top Soil Dump		0.83	1.04	1.87		1.87
Railway/Approach Road/Infrastructure	2.33	14.82	6.15	23.30		23.30
Barrier & Nala Diversion-East		0.29	2.34	2.63		2.63
Barrier & Nala Diversion-West		4.03	5.53	9.56		9.56
Peripheral Roads and Safety Barriers along Quarry edge		4.58	5.75	10.33		10.33
Embankment			1.74	1.74		1.74
Explosive Magazine and its Safety Zone					8.91	8.91
Corridor from Utkal-E to Dump-II					3.70	3.70
<b>TOTAL</b>	<b>2.33</b>	<b>173.75</b>	<b>221.62</b>	<b>397.70</b>	<b>128.36</b>	<b>526.06</b>
<b>Area required for Mining Lease</b>						<b>526.06</b>
Area required for CISF Colony in Korara Village (Non-forest land)						12.05

Location and area of land required for residential colony and welfare buildings are yet to be assessed and not included in the above land requirement.

## 11.0 Progressive mine Closure plan

'Mine Closure Plan' is a whole-of-life exercise that begins at the start of a mine life and continues through to post-closure.

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 Place: Bhubaneswar

There are two types of 'Mine Closure Plan' as given below :

- Progressive mine closure plan
- Final mine closure plan

A '**Progressive Mine Closure Plan**' means a progressive plan for the purpose of providing protective, reclamation and rehabilitation measures in a mine or part thereof. A '**Final Mine Closure Plan**' means a plan for the purpose of decommissioning, reclamation and rehabilitation in the mine or part thereof after cessation of mining and related activities that has been prepared in the manner to address all environmental aspects taking into consideration.

The final mine closure plan shall be formulated one (1) year in advance of closure for submission to MoEF, Govt. of India considering the ground reality prevailing during the period. 'Progressive Mine Closure Plan' has been drawn up for Utkal-E OC Coal project 2.0 Mty, which has a life of 36 years.

Following aspects would be dealt in the mine closure plan :

- Final stage and post operational stage land use plan
- Management of hydrology and hydrogeology
- Management of recharge areas
- Drainage arrangement for external OB dump
- Drainage arrangement for internal OB dumps
- Management of air quality
- Management of wastes
- Management of topsoil



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## 1.2 Captive Coal Block and Project

Talcher coalfield spread over an area of 1860 sq.km contains huge reserves of power grade coal. Government of India allotted Utkal-E block situated in this coalfield to M/s NALCO on 27-8-2004 for coal mining to meet the requirements of its captive power plant.

The reserve figures, both geological and extractable, given in the allotment letter were based on preliminary assessment by CMPDI, pending preparation of Geological Report, which was to take long time as per CMPDI's letter dated 18.8.2004 (Annexure-I). The Geological Report was completed in April 2005, which has estimated a geological reserve of 113.393 Mt.

Considering the requirement of coal for 2<sup>nd</sup> phase of CPP expansion, NALCO desires to develop a coal mine in this block. The present mining plan is developed to seek clearances for mining of coal from Utkal-E block based on Geological Report of April, 2005 prepared by CMPDI.

CMPDI was engaged as consultant and Sri U.K.Mohanty as Recognised Qualified Person (Annexures-II, III & IV).

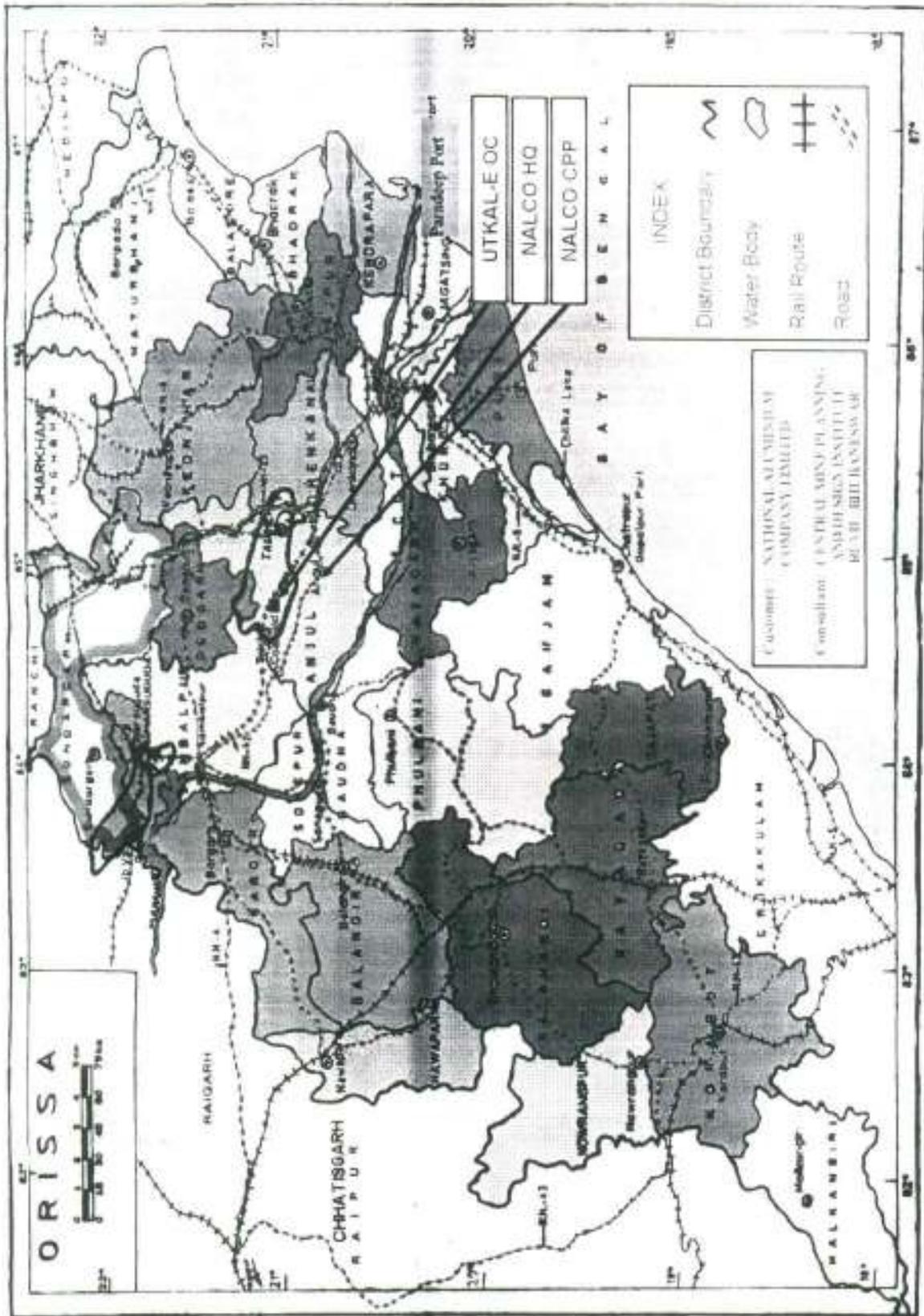
The end use project will be funded through internal resources.

  
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 अवर निदेशिका  
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LOCATION PLAN OF UTKAL-E OPEN CAST PROJECT, NALCO HQ AND NALCO CPP

PLATE No. - GEN-I



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**CHAPTER - II**
**LOCATION, COMMUNICATION & ACCESSIBILITY,  
 PHYSIOGRAPHY AND CLIMATE**
**2.1 Location (Ref. plate Gen-II)**

Utkal-E block is situated in the south-central part of the Talcher coalfield in Jarpada Tahsil, dist Angul, Orissa. The block lies between latitude  $20^{\circ}56'57''$  N and  $20^{\circ}58'58''$  N and longitude  $84^{\circ}55'49''$  E and  $84^{\circ}56'37''$  E and is covered under Survey of India toposheet No.73 D/13 on RF 1:50,000 and special toposheet L2 on RF 1:10,000.

**2.2 Communication**

The Utkal-E block is well approachable from village Raijharan located towards east at a distance of about 3km on Angul-Chhendipada state highway. Jarpada Tahsil HQ is around 10km south-west of the block and approachable by unmetalled road. The district HQ Angul is about 26km from the block towards south-east on National Highway No.42 i.e. (Bhubaneswar-Sambalpur) and is connected with all weather metalled road. Nearest rail head is Angul at a distance of about 26km on Sambalpur-Talcher-Bhubaneswar rail line of East Coast Railway. The block is well connected with State capital Bhubaneswar which is around 170 km from the block.

**2.3 Physiography and Drainage (Ref. plate G-1)**

The Utkal-E block exhibits a gentle undulating topography with general slope towards north. The minimum & maximum elevations above mean sea level of the block are 140m (near BH CSUE-009) on the north and 185m (near BH CMTU-94) on the south respectively. Surface soil is generally sandy containing

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 JARPADA TAHSIL  
 DISTRICT ANGUL  
 ORISSA

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quartz pebbles and boulders. Southern part of the block is represented mainly by rough, rigid and hilly terrain and is under forest cover whereas central and northern parts are being utilized for agricultural purposes. Patches of forest and open shrubs also occur along seasonal nala & Singhada jhor.

Drainage of the block is mainly controlled by easterly flowing Singhada jhor which forms the northern boundary of the block and maintains the base flow even during the dry summer. Gundijeri nala and few other seasonal nalas traversing the area drain into Singhada Jhor, which ultimately meets the Brahmani River towards north-east of the area. There are only two ponds in the block area and mainly used for domestic & irrigation purposes.

2.4

### Climate

This area experiences warm & humid tropical to sub-tropical climate and temperature ranges from 6.7°C (during winter) to 46.7°C (during summer season). Annual rainfall varies from 932mm to 1588mm (average being 1270mm). Humidity varies from 25% to 88%. Annual mean wind speed is 3.24km/hour. Wind direction is mainly east during pre-monsoon season and during post-monsoon period it changes towards north-west and north-east.

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## CHAPTER - III

### MARKETING & JUSTIFICATION

#### 3.1 Introduction

Government of India allotted Utkal-E block to M/s NALCO to meet the future requirements of power to their CPP under expansion at Angul, Orissa.

#### 3.2 Demand and Availability

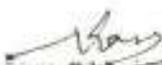
Aluminum smelter plant is located at Angul in Angul district of Orissa. The captive power plant with an installed capacity of 960 MW is also located at Angul, close to Talcher coalfield. The present demand of about 5 Mty is being met from Bharatpur opencast mine of Mahanadi Coalfields Limited.

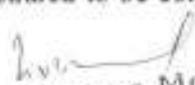
The additional demand for 2 units of 120 MW is projected as about 2 Mty.

The mine is also being developed with production capacity of 2 Mty to meet this entire requirement. Utkal-E block has enough reserves to produce the coal at this capacity for about 32 years.

#### 3.3 Demand and Production

Under the phase-2 expansion scheme, 9<sup>th</sup> unit of 120 MW is scheduled to be commissioned in May 2008 while 10<sup>th</sup> unit is scheduled to be commissioned in December 2008.

  
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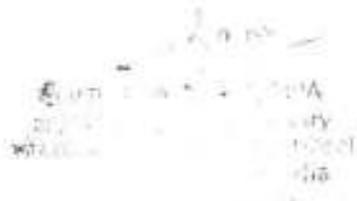
  
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Based on the above schedule of commissioning of generation units, following coal production schedule is proposed:

Year	Production
2007-2008	NIL
2008-2009	1.32 Mty
2009-2010	2.0 Mty

The entire coal will be consumed by captive power plant located near Angul. As there is no other linkage to the generation units under the phase-2 expansion, the development of this mine is justified.

  
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## CHAPTER – IV

### GEOLOGY

#### 4.1 General

This chapter is prepared on the basis of "Geological Report on coal exploration Utkal-E block, Talcher coalfield, district Angul, Orissa" – April 2005 by CMPDI, RI-VI [At & P.O: Jayant, Dist.: Sidhi (M.P)]. Necessary plans, as required have been reproduced from the Geological Report under reference.

#### 4.2 Background

Utkal-E block, forming a part of larger Utkal block lies in the south-central part of the Talcher coalfield which has now occupied a premier position with its vast extent of 1860 sq.km, as far as availability of power grade coal is concerned in this part of the country.

On the basis of regional exploration in the south-central part of the coalfield, a potential area of about 22 sq.km named as Utkal block was identified. Subsequently, the Utkal block was sub-divided into 7 blocks namely, Utkal-A, B1, B2, C, D, E & F (Ref. Plate Gen-II). All these blocks were identified by the Ministry of Coal, Govt. of India for captive mining. Although, regional exploration in larger Utkal block was carried out by Mineral Exploration Corporation Limited at the instance of Central Mine Planning and Design Institute Limited from February 1983 to February 1984 and detailed exploration by CMPDI commenced in April 1989 it was only in November 2003 that Utkal-E block was taken up, independently for detailed exploration by CMPDI after the advice from Ministry of Coal to explore this block on top priority.

#### 4.3 Block Boundary (Ref. Plate G-I)

The block lies between latitude 20°56'57" N and 20°58'58" N and longitude 84°55'49"E and 84°56'37" E and is covered under Survey of India toposheet No.73 D/13 on RF 1:50,000. In terms of local grid in which survey has been done, block boundaries are given in table-4.1 below.

to  
 EANA  
 Secretary  
 Ministry of Coal  
 Govt. of India  
 New Delhi

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 Under Rule 22C of MCR 1960  
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**Table – 4.1**

North	Defined by southern bank of Singadha jhor
South	East-west line at local grid Latitude 2115 m
East	North-south line at local grid Departure (+) 321435, up to northern extent of Latitude +5549
West	North-south line at local grid Departure (+) 22735 up to northern extent of Latitude +5790

(Refer plate no. GEN-IV)

**4.4 Area of the Block**

The Utkal-E block covers an area of 4.60 sq km. The block is nearly rectangular in shape having about 3.5 km length in north-south direction and approximately 1.3 km width in east-west direction.

**4.5 Mining Status**

No mining activity is reported from the block. Hingula Opencast Project located about 10 km east of the block is the nearest, where mining activities are going on.

**4.6 Status of Exploration**

The exploration in the block is carried out in different phases by MECL and CMPDIL. Agency-wise drilling carried out in Utkal block is given below in Table-4.2.

**Table – 4.2**

Exploration Agency	Bore-Hole Series	Period of Operation		Drilling		Type of exploration	Status of documentation
		From	To	No. of Hbs.	Metreage		
MECL	171	Apr '83	Aug '83	4	772.00	Regional	Geological Report on Exploration for Coal, Utkal block, Talcher Coalfield, Apr '85 by MECL.
CMPDIL							
a) RI-VII, Bhubaneswar	CMTU	Dec '98	Nov '99	22	3314.30	Detailed	Results are documented in present geological report on coal exploration
	CMTU	Nov '03	Dec '03	2	265.00	Detailed	
b) RI-VI, Singaoli	CSLE	Dec '03	Mar '04	30	4409.00	Detailed	
Total				58	8760.30		

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**INDEX**

- SERIES OF BENCHES DRILLED BY OPHL. M-12
  - SERIES OF BENCHES DRILLED BY OPHL. M-11
  - SERIES OF BENCHES DRILLED BY MCL
  - SURFACE CENTER
  - ▲ MARK STATION
  - SWANNE
  - UNMETALLED ROAD
  - CROSS-SECTION LINE
  - FAULT
  - BLOCK BOUNDARY
  - SLOPE OF THE GEAR
  - PATENTS
  - TILES
  - POND/TANK
  - BENCHES NAME
  - BENCHES POINT
  - BENCHES LEVEL IN METRE
- All values are given in metre.

SCALE PLATE No. 5-1

REPRODUCED FROM GEOLOGICAL REPORT BY:

<b>NATIONAL ALUMINIUM CO. LTD.</b>	
MINING PLAN FOR UTKAL E BLOC	
Geology and Surface Features	Scale: 1:5000
CMPDI	1984

MINISTRY OF COAL, GOVT. OF INDIA

GEOLOGICAL REPORT OF UTKAL E BLOC, TALCHER COALFIELD, ORISSA.	
Author	Udaya Kumar Mohanty
Editor	Udaya Kumar Mohanty
Reviewer	Udaya Kumar Mohanty
Checked	Udaya Kumar Mohanty
Approved	Udaya Kumar Mohanty
Date	1984
Scale	1:5000
Sheet No.	5-1

**CMPDI**

Thus, 58 boreholes spreading over 4.60 sq.km area and involving 8760 30 meter of drilling have been drilled in the block under reference. The borehole density of the block comes to 12.6 boreholes/sq.km. Within the quarry area of 2.11 sq.km, there are 30 boreholes which works out to a density of 14.21 boreholes / sq.km. Data of nearby boreholes of adjacent blocks have also been considered for geological interpretation.

#### 4.7 Survey

Survey of India has prepared special toposheet on RF 1:10,000 for the Talcher coalfield. Toposheet No.L2 (1992) covers the entire block & utilized for surface contours by enlarging the said toposheet on RF 1:5,000.

Two base stations R-14 and R-15 were established within Utkal-E block (by extending survey from the base station fixed in Kalinga West block by CMPDI). The co-ordinates & reduced level of the stations are given below in Table-4.3.

Table – 4.3

Base station	Co-ordinates(m)		Reduced level
	Latitude North	Longitude East	
R-14	(+)4395.80	(-)22285.70	157.81
R-15	(+)4514.92	(-)21920.20	155.99

#### 4.8 Geophysical Investigations

##### i) Resistivity Survey

To delineate incrops of coal seams underneath the soil/weathered mantle, Resistivity surface survey was carried out for 16.88 line km along six profile lines.

##### ii) Geophysical logging

As a supplement to borehole data, geophysical logging has been carried out in 9 boreholes involving 2324.80m with the help of 'BPB' & 'STRATALOG' loggers.

#### 4.9 Geology & Structure Regional Geology

Utkal-E block is located in the south central part of Talcher coalfield Orissa. Talcher coalfield is the south-eastern most part of Lower Gondwana basin within northwest-southeast trending Sone-Mahanadi master basin belt. The coalfield spans over an area of about 1860 sq.km and lies in between latitudes 20°53'00" 21°12'00" North and longitudes 84°20'00" & 85°23'00". The coalfield is nearly elliptical in shape having strike length of about 80km (east-west) and dip extension (north-south) of around 26km. The Talcher coalfield may be regarded as the southern half of a north-westerly plunging synclinal basin with natural closure on three sides and faulted in the north. Regional strike of the Gondwana sediments is nearly east-west with variations from ENE-WSW to ESE-WNW with low northerly dip.

#### Stratigraphic Succession of Talcher Coalfield

The general stratigraphic succession of Talcher coalfield as per GSI 1997 is given in Table-4.4.

**Table - 4.4**  
**Stratigraphic succession of Talcher coalfield**

Group	Age	Formation	Thickness (m)		Lithology
			From	To	
	Quaternary	Quaternary deposits	-	40+	Colluvial fills, sand, silt and clay of older alluvium, older and younger floodplain deposits, channel fills etc.
	Cenozoic	Laterite	-	-	Laterites, lateritised detrital pebble bed.
GOND WANA	Upper Permian to Lower Triassic	Undifferentiated Kamthi Formation	-	575+	Fine to medium grained light grey to reddish sandstone and shale at the base and pale greenish sandstone with rare shale and pink clay bands, ferruginous coarse grained to pebbly sandstone at top.
----- Unconformity -----					
SUPER GROUP	Upper Permian	Barren Measures	-	50+	Greenish grey to buff coloured pebbly, coarse to medium grained highly ferruginous sandstone with variable proportions of fresh K-feldspar.

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Govt. of India

Dr. P. K. SINGH / P. K. SINGH  
Joint Secretary  
Ministry of Coal  
Government of India  
New Delhi

Group	Age	Formation	Thickness (m)		Lithology
			From	To	
GOND	Lower Permian	Barakar Formation	-	500+	Medium to coarse grained greyish feldspathic sandstone, grey to dark grey shale and coal seams.
WANA	Lower Permian	Karharbari Formation	-	270+	Pale brownish yellow coloured massive medium to coarse grained sandstone containing clasts of Talchir shale and coal seams.
SUPER GROUP	Upper Carboniferous to Lower Permian	Talchir Formation	-	170+	Diamictite, sandstone, needle shale, turbidite, rhythmites and varves.
----- Unconformity -----					
	Archaean (?) to Lower Proterozoic	Pre-Cambrian Metamorphics			Granites, gneisses and associated supracrustals.

#### Geology of Utkal-E Block

The block is located in the south-central part of Talcher coalfield. All the formations established to occur in eastern part of the coalfield are likely to be preserved in Utkal-E block.

#### Geological succession of Utkal-E block

Geological/stratigraphic succession of Utkal-E block is shown below in Table-4.5.

**Table - 4.5**  
**Stratigraphic succession of Utkal-E block**

Age	Group	Formation	Thickness (m)	Lithology
Recent		Recent deposits	2 - 17	Soil, Sub-soil, etc.
Lower Permian		Barakar Formation	315+	Medium to coarse grained greyish feldspathic sandstone, grey to dark grey shale and coal seams.
	Gondwana Super Group	Karharbari Formation	160+ (?)	Pale brownish yellow coloured massive medium to coarse grained sandstone containing clasts of Talchir shale and coal seams.
Upper Carboniferous to Lower Permian		Talchir Formation	102+ (?)	Diamictite, sandstone, needle shale, turbidite, rhythmites and varves.
----- Unconformity -----				
Archaean (?) to Lower Proterozoic		Pre-Cambrian Metamorphics		Granites, gneisses and associated supracrustals.

#### 4.10 Description of formations

None of the boreholes has been deepened to encounter Karharbari & Talchir formation in the block. Barakar formation covers the entire block & is capped by 3m to 9m thick soil cover. Barakar formation consists of medium to coarse grained, gray to buff-white felspathic sandstones with gray shale & sandy shale.

#### Geological Structure (Ref. plate G-II)

Geological structure of the block is mainly based on subsurface data, considering the regional set up and the structural interpretation available from the adjacent block.

#### Strike and Dip

General strike of the beds is mainly ESE-WNW with slight variations in the central part of the block. The direction of the dip of the strata is towards NNE and the amount varies from 5° to 8°.

#### Description of Faults

Entire block is free from fault except north-central part where two parallel faults dipping in opposite direction and forming a narrow trough are continuing from the adjacent eastern block & dies out towards western limit of the block. Dip of the fault plane is assumed 70°. Description of these, faults are as follows

**F1** - It is a westward continuation of F3 fault of the adjacent block, located to the east, having almost east-west alignment and **southerly throw** ( maximum 10 m towards east of the block) traverses the property and dies out within the block about 200 m before western boundary.

**F2** - It is a westward extension of F2 fault of the adjacent block in the east. It is parallel to F1 with similar amount of **throw towards north**. It also vanishes within the block before reaching the western limit. Details of fault are given in table-4.6.

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**Table - 4.6**  
**Details of faults, Utkal-E block, Talcher Coalfield**

Fault No.	Extent	Trend	Throw		Evidences
			Direction	Amount	
F1	About 900 m, from the area near CMTU-143 on the east to the area nearby CSUE-026 on the west.	East-West	Towards south	10 m in the east gradually reduces to zero m towards west	- Continuation of F3 of adjacent block on the east - Difference in the floor levels of coal seams between boreholes CSUE018 and CMTU147, CMTU143.
F2	About 800 m, from the area nearby to borehole No. CSU018 on the east upto the area close to CMTU153 on the west.	East-West	Towards north	10 m in the east to zero m on the west.	- Extension of fault, F2 of adjacent block on the east. - Difference in the floor level of coal seams between boreholes CMTU159, CMTU157 and CSUE018 and CSUE017.

4.11

**COAL SEAMS**

Sum total of 20 correlatable coal seams - IIA to XI (seams of Barakar Formation) in ascending order from bottom to top are preserved in the block. Seam I generally occurs below seam II with a parting ranging from about 80m to 130 m in Talcher coalfield. However, this seam intersected 122 m below seam II, in borehole UT-23 drilled in nearby block shows very poor development and found to occur in three thin splits viz-Upper Split, Middle Split & Lower Split with a thickness of 0.34 m, 0.25 m & 0.12 m respectively. None of the boreholes has been deepened to intersect the seam I of Karharbari formation in the block.

The correlation of the coal seams has been worked out taking into account the stratigraphic position, physical and chemical characteristics, parting, nature of roof and floor etc. Except Seam XI, X and IX all other coal seams occur in split sections in the block i.e. Seam VIII, VII and V in 2 splits each, Seam III in 5 splits, Seam II in 4 splits. Only bottom split of Seam VI and Seam IV are found developed in the block. Each split section has been given the status

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of an independent coal seam even if intervening parting at places is less than 1 m

**SEQUENCE OF COAL SEAMS (Ref. plate G-III)**

The sequence of coal seams, their thicknesses, both stratigraphic & effective, and intervening partings as intersected in the boreholes drilled within the block is given in descending order in Table - 4.7.

Table - 4.7

**Sequence of coal seams intersected in Utkal-E block, Talcher coalfield**

Coal seam/ Parting	Thickness (m)				**No. of intersections
	Stratigraphic		*Effective		
	Range		Range		
	Min.	Max.	Min.	Max.	
Seam XI	1.15 (CSUE015)	9.56 (CSUE004)	1.15 (CSUE015)	6.89 (CSUE020)	08
Parting	7.15 (CSUE015)	11.87 (CSUE001)			10
Seam X	0.40 (CSUE002)	3.40 (CSUE009)	0.40 (CSUE002)	3.40 (CSUE009)	11
Parting	30.37 (CSUE003)	53.50 (CSUE009)			10
Seam IX	25.19 (CMTU145)	34.52 (CSUE023)	19.30 (CMTU145)	32.22 (CSUE023)	13
Parting	0.28 (CMTU249)	4.70 (CSUE004)			19
Seam VIII Top	1.32 (UT021)	6.53 (CSUE006)	1.32 (UT021)	5.90 (CSUE020)	19
Parting	0.50 (CSUE023)	15.83 (CMTU143)			12
Seam VIII Bottom	Nil	3.35 (CSUE023)	Nil	3.35 (CSUE023)	21
Parting	2.72 (CSUE003)	10.61 (CSUE018)			21
Seam VIIIB	0.40 (CSUE026)	4.95 (CSUE009)	0.40 (CSUE026)	4.95 (CSUE009)	27
Parting	3.02 (CSUE009)	6.60 (CMTU156)			24
Seam VIIA	Nil	2.10 (CSUE004)	Nil	2.10 (CSUE004)	25
Parting	9.15 (CSUE015)	20.45 (CSUE023)			07
Seam VIB	Nil	0.96 (CSUE009)	Nil	0.96 (CSUE009)	07
Parting	5.80	19.70			07

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Coal seam/ Parting	Thickness (m)				**No. of intersections
	Stratigraphic		*Effective		
	Range		Range		
	Min.	Max.	Min.	Max.	
	(CSUE023)	(CSUE015)			
Seam VB	0.00	4.84 (CSUE023)	Nil	4.84 (CSUE023)	27
Parting	1.79 (CMTU101)	6.65 (CMTU156)			27
Seam VA	Nil	2.48 (CMTU249)	Nil	2.48 (CMTU249)	32
Parting	1.73 (CMTU143)	7.16 (CMTU144)			19
Seam IVB	Nil	3.64 (CSUE023)	Nil	3.64 (CSUE023)	20
Parting	3.50 (CSUE023)	11.91 (CMTU143)			19
Seam IIIE Top	Nil	4.90 (CSUE023)	Nil	4.90 (CSUE023)	33
Parting	0.78 (CSUE006)	8.19 (CMTU097)			29
Seam IIIE Bottom	Nil	5.30 (CSUE009)	Nil	5.30 (CSUE009)	31
Parting	0.65 (CSUE023)	19.03 (CMTU297)			28
Seam IIID	Nil	10.90 (CSUE023)	Nil	10.90 (CSUE023)	36
Parting	0.40 (CSUE006)	8.65 (CSUE014)			33
Seam IIIA Top	Nil	2.05 (CSUE020)	Nil	2.05 (CSUE020)	35
Parting	0.80 (CMTU100)	7.02 (CMTU145)			22
Seam IIIA Bottom	Nil	4.60 (CSUE006)	Nil	4.60 (CSUE006)	25
Parting	0.40 (CSUE023)	12.40 (CSUE007)			10
Seam IIE	Nil	3.15 (CSUE023)	Nil	3.15 (CSUE023)	14
Parting	26.25 (CSUE020)	42.23 (UT022)			9
Seam IIC	Nil	0.70 (CSUE005)	Nil	0.70 (CSUE005)	15
Parting	3.36 (CSUE023)	18.72 (UT016)			13
Seam IIB	Nil	3.22 (CSUE23)	Nil	3.22 (CSUE023)	24
Parting	0.56 (UT016)	17.14 (CMTU147)			16
Seam IIA	Nil	1.46 (CSUE004)	Nil	1.46 (CSUE004)	20

\*Excluding dirt bands of 1 m and above in thickness.

\*\*Intersecting full coal seam/parting thickness.

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**Table - 4.8**  
**Thickness Range of coal seams, in workable areas,**  
**Utkal-E block, Talcher coalfield**

Coal seam	Thickness (m)								*No. of intersecti on
	Stratigraphic				Effective				
	Min.	Max.	Mean	S.D	Min.	Max.	Mean	S.D	
XI	1.15 (CSUE015)	9.56 (CSUE004)	6.47	3.08	1.15 (CSUE015)	6.89 (CSUE020)	4.53	2.02	08
X	1.02 (CSUE004)	3.40 (CSUE009)	2.06	0.62	1.02 (CSUE004)	3.40 (CSUE009)	2.06	0.62	10
IX	25.19 (CMTU145)	74.52 (CSUE023)	28.72	2.24	19.30 (CMTU145)	32.22 (CSUE023)	24.78	2.97	13
VIII Top	1.32 (UT021)	6.53 (CSUE006)	3.95	1.40	1.32 (UT021)	5.90 (CSUE020)	3.29	1.26	19
VIII Bottom	1.28 (CMTU249)	3.35 (CSUE023)	2.13	0.69	1.28 (CMTU249)	3.35 (CSUE023)	2.13	0.69	10
VIII	1.40 (CSUE028)	4.95 (CSUE009)	2.81	1.02	1.40 (CSUE028)	4.95 (CSUE009)	2.81	1.02	25
VIIA	1.33 (CMTU249)	2.10 (CSUE004)	1.64	0.42	1.13 (CMTU249)	2.10 (CSUE004)	1.64	0.42	5
VII	Nil				Nil				-
VI	1.12 (UT022)	4.84 (CSUE023)	2.29	1.40	1.12 (UT022)	4.84 (CSUE023)	2.29	1.40	6
VA	1.05 (CSUE015 & CSUE025)	2.48 (CMTU249)	1.66	0.44	1.05 (CSUE015 & CSUE025)	2.48 (CMTU249)	1.66	0.44	10
IVB	1.05 (CSUE020)	3.64 (CSUE023)	2.26	1.08	1.05 (CSUE020)	3.64 (CSUE023)	2.26	1.08	06
III Top	1.00 (CMTU147)	4.90 (CSUE023)	2.59	1.37	1.00 (CMTU147)	4.90 (CSUE023)	2.59	1.37	19
III Bottom	1.20 (CSUE005 & CSUE022)	5.30 (CSUE009)	3.23	1.37	1.20 (CSUE005 & CSUE022)	5.30 (CSUE009)	3.23	1.37	21
IID	1.00 (CMTU143)	10.90 (CSUE023)	3.86	3.04	1.00 (CMTU143)	10.90 (CSUE023)	3.86	3.04	25
IIIA Top	1.00 (CMTU147, CMTU156, CMTU006 & CSUE025)	2.05 (CSUE020)	1.29	0.32	1.00 (CMTU147, CMTU156, CMTU006 & CSUE025)	2.05 (CSUE020)	1.29	0.32	19
IIIA Bottom	1.40 (CSUE015)	4.60 (CSUE006)	3.44	1.00	1.40 (CSUE015)	4.60 (CSUE006)	3.44	1.00	10
II	1.45 (CSUE020)	3.15 (CSUE023)	2.05	0.75	1.45 (CSUE020)	3.15 (CSUE023)	2.05	0.75	04
II	Nil				Nil				-
IB	1.00 (CMTU147)	3.22 (CSUE023)	1.96	0.86	1.00 (CMTU147)	3.22 (CSUE023)	1.96	0.86	8
IA	1.25 (CMTU157 & UT022)	1.46 (CSUE004)	1.32	0.12	1.25 (CMTU157 & UT022)	1.46 (CSUE004)	1.32	0.12	3

SD - Standard deviation

#### 4.12 DESCRIPTION OF SEAMS

The coal seams contain high moisture, high ash, high volatile, low rank, non-coking bituminous coal. Quality of coal seams is largely G to F grade. However

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the extreme variations are ungraded to Grade C for including band i.e. I<sub>100</sub> sample. Except Seams XI, IX & VIII Top, all other seams are free from 1 m and above thick dirt bands. Less than 1m bands are composed of carbonaceous shale, grey shale and thin bands of shaly coal / coal. Effective thickness of coal seam for I<sub>100</sub> sample is excluding the bands of 1 m and above in thickness.

#### DETAILS OF THE COAL SEAMS

Details of the various geological parameters for the individual coal seam are described below:

4.13

##### SEAM – IIA (Ref. plate G-IV)

###### A. Intersections:

i)	No. of full seam intersections in boreholes	:	20 Nos.
ii)	No. of incrop proving boreholes with part thickness	:	Nil
iii)	No. of boreholes with part thickness due to faulting	:	Nil
iv)	No. of boreholes where seam is totally omitted due to fault	:	Nil
v)	No. of boreholes where seam is not encountered due to non-development.	:	14 Nos.
vi)	Total area of occurrence	:	4.569 sq.km
vii)	Total workable area	:	0.3331 sq.km (7.3%)

###### B. Depth of intersections (roof):

i)	Shallowest	:	95.65 m (CSUE010)
ii)	Deepest	:	306.60m (CSUE023)

###### C. Floor reduced levels:

i)	Minimum	:	71.48 m (CSUE010)
ii)	Maximum	:	-167.75 m (CSUE023)

##### Stratigraphic position

Seam IIA is the bottommost seam and lies below Seam IIB. Seam I of Karharbari Formation occurs about 80-90 m below seam IIA in the nearby blocks.

### Parting (with overlying seam)

Parting with overlying Seam IIB ranges from 0.56 to 17.14 m and generally contain fine to medium grained sandstone with thin grey shale bands. Parting exhibit the increasing trends in the central and north-western parts from low parting areas on the south and north-east.

### Thickness

Both stratigraphic and effective thickness vary from 0.00 to 1.46 m. Seam attains more than 1 m thickness only in small patches in north-eastern and central part in the region of boreholes CSUE-004 and CMTU-157 respectively. Seam is found not to develop almost in the entire southern part and in extreme northern part around the boreholes CSUE009. In the remaining area, the seam thickness is less than 1 m.

### Incrop

Seam does not incrop in the area.

### Roof and floor

Roof is mainly represented by medium to fine grained sandstone with grey and carbonaceous shales, at places, while floor is constituted of generally grey and carbonaceous shales.

**Dirt bands** Seam is free from bands except borehole UT-021 in which one less than 1 m band is present. Summarised data is given below:

**Table- 4.9**

**Dirt bands in Seam IIA, Utkal-E block, Talcher Coalfield**

Range	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
No.	Thickness	No.	Thickness	No.	Thickness			
Min.	Nil	-	Nil	0.05	Nil	0.05	Nil	Nil



Max.	Nil	-	01 (U1021)	0.05 (U1021)	01 (U1021)	0.05 (U1021)	Nil	Nil
------	-----	---	---------------	-----------------	---------------	-----------------	-----	-----

### Proximate Analysis & Gross CV

Seam contains **G to F grade** coal in workable zone for I<sub>100</sub> sample. Details of quality parameters are given below :

**Table – 4.10**  
Range of Proximate analysis, grade and Gross CV, Seam IIA,  
Utkal-E block, Talcher Coalfield

Sample	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k.cal/kg)	UHV (k.cal/kg)	Grade on UHV
BCS	Range Min.	4.2	27.0	22.0	3550	1296	UG
	Range Max.	7.8	50.9	34.3	3810	4098	E
	No. of samples	7	7	7	3	7	7
	A.M.	5.8	41.0	24.9	3677	2442	F
	S.D.	1.5	8.4	4.4	130.1	963.7	
1100	Range Min.	4.2	27.0	22.0	3550	1296	UG
	Range Max.	7.8	50.9	34.3	3810	4098	E
	No. of samples	8	8	7	3	9	9
	A.M.	5.7	41.8	24.9	3677	2350	G
	S.D.	1.4	8.1	4.4	130.1	929	

### Ultimate analysis

Results of ultimate analysis available for one borehole, are given below:

**Table – 4.11**  
Ultimate analysis, VM and CV on dmmf basis of Seam IIA,  
Utkal-E block, Talcher Coalfield

Particulars	V.M.%	C.V. (k. cal/kg)	C%	H%	N%	S%	Oxy% by diff.
Min.	37.5	7508	80.48	4.74	2.00	1.27	11.51
Max.	50.6	7926	80.48	4.74	2.00	1.27	11.51
No. of samples	7	3	1	1	1	1	1
A.M.	42.0	7698					
S.D.	4.6	211.7					

### Long flame characteristics

Seam exhibits B5 group of long flame coal characteristics. Range of different parameters is given in table-4.12.

**Table – 4.12**  
**Long flame parameters of Seam IIA, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg			
	BCS	1100	BCS	1100	BCS	1100
Range Min.	37.5	37.5	7508	7508	9.2	9.2
Range Max.	50.6	50.6	7926	7926	12.4	12.4
No. of samples	7	7	3	3	7	9
A.M.	42.0	42.0	7698	7698	10.4	10.4
S.D.	4.6	4.6	211.7	211.7	1.1	1.0
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

### Phosphorus and Carbonate

The phosphorus and carbonate (CO<sub>2</sub>) are 0.111 and 1.47% respectively.

### Summary of seam parameters and special observations

Seam is thin and attains workable thickness in north-eastern and central parts only. In rest of the area it is either not developed or less than 1 m thick. Seam contain ungraded to E grade coal.

#### 4.14 SEAM-IIB

##### A. Intersections:

- |      |  |                                    |
|------|--|------------------------------------|
| i)   | No. of full seam intersections in boreholes                            | : 24 Nos.                          |
| ii)  | No. of incrop proving boreholes with part thickness                    | : Nil                              |
| iii) | No. of boreholes with part thickness due to faulting                   | : Nil                              |
| iv)  | No. of boreholes where seam is totally omitted due to fault            | : Nil                              |
| v)   | No. of boreholes where seam is not encountered due to non development. | : 10 Nos.                          |
| vi)  | Total area of occurrence   | : 4.5969km <sup>2</sup>            |
| vii) | Total workable area  | : 0.9638km <sup>2</sup><br>(20.9%) |

##### B. Depth of intersections (roof):

- |     |            |                         |
|-----|------------|-------------------------|
| i)  | Shallowest | : 80.85 m<br>(CMTU090)  |
| ii) | Deepest    | : 305.00 m<br>(CSUE009) |

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 I am a member of Dept. of  
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**C. Floor reduced levels:**

- i) Minimum : 87.99 m  
(CMTU090)
- ii) Maximum : -167.00 m  
(CSUE009)

**Stratigraphic position**

It is overlain and underlain by Seams IIC and IIA respectively.

**Parting (with overlying seam)**

Parting with overlying Seam IIC is mainly consists of coarse to medium grained sandstone with intercalation of shale and sandstone at places and ranges from 3.36 m to 18.72 m in thickness. It increases from the north-western part towards south-west of the block.

**Thickness**

Seam thickness varies from 0.00 m to 3.22 m. Seam is thickest in north-eastern part from where gradually thins towards west and south showing non-development. Range of effective thickness is 1.00 to 3.22 m in workable area i.e. north-western part.

**Incrop**

Seam does not incrop in the block.

**Roof and floor**

Roof is represented by medium grained to coarse grained sandstone with rare sandy shale, while floor contains mainly grey shale, sandy shale.

**Dirt bands**

Seam contains only less than 1m bands. Summarised data of dirt bands, is given below:

**Table - 4.13**  
**Dirt band in Seam IIB, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thicknes s
No.	Thickness	No.	Thickness	No.	Thickness			
Min.	Nil	0.19 (CMTU 147)	Nil	0.04 (UT022)	Nil	0.04 (UT022)	Nil	Nil

Job No.:780004

*[Signature]*  
**V. SIBANA**  
 Under Secretary  
 Ministry of Coal  
 Govt. of India  
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 1. 2016  
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 1. 2016

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### Ash Fusion Temperature Range

Results available from 2 boreholes are given below:

**Table – 4.16**  
**Ash Fusion Temperature Range of Seam IIB,**  
**Utkal-E block, Talcher Coalfield**

Sample type	Particulars	Ash fusion range (at MRA) °C		
		IDT	HT	FT
BCS/1100	Range	1250-1260	1340-1390	+ 1400
	No. samples	2	2	2

### Hardgrove Grindability Index

HGI is available for 2 samples only. The indices are 56 and 59.

### Phosphorus and Carbonate

Results available from 2 boreholes indicate P% and CO<sub>2</sub>% as 0.079-0.117 and 0.97-1.12 respectively.

### Long flame characteristics

Seam is close to the stipulated parameters required for long flame coal and may be kept in B5 group. Range of parameters is given below:

**Table – 4.17**  
**Long flame parameters of Seam IIB, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg			
	BCS	I100	BCS	I100	BCS	I100
Range Min.	41.3	41.3	7298	7272	7.2	7.2
Range Max.	55.8	55.8	7845	7845	11.4	11.4
No. of samples	11	11	9	9	11	14
A.M.	45.3	45.2	7667	7617	9.5	9.6
S.D.	3.8	3.8	168.9	211.7	1.4	1.2
Long flame parameters for B5 Bituminous coal	Over 32		7500-8000		7-14	

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**Thickness**

Thickness varies from 0.00 m to 0.70 m. Seam does not attain more than 1 m thickness in the area and not workable. Seam is not developed in the western, southern and south-eastern parts.

**Incrop**

Seam does not incrop in the block directions.

**Roof and floor**

Roof of seam generally contains medium to coarse grained sandstone and rarely grey and carbonaceous shale while floor is mostly made up of medium grained sandstone, at places grey shale and intercalations also define the floor.

**Dirt bands**

Coal seam is free from dirt bands.

**Proximate Analysis & Gross CV**

Overall analysis is available only from one borehole and is presented below :

**Table - 4.18**  
**Range of Proximate analysis, grade and Gross CV, Seam IIC,**  
**Utkal-E block, Talcher Coalfield**

Sample	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k. cal/kg)	UHV (k. cal/kg)	Grade on UHV
BCS	Range Min.	4.9	46.6	24.8	3400	1793	G
	Range Max.	4.9	46.6	24.8	3400	1793	G
	No. of samples	1	1	1	1	1	1
	A.M.	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-
1100	Range Min.	4.9	46.6	24.8	3400	1793	G
	Range Max.	4.9	46.6	24.8	3400	1793	G
	No. of samples	1	1	1	1	1	1
	A.M.	-	-	-	-	-	-
	S.D.	-	-	-	-	-	-

*Handwritten signature*  
 Utkal Coalfield  
 Talcher  
 Odisha  
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### Summary of seam parameters and special observations

Seam does not attain workable thickness throughout the block.

4.16

#### SEAM-III

##### A. Intersections:

i)	No. of full seam intersections in boreholes	: 14 Nos.
ii)	No. of incrop proving boreholes with part thickness	: Nil
iii)	No. of boreholes with part thickness due to faulting	: Nil
iv)	No. of boreholes where seam is totally omitted due to fault	: Nil
v)	No. of boreholes where seam is not encountered due to non development.	: 20 Nos.
vi)	Total area of occurrence	: 4.0258km <sup>2</sup>
vii)	Total workable area	: 0.4367km <sup>2</sup> (10.8%)

##### B. Depth of intersections (roof):

i)	Shallowest	: 32.00 m (CSUE010)
ii)	Deepest	: 271.20 m (CSUE009)

##### C. Floor reduced levels:

i)	Minimum	: 134.83 m (CSUE010)
ii)	Maximum	: -132.65 m (CSUE009)

#### Stratigraphic position

Seam is overlain by Seam IIIA Bottom and underlain by Seam IIC. It attains fourth level from the bottom in the column.

#### Parting (with overlying seam)

Overlying parting ranging from 0.40 m to 12.40 m, consists mostly of fine to medium grained sandstone and occasionally grey shale & alternate bands of shale and sandstone. Minimum, parting is less than 1 m towards the north-eastern corner and increases to more than 6 m in the central part. More than 12 m parting is noticed in southern part.

#### Thickness

Stratigraphic thickness varies from non-development i.e. 0.00 to 3.15 m while effective thickness in workable area ranges from 1.45 m to 3.15 m. Seam is

thickest in north-eastern part and gradually reduces in thickness towards west and south and loses its existence in western, central and southern parts.

### Incrop

Seam incrop is thin and linear and covers about 600m strike length, in south-western part. In rest of the area seam is not developed.

### Roof and floor

Roof generally contains grey shale, sandy shale and at places alternate sandstone and shale while floor is made up of medium grained sandstone and alternate shale and sandstone bands.

### Dirt bands

Seam is free from 1 m and above thick bands. Summarised account of bands is given below:

Table - 4.19

Dirt band in Seam IIE, Utkal-E block, Talcher Coalfield

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thick-ness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	Nil	0.10 (CSUE 020)	Nil	0.10 (CSUE 006)	Nil	0.10 (CSUE 006 & 020)	Nil	Nil
Max.	01 (CSUE 004, 020)	0.20 (CSUE 004)	01 (CSUE 006 & 012)	0.21 (CSUE 012)	01 (CSUE0 04, 006, 012 & 020)	0.21 (CSUE 012)	Nil	Nil

### Proximate Analysis & Gross CV

In workable area seam is largely G to F in quality. In a small area, around borehole CSUE006 quality deteriorates to ungraded. Range of quality parameters are given in table-4.20.

**Table – 4.20**  
**Range of Proximate analysis, grade and Gross CV, Seam IIE,**  
**Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M. %	C.V. (k cal/kg)	UHV (k cal/kg)	Grade On UHV
BCS	Range Min.	3.7	30.4	23.3	3270	1655	G
	Range Max.	6.4	48.6	31.0	4685	3904	E
	No. of samples	5	5	5	4	5	5
	A.M.	5.0	39.9	26.9	3764	2701	F
	S.D.	1.2	7.7	3.1	663.1	951.4	
I <sub>100</sub>	Range Min.	3.6	33.7	22.6	3290	1117	UG
	Range Max.	6.4	52.8	29.2	4220	3366	E
	No. of samples	7	7	5	2	7	7
	A.M.	4.9	44.1	25.4	3755	2138	G
	S.D.	1.0	7.7	3.0	657.6	923.6	

#### Long flame characteristics

Long flame parameters as shown below:

**Table – 4.21**  
**Long flame parameters of Seam IIE, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg			
	BCS	I100	BCS	I100	BCS	I100
Range Min.	43.0	43.0	7354	7354	6.8	8.6
Range Max.	44.8	46.6	7711	7685	10.2	10.2
No. of samples	5	5	4	2	5	7
A.M.	43.9	44.7	7560	7519	8.9	9.5
S.D.	0.8	1.5	163	234	1.4	0.6
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

#### Summary of seam parameters and special observations

Seam is workable in a localized area on north-eastern part. It is not developed in a substantial part in west, central & southern regions. Seam incrops in a small area, on the west with less than 1 m thickness. Parting with overlying seam is from less than 1 m to about 4 m in workable zone. Minimum parting 0.40 m is in borehole CSUE003 where seam has maximum thickness i.e. 3.15 m. Coal seam may be kept under B5 group of long flame coal.

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 4/22  
 4/22

## 4.17 SEAM-IIIA BOTTOM (Ref. plate G-V)

**A. Intersections:**

- |      |  |                                    |
|------|--|------------------------------------|
| i)   | No. of full seam intersections in boreholes                            | : 25 Nos.                          |
| ii)  | No. of incrop proving boreholes with part thickness                    | : Nil                              |
| iii) | No. of boreholes with part thickness due to faulting                   | : Nil                              |
| iv)  | No. of boreholes where seam is totally omitted due to fault            | : Nil                              |
| v)   | No. of boreholes where seam is not encountered due to non development. | : 12 Nos.                          |
| vi)  | Total area of occurrence   | : 3.5176km <sup>2</sup>            |
| vii) | Total workable area  | : 1.1596km <sup>2</sup><br>(32.9%) |

**B. Depth of intersections (roof):**

- |     |            |                         |
|-----|------------|-------------------------|
| i)  | Shallowest | : 19.35 m<br>(CMTU092)  |
| ii) | Deepest    | : 266.00 m<br>(CSUE009) |

**C. Floor reduced levels:**

- |     |         |                          |
|-----|---------|--------------------------|
| i)  | Minimum | : 146.12 m<br>(CMTU092)  |
| ii) | Maximum | : -129.15 m<br>(CSUE009) |

**Stratigraphic position**

In ascending order, the seam occupies the position above Seam IIE and below Seam IIIA Top at fifth level in the column from the bottom.

**Parting (with overlying seam)**

Parting is represented by grey shale, carbonaceous shale and also by sandy shale. The thickness of the parting varies from 0.80 m to 7.02 m. It is less than 2 m in north-eastern part and increases to more than 7 m in a small zone in central part and further decreases towards south.

**Thickness**

Seam thickness ranges from 0.00 to 4.60 m. Seam is more than 3 m in northern part and gradually thins down to less than 1m. Seam is not developed in the central part. In southern area seam again develops with less than 1 m thickness.

**Incrop**

Seam incrops in the southern part along the entire strike length.

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### Roof and floor

Mostly grey shale, carbonaceous shale and occasionally sandy shale constitute both roof and floor of the seam.

### Dirt bands

Seam is free from 1 m and above band. Only combustible bands having cumulative thickness of 0.06 to 0.40 m, maximum 2 nos., are present. Seam is entirely free from bands in 2 boreholes. Brief account of dirt bands is given below:

**Table - 4.22**  
**Dirt band in Seam IIIA Bottom, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	Nil	0.06 (UT016)	Nil	-	Nil	0.06 (UT016)	Nil	Nil
Max.	2 (CSUE 012)	0.40 (CSUE 020)	Nil	-	02 (CSUE 012)	0.40 (CSUE 020)	Nil	Nil

### Proximate Analysis & Gross CV

Seam contains G to D grade coal including band I<sub>100</sub>. I<sub>100</sub> sample. Range of quality parameters are given below:

**Table - 4.23**  
**Range of Proximate analysis, grade and Gross CV of Seam IIIA Bottom**  
**Utkal-E block, Talcher Coalfield**

Sample	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k cal/kg)	UHV (k cal/kg)	Grade on UHV
BCS	Range Min.	6.1	26.4	23.7	3445	2262	G
	Range Max.	7.0	41.8	31.2	4940	4291	D
	No. of samples	6	6	6	3	6	6
	A.M.	6.4	33.6	27.1	4232	3387	E
	S.D.	0.3	5.4	3.0	750.6	723.1	
I <sub>100</sub>	Range Min.	4.7	26.4	23.7	3180	1903	G
	Range Max.	7.0	46.0	31.2	4940	4291	D
	No. of samples	11	11	6	3	11	11
	A.M.	6.1	34.9	27.0	4143	3252	F
	S.D.	0.6	5.1	3.0	891.8	628.6	

Job No.: 750004

 Uday Kumar Moha  
 Qualified Person  
 22C of MCR  
 No. 13016/8/2004  
 of Dept. of Coal,  
 Govt. of India

4, 24

 Talcher Coalfield  
 Utkal-E block  
 Seam IIIA Bottom  
 Sample I<sub>100</sub>  
 Proximate Analysis  
 Date: 12/12/2004  
 Analyst: Uday Kumar Moha

Udaya Kumar Mohanty  
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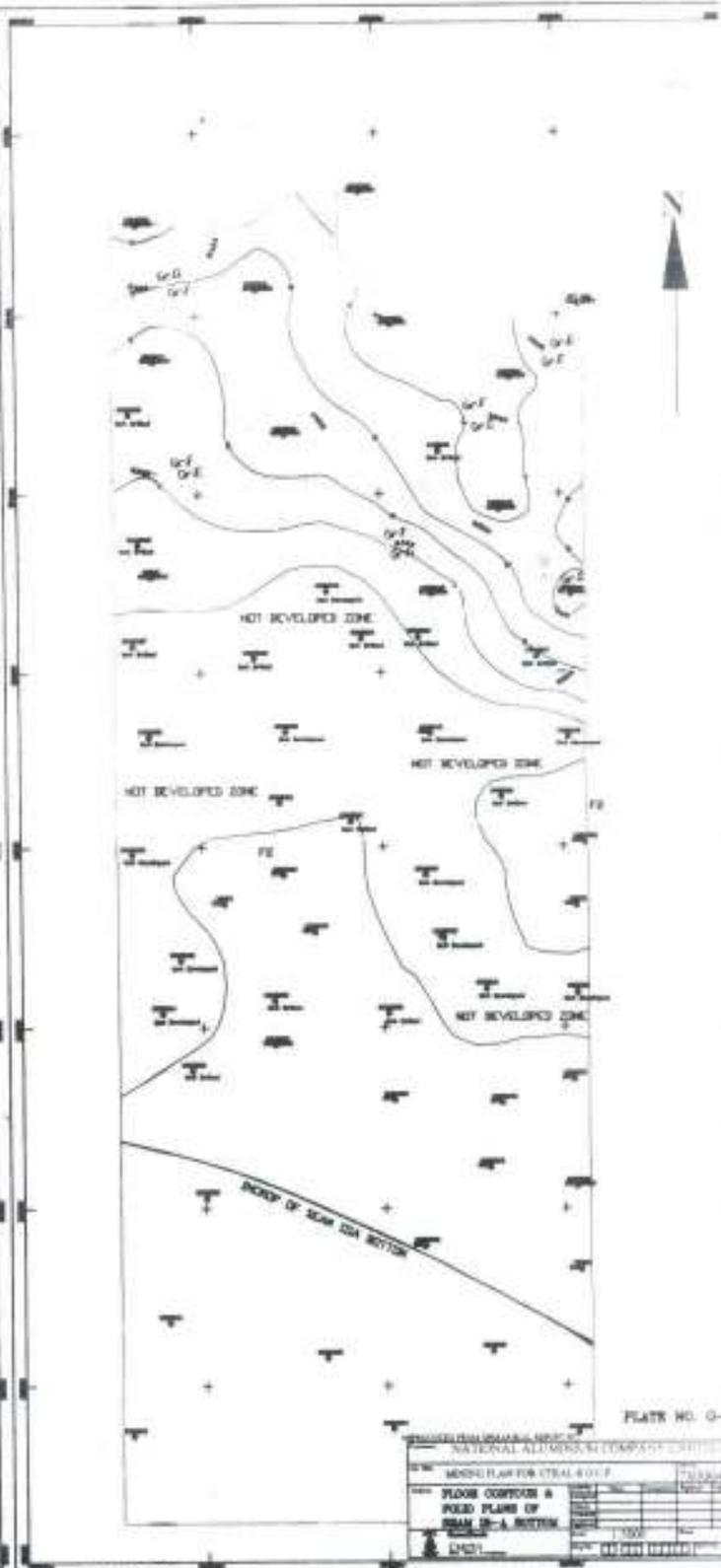
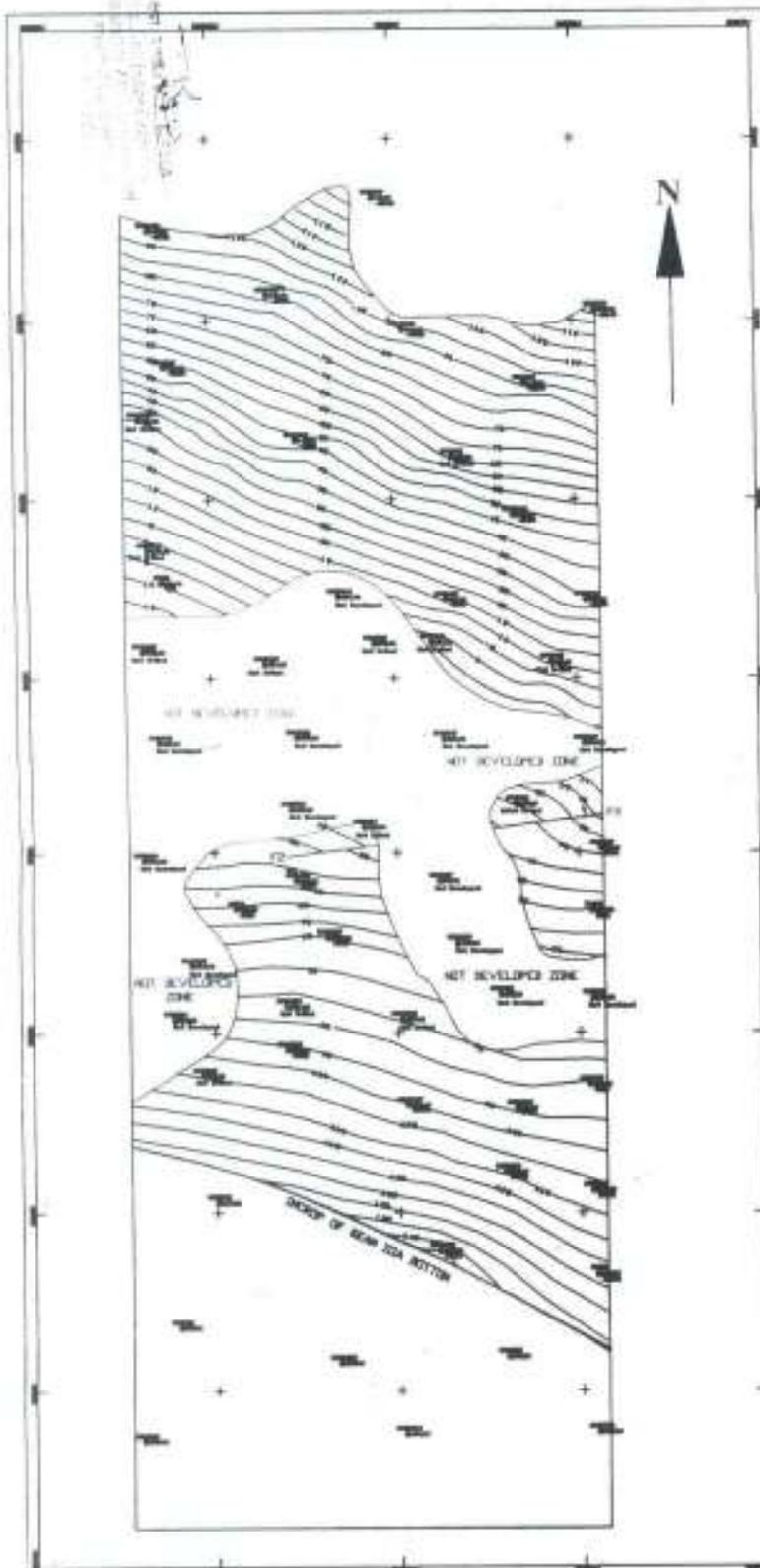


PLATE NO. G-1

NATIONAL ALUMINUM COMPANY LIMITED	
MINING PLAN FOR SEAM 20A	
SCALE	1:5000
DATE	19/10/04
BY	U. K. MOHANTY
CHECKED BY	
APPROVED BY	

- INDEX**
- BOUNDARY OF DEVELOPED ZONES BY OFFPLAN-10
  - BOUNDARY OF DEVELOPED ZONES BY OFFPLAN-11
  - BOUNDARY OF DEVELOPED ZONES BY WELL
  - FLOOR CONTOUR
  - DEVELOPMENT POINT
  - BENCH MARK LEVEL, IN METRE
  - FLOOR BENCH MARK LEVEL, IN METRE
  - BENCH MARK
  - DIP OF THE SEAM
  - FAULT WITH SEAM 20A

MINISTRY OF COAL, GOVT. OF INDIA  
 NATIONAL ALUMINUM COMPANY LIMITED  
 MINING PLAN FOR SEAM 20A  
 SCALE: 1:5000  
 DATE: 19/10/04  
 BY: U. K. MOHANTY  
 CHECKED BY: \_\_\_\_\_  
 APPROVED BY: \_\_\_\_\_

- INDEX**
- BOUNDARY OF DEVELOPED ZONES BY OFFPLAN-10
  - BOUNDARY OF DEVELOPED ZONES BY OFFPLAN-11
  - BOUNDARY OF DEVELOPED ZONES BY WELL
  - DEVELOPMENT POINT WITH EFFECTIVE SEAM THICKNESS AND OR
  - BENCH MARK LEVEL WITH EFFECTIVE SEAM THICKNESS AND OR
  - BENCH MARK LEVEL WITH EFFECTIVE SEAM THICKNESS AND OR
  - BENCH MARK
  - DIP OF THE SEAM
  - FAULT WITH SEAM 20A

MINISTRY OF COAL, GOVT. OF INDIA  
 NATIONAL ALUMINUM COMPANY LIMITED  
 MINING PLAN FOR SEAM 20A  
 SCALE: 1:5000  
 DATE: 19/10/04  
 BY: U. K. MOHANTY  
 CHECKED BY: \_\_\_\_\_  
 APPROVED BY: \_\_\_\_\_



**Table – 4.26**  
**Long flame parameters of Seam IIIA Bottom, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg		BCS	I <sub>100</sub>
	BCS	I <sub>100</sub>	BCS	I <sub>100</sub>		
Range Min.	35.0	35.0	7219	7114	9.5	9.5
Range Max.	44.9	44.9	7872	7872	11.7	10.7
No. of samples	6	6	4	4	6	12
A.M.	42.3	42.3	7503	7476	10.2	9.8
S.D.	3.7	3.7	271.3	310.1	0.9	0.3
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

**Summary of seam parameters and special observations**

Seam attains workable thickness only in northern part where parting with overlying seam is around 2 m. Seam contains Grade G to Grade D coal and may marginally fall under B5 category of long flame coal. Seam incrops along entire strike length on the south.

**4.18 SEAM-IIIA TOP (Ref. plate G-VI)**

**A. Intersections:**

- i) No. of full seam intersections in boreholes : 35 Nos.
- ii) No. of incrop proving boreholes with part thickness : Nil
- iii) No. of boreholes with part thickness due to faulting : Nil
- iv) No. of boreholes where seam is totally omitted due to fault : Nil
- v) No. of boreholes where seam is not encountered due to non development : 3 Nos.
- vi) Total area of occurrence : 3.4370km<sup>2</sup>
- vii) Total workable area : 1.1137km<sup>2</sup>  
(32.4%)

**B. Depth of intersections (roof):**

- i) Shallowest : 37.50 m  
(UT012)
- ii) Deepest : 262.30 m  
(CSUE009)

**C. Floor reduced levels:**

- i) Minimum : 125.26 m  
(UT012)
- ii) Maximum : -123.45 m  
(CSUE009)

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**Dirt bands**

Seam is almost free from the bands and only one band of less than 1 m thickness is present in only five boreholes. Details of dirt band are given below:

**Table - 4.27**

**Dirt band in Seam IIIA Top, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	Nil	0.15 (CMTU 157 & CSUE009)	Nil	0.15 (CSUE 023)	Nil	0.15 (CMTU 157, CSUE009, 023)	Nil	Nil
Max.	01 (CMTU 57, CSUE 009 & 020)	0.45 (CSUE 020)	01 (CMTU 249 & CSUE 023)	0.33 (CMTU 249)	01 (CMTU 57, 249, CSUE 009, 020 & 023)	0.45 (CSUE 020)	Nil	Nil

**Proximate Analysis & Gross CV**

Seam varies in quality from ungraded to Grade E. Largely seam is Grade G and F in quality in workable area. It becomes ungraded in north-western corner and in a small area in central part. Details are given below:

**Table - 4.28**

**Range of Proximate analysis, grade and Gross CV, Seam IIIA Top, Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k cal/kg)	UHV (k cal/kg)	Grade on UHV
BCS	Range Min.	4.6	35.0	20.8	2800	1062	UG
	Range Max.	7.2	52.2	27.3	4260	3214	F
	No. of samples	14	14	14	10	14	14
	A.M.	6.1	40.1	24.1	3854	2524	F
	S.D.	0.7	5.2	1.9	414.1	657.8	
1100	Range Min.	4.6	29.0	18.7	2150	178	UG
	Range Max.	7.5	58.4	27.5	4260	3863	E
	No. of samples	22	22	14	10	22	22
	A.M.	6.1	40.7	24.0	3774	2441	F
	S.D.	0.8	6.5	2.4	300.5	600.8	

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### Ultimate analysis

The results of ultimate analysis are summarised below:

**Table – 4.29**  
**Ultimate analysis VM and CV on dmmf basis, Seam IIIA Top,**  
**Utkal-E block, Talcher Coalfield**

Particulars	V.M.%	C.V. (k. cal/kg)	C%	H%	N%	S%	Oxy% by diff
Min.	35.6	7189	78.02	4.64	1.85	0.96	13.52
Max	46.8	7880	78.67	4.86	2.01	1.25	14.16
No. of samples	14	10	5	5	5	5	5
A.M	40.9	7687	78.48	4.69	1.93	1.10	13.79
S.D.	3.3	203.2	0.3	0.1	0.1	0.1	0.2

### Phosphorus and Carbonate

Phosphorus and Carbonate (CO<sub>2</sub>) have been carried out for some boreholes. The range of phosphorus and carbonate are 0.069-0.117% and 1.17-2.47% respectively.

### Hardgrove Grindability Index

HGI is varies from 57-59

### Ash Fusion Temperature Range

Ash fusion temperature range available from two boreholes are given below

**Table – 4.30**  
**Ash Fusion Temperature Range of Seam IIIA Top,**  
**Utkal-E block, Talcher Coalfield**

Sample type	Particulars	Ash fusion range (at MRA) °C		
		IDT	HT	FT
BCS/ I100	Range	1170 – 1290	1290 - +1400	+ 1400
	No. of samples	2	2	2

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 Talcher Coalfield  
 Utkal-E block  
 Seam IIIA Top  
 Sample No. I100  
 Date: 19/08/2004  
 Analyst: Udaya Kumar Mohanty  
 Talcher Coalfield

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**C. Floor reduced levels**

- |             |                           |
|-------------|---------------------------|
| i) Minimum  | : 133.13 m<br>(UT012)     |
| ii) Maximum | : -119.90 m<br>(CSUE0819) |

**Stratigraphic position**

In stratigraphic column the seam occupies the seventh position and lies between Seam III E Bottom and overlies Seam III A Top.

**Parting (with overlying seam)**

The parting ranging from 0.65 to 19.03 m is characterised by the medium to coarse grained sandstones. Minimum parting is in the north-eastern area from where parting increases towards west and south and becomes more than 18 m in the south-eastern and south-western parts.

**Thickness**

Seam varying in thickness from less than 1 to 10.90 m. Seam is thickest on the north-eastern corner and from this area seam thins down towards up dip direction in central and southern parts and finally, becomes less than 1 m in western and southern-eastern parts.

**Incrop**

Seam incrops almost along the entire strike length except in a small area where it is not developed. Incrop measures about 500 m strike length both on the eastern and western parts of the block.

**Roof and floor**

The roof and floor of seam mainly contain medium to coarse grained sandstone and alternate band of shale and sandstone, medium grained sandstone respectively. Carbonaceous shale, sandy shale and grey shale also constitute roof and floor at some places.



### Ultimate analysis

The results of ultimate analysis are furnished below:

**Table – 4.34**  
**Ultimate analysis VM and CV on dmmf basis, Seam IID,**  
**Utkal-E block, Talcher Coalfield**

	V.M.%	C.V. (kcal/kg)	C%	H%	N%	S%	Oxy % by diff.
Min.	35.9	7256	77.92	4.64	1.80	0.87	11.20
Max.	46.8	7845	80.60	5.20	2.10	2.10	14.51
No. of samples	18	12	7	7	7	7	7
A.M.	42.3	7624	78.87	4.80	1.89	1.44	13.42
S.D.	3.2	176.9	0.9	0.2	0.1	0.5	1.1

### Phosphorus and Carbonate

The phosphorus % and CO<sub>2</sub>%, determined for some boreholes, are 0.074-0.107 and 0.55-2.31 respectively.

### Hardgrove Grindability Index

HGI data is available from 6 boreholes for 1100 sample. It varies between 57 and 63.

### Ash Fusion Temperature Range

Ash fusion characteristics determined under mild reducing atmosphere indicate that coal of the seam has initial deformation temperature around 1200 °C. Ash fusion temperature range is given below :

**Table – 4.35**  
**Ash Fusion Temperature Range of Seam IID,**  
**Utkal-E block, Talcher Coalfield**

Sample type	Particulars	Ash fusion range (at MRA) °C		
		IDT	HT	FT
BCS	Range	1190 – 1270	1270 – 1400	+ 1400
	No. of samples	2	2	2
1100	Range	1190 – 1270	1270 – 1400	+ 1400
	No. of samples	5	5	5

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 Talcher  
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**Long flame characteristics**

Coal seam marginally satisfies the norms of B5 group of long flame coals. The details are given below:

**Table – 4.36****Long flame parameters of Seam IID, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in (k. cal/kg)		BCS	I <sub>100</sub>
	BCS	I <sub>100</sub>	BCS	I <sub>100</sub>		
Range Min.	35.9	35.9	7256	7256	9.7	9.7
Range Max.	46.8	46.8	7845	7814	12.6	12.6
No. of samples	18	18	12	13	18	31
A.M.	42.3	41.8	7624	7578	1.8	10.9
S.D.	3.2	3.2	176.9	167.8	0.9	0.7
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

**Summary of seam parameters and special observations**

Seam IID having thickness between 6 to 11 m. Seam is practically free from dirt bands of 1 m and more in thickness. Seam quality for 1100 sample largely varies from Grade G to E, however, the extreme range is from ungraded to Grade E. Seam may be kept marginally under the B5 category of long flame coal.

**4.20 SEAM-III Bottom****A. Intersections:**

- |      |  |                                    |
|------|--|------------------------------------|
| i)   | No. of full seam intersections in boreholes                            | : 31 Nos.                          |
| ii)  | No. of incrop proving boreholes with part thickness                    | : Nil                              |
| iii) | No. of boreholes with part thickness due to faulting                   | : Nil                              |
| iv)  | No. of boreholes where seam is totally omitted due to fault            | : Nil                              |
| v)   | No. of boreholes where seam is not encountered due to non development. | : 7 Nos.                           |
| vi)  | Total area of occurrence   | : 3.2264km <sup>2</sup>            |
| vii) | Total workable area  | : 2.3098km <sup>2</sup><br>(71.5%) |

**B. Depth of intersections (roof):**

- |     |            |            |
|-----|------------|------------|
| i)  | Shallowest | : 25.81 m  |
| ii) | Deepest    | : 243.90 m |

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25.81 m  
 (CMTU009)  
 243.90 m  
 (CSUE009)

**C. Floor reduced levels:**

- |     |         |   |                        |
|-----|---------|---|------------------------|
| i)  | Minimum | : | 137.22 m<br>(CMTU098)  |
| ii) | Maximum | : | -108.85 m<br>(CSUE009) |

**Stratigraphic position**

Seam is overlain by Seam-IIIE Top and underlain by Seam-IIID. It occupies eighth position from the bottommost seam in the column.

**Parting (with overlying seam)**

Grey shale and carbonaceous shale largely constitute the parting with the IIIE Top & at by sandstones and alternate bands of shale and sandstones. Parting varies from 0.78 to 8.19 m. Parting is less than 2 m almost in the entire northern part and exhibits increasing pattern towards up dip areas normally between 2 to 4 m. It further increases towards south and records maximum in the area close to incrop.

**Thickness**

Seam having thickness range from 0.05 to 5.30 m attains maximum thickness of 5.30 m in the northern part. From northern part thickness gradually decreases towards south being 3 to 1 m in central part and thins down to less than 1 m in southern part. Finally seam pinches out in south-western part.

**Incrop**

Seam incrops in south eastern and vanishes after covering the strike length of about 900 m.

**Roof and floor**

Roof predominantly consists of grey shale, carbonaceous shale with thin shaly/coal bands while floor is mostly made up of coarse to medium grained sandstones & sandy shale.

### Dirt bands

Seam contains only less than 1 m dirt bands which are largely combustible in nature. Non-combustible bands are rare. The total number and thickness of dirt bands ranges from 1 to 4 and 0.15 m to 1.28 m respectively. Bands share to a maximum of 26.23% of seam thickness.

**Table – 4.37**  
**Dirt band in Seam III-E Bottom, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	-1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
Min.	No.	Thickness	No.	Thickness	No.	Thickness	No.	Thickness
	Nil	0.15 (CMTU1156 & CSUE026)	Nil	0.10 (CSUE022)	Nil	0.10 (CSUE022)	Nil	Nil
Max.	04 (CSUE002)	1.28 (CMTU249)	03 (CMTU143)	0.49 (CMTU143)	04 (CSUE002)	1.28 (CMTU249)	Nil	Nil

### Proximate Analysis & Gross CV

Seam is largely Grade G in northern and southern parts. Seam shows improvement in quality to Grade G in north-western, western and in a central parts.

**Table – 4.38**  
**Range of Proximate analysis, grade and Gross CV,  
 Seam III-E Bottom, Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k cal/kg)	UHV (k cal/kg)	Grade On UHV
BCS	Range Min.	5.4	29.7	22.8	3640	2304	G
	Range Max.	7.0	42.3	29.4	4620	3849	E
	No. of samples	11	11	11	7	11	11
	A.M.	6.5	35.6	25.9	4060	3094	F
	S.D	0.6	3.7	1.9	378	473.8	
I <sub>100</sub>	Range Min.	4.2	33.9	20.5	3150	1434	G
	Range Max.	6.8	49.1	26.4	4110	3283	F
	No. of samples	21	21	11	7	21	21
	A.M.	5.8	42.6	23.9	3708	2223	G
	S.D	0.7	4.3	1.7	386.2	520.3	

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**Ultimate analysis**

Ultimate analysis is available for five samples. The range of various parameters is given below:

**Table – 4.39**  
Ultimate analysis, VM and CV on dmmf basis, Seam III-E Bottom,  
Utkal-E block, Talcher Coalfield

Particulars	V.M.%	C.V. (k. cal/kg)	C%	H%	N%	S%	Oxy% by diff.
Min.	36.5	7617	77.94	4.64	1.82	0.90	12.00
Max.	44.9	7808	79.60	5.10	2.40	1.09	14.53
No. of samples	6	4		5	5	5	5
A.M.	39.9	7737	78.43	4.76	1.97	1.00	13.84
S.D.	3.6	83.0	0.7	0.2	0.2	0.1	1.0

**Phosphorus and Carbonate**

The phosphorus % and CO<sub>2</sub> % of the seam ranges between 0.084 - 0.117 and 0.68-2.09 respectively.

**Hardgrove Grindability Index**

HGI for I100 sample is available from five boreholes. It ranges from 57 to 65.

**Long flame characteristics**

Coal seam satisfies the parameters of B5 group of long flame coal for BCS sample while for including band sample seam may be kept marginally under B5 group. Range of various parameters are given below :

**Table – 4.40**  
Long flame parameters of III-E Bottom, Utkal-E block, Talcher Coalfield

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg			
	BCS	I100	BCS	I100	BCS	I100
Range Min.	36.5	36.0	7617	7359	8.6	8.0
Range Max.	44.9	45.6	7808	7701	11.8	12.1
No. of samples	6	11	4	7	11	21
A.M.	39.9	40.6	7737	7567	10.7	10.9
S.D.	3.6	3.2	83.0	153	0.8	0.8
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

**Ash Fusion Temperature Range**

Ash fusion temperature range determined under mild reducing atmosphere is given below:

**Table – 4.41**  
**Ash Fusion Temperature Range of Seam III-E Bottom,**  
**Utkal-E block, Talcher Coalfield**

Sample type	Particulars	Ash fusion range (at MRA) °C		
		IDT	HT	FT
II00	Range	1180 - 1290	1300 - 1360	+ 1400
	No. of samples	4	4	4

**Summary of seam parameters and special observations**

Out of the 31 boreholes, workable thickness ranging from 1.20 to 5.30m has been encountered in 21 boreholes in the northern and central parts. Seam is unworkable in the southern part and also not developed in south-western part. WNW-ESE trending thin incrop has been interpreted in south-eastern part, which extends towards west and finally vanishes. Seam is free from 1 m and above bands. Seam contains G and F Grade coal. Seam shows long flame coal characteristics of B5 group on excluding band basis.

4.21

**SEAM-III-E TOP****A. Intersections:**

- |      |  |                                    |
|------|--|------------------------------------|
| i)   | No. of full seam intersections in boreholes                            | : 33 Nos.                          |
| ii)  | No. of incrop proving boreholes with part thickness                    | : Nil                              |
| iii) | No. of boreholes with part thickness due to faulting                   | : Nil                              |
| iv)  | No. of boreholes where seam is totally omitted due to fault            | : Nil                              |
| v)   | No. of boreholes where seam is not encountered due to non-development. | : 6 Nos.                           |
| vi)  | Total area of occurrence   | : 3.1554km <sup>2</sup>            |
| vii) | Total workable area  | : 1.9195km <sup>2</sup><br>(60.8%) |

**B. Depth of intersections (roof):**

- |     |            |                         |
|-----|------------|-------------------------|
| i)  | Shallowest | : 17.46 m<br>(CMTU097)  |
| ii) | Deepest    | : 239.00 m<br>(CSUE009) |

  
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 Job No.: 78004

**C. Floor reduced levels:**

- |     |         |                          |
|-----|---------|--------------------------|
| i)  | Minimum | : 136.31 m<br>(CMTU097)  |
| ii) | Maximum | : -102.45 m<br>(CSUE009) |

**Stratigraphic position**

Seam-IIIE Top occupies the ninth position in the column from bottom. It overlies seam-IIIE Bottom and underlies seam-IVB.

**Parting (with overlying seam)**

The parting with seam-IVB varies from 3.50 to 11.91 m and generally consists of medium to coarse grained sandstone and occasionally intercalations of shale and sandstone. Increasing trends of parting increases towards up-dip direction from north-eastern zone where it is around 4 m. In central and southern parts it is in the order of 9-10 m and becomes maximum i.e. > 11 m towards west.

**Thickness**

Seam is thickest in the north-eastern part being more than 4 m (0). Thickness decreases towards west and south and finally thins down to less than 1 m in central part. Seam shows non-existence on the south-eastern and south-western parts. Range of thickness is from 0.00 to 4.90 m.

**Incrop**

Seam incrops only in the south-central part. Incrop pinches out on both ends toward east and west.

**Roof and floor**

Carbonaceous shale with thin shaly coal/coal bands and medium to coarse grained sandstones generally constitute the roof. Floor is largely characterised by carbonaceous shale with thin coal bands, grey shale and sandy shale.



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**Dirt bands**

Seam is free from 1 m and above bands and contains only less than 1 m bands ranging in number from nil to 6 with the maximum cumulative thickness of 1.31 m. Detail of dirt bands is given below :

**Table - 4.42**  
**Dirt band in Seam III E Top, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	Nil	0.15 (CMTU/152)	Nil	0.10 (CMTU/101)	Nil	0.10 (CMTU/101)	Nil	Nil
Max.	04 (CSUE023)	0.86 (CSUE023)	02 (CSUE009, 012 & 023)	0.52 (CSUE009)	06 (CSUE023)	1.31 (CSUE023)	Nil	Nil

**Proximate Analysis & Gross CV**

Seam contains largely Grade G coal in workable areas showing improvement to Grade F on the east in central part and north-western corner. Range of proximate analysis data and determined gross CV is given below:

**Table - 4.43**  
**Range of Proximate analysis, grade and Gross CV,**  
**Seam III E Top, Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k cal/kg)	UHV (k cal/kg)	Grade on UHV
BCS	Range Min.	4.6	33.7	22.3	3580	1683	G
	Range Max.	7.1	46.6	29.6	4010	3325	F
	No. of samples	12	12	12	7	12	12
	A.M.	6.0	40.2	25.4	3776	2523	F
	S.D.	0.8	3.5	1.9	172.6	437.6	
1100	Range Min.	3.7	33.7	20.2	2975	1020	UG
	Range Max.	7.1	52.1	29.6	4010	3325	F
	No. of samples	23	23	12	8	23	23
	A.M.	5.6	44.1	24.5	3676	2036	G
	S.D.	0.8	5.4	2.6	325.3	650.8	

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**Ultimate analysis**

It is available from four boreholes, details of which are summarised below:

**Table – 4.44**  
**Ultimate analysis VM and CV on dmmf basis, Seam III-E Top,**  
**Utkal-E block, Talcher Coalfield**

	V.M.%	C.V. (k. cal/kg)	C%	H%	N%	S%	Oxy% by diff
Min.	37.9	7471	78.11	4.67	1.85	0.80	12.60
Max.	47.0	7833	79.20	5.20	2.20	1.16	14.20
No. of samples	12	8	4	4	4	4	4
A.M.	42.8	7642	78.69	4.88	1.96	0.98	13.51
S.D.	2.4	105.9	0.5	0.2	0.2	0.2	0.8

**Phosphorus and Carbonate**

Phosphorus % and CO<sub>2</sub>% show range from 0.102-0.121 and 0.69-1.79 % respectively.

**Hardgrove Grindability Index**

Hardgrove grindability index has been determined for three samples. The range of index is from 56 to 63.

**Long flame characteristics**

Long flame parameters calculated show that seam contains B5 group of long flame coal upto some extent. Range of parameters is given below:

**Table – 4.45**  
**Long flame parameters of III-E Top, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg		RH & 40°C (on mineral free basis)	
	BCS	I100	BCS	I100	BCS	I100
Range Min.	37.9	37.9	7471	7532	8.1	8.7
Range Max.	47.0	47.0	7833	7833	11.8	12.3
No. of samples	12	12	8	9	12	23
A.M.	42.8	42.5	7642	7648	10.8	10.9
S.D.	2.4	2.6	105.9	87.5	1.2	0.8
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

### Ash Fusion Temperature Range

Ash fusion characteristics of the seam indicate that coal soften at the temperature of 1190 °C under mild reducing atmosphere. The range is given below.

**Table – 4.46**  
**Ash Fusion Temperature Range of Seam III-E Top,**  
**Utkal-E block, Talcher Coalfield**

Sample type	Particulars	Ash fusion range (at MRA) °C		
		IDT	HT	FT
BCS/1100	Range	1190 - 1230	1280 - 1290	+ 1400
	No. of samples	2	2	2

### Summary of seam parameters and special observations

Workable thickness of the seam ranging from 1.00 m to 4.90 m has been observed in 19 boreholes. Seam attains thickness more than 4 m in north-eastern part and between 1-4 m in north-central part. In the rest areas (updip) seam is less than 1 m. Its incrop, occupying the south-central part only vanishes on the both sides i. e. east and west. Seam contains 1 to 5 bands of less than 1 m with total thickness of 0.10 to 1.31 m. Seam is also free from bands in few boreholes. In the major part seam is G to F in grade. Seam qualifies the stipulated parameters of B5 class of long flame coal.

4.22

### SEAM IVB

#### A. Intersections:

- |      |  |                                    |
|------|--|------------------------------------|
| i)   | No. of full seam intersections in boreholes                            | : 20 Nos.                          |
| ii)  | No. of incrop proving boreholes with part thickness                    | : Nil                              |
| iii) | No. of boreholes with part thickness due to faulting                   | : Nil                              |
| iv)  | No. of boreholes where seam is totally omitted due to fault            | : Nil                              |
| v)   | No. of boreholes where seam is not encountered due to non development. | : 16 Nos.                          |
| vi)  | Total area of occurrence   | : 2.9926km <sup>2</sup>            |
| vii) | Total workable area  | : 0.4692km <sup>2</sup><br>(15.7%) |

#### B. Depth of intersections (roof):

- |     |            |                         |
|-----|------------|-------------------------|
| i)  | Shallowest | : 27.70 m<br>(CSUE022)  |
| ii) | Deepest    | : 231.15 m<br>(CSUE009) |

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**C Floor reduced levels:**

- |     |         |                         |
|-----|---------|-------------------------|
| i)  | Minimum | : 129.09 m<br>(CSUE022) |
| ii) | Maximum | : -92.65<br>(CSUE009)   |

**Stratigraphic position**

Seam having existence below Seam VA and above Seam III E Top represents the tenth position in the column starting from Seam IIA.

**Parting (with overlying seam)**

Grey shale and carbonaceous shale predominantly constitute the parting with overlying Seam VA. Thickness of parting, ranging from 1.73 to 7.16 m shows increasing trends towards north-east. The parting becomes more than 6 m in north-eastern and north-western corners.

**Thickness**

Seam ranges in thickness from 0.00 to 3.64 m showing maximum development i.e. more than 3 m in north-eastern corner from where seam reduces in thickness sharply and becomes less than 1 m in the entire block and gradually disappears towards up-dip direction in central and southern parts.

**Incrop**

Seam incrops only in a limited area - south of boreholes number CSUE-022, occupying length of about 500 m.

**Roof and floor**

Roof is mainly represented by medium to coarse grained sandstone, alternate shale and sandstone, Carbonaceous shale & medium to coarse grained sandstone form the floor.

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**Dirt bands**

Seam is free from 1 m and above band and contains, 1 to 3 nos., less than 1m bands having maximum total thickness of 0.95 m. Range of dirt bands is given below:

**Table – 4.47**  
**Dirt band in Seam IVB, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	Nil	0.10 (CSUE020)	Nil	0.10 (CSUE004)	Nil	0.10 (CSUE020)	Nil	Nil
Max.	03 (CSUE023)	0.95 (CSUE023)	01 (CSUE004, 006)	0.20 (CSUE006)	03 (CSUE004, 006 & 023)	0.95 (CSUE023)	Nil	Nil

**Proximate Analysis & Gross CV**

Seam ranges in quality from ungraded to Grade G. In workable area seam is of Grade G except in the northern-most region where quality deteriorate to ungraded.

**Table – 4.48**

**Range of Proximate analysis, grade and Gross CV,  
Seam IVB, Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					Grade on UHV
		M%	A%	V.M.%	C.V. (k cal/kg)	UHV (k cal/kg)	
BCS	Range Min.	5.0	43.1	22.4	3310	1655	G
	Range Max.	6.1	46.7	26.6	3640	2262	G
	No. of samples	4	4	4	3	4	4
	A.M.	5.7	44.9	23.8	3430	1917	G
	S.D.	0.5	1.5	1.9	182.5	256.3	
1100	Range Min.	4.3	43.1	21.5	3310	565	UG
	Range Max.	5.9	56.1	26.6	3640	2262	G
	No. of samples	8	8	4	3	8	8
	A.M.	5.1	48.9	23.4	3442	1438	G
	S.D.	0.6	4.3	2.2	174.8	535.3	

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### Long flame characteristics

Seam qualifies the stipulated parameters of long flame coal of B5 category. Range of long flame parameters is given below :

**Table – 4.49**  
**Long flame parameters of Seam IVB, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg		BCS	I100
	BCS	I100	BCS	I100		
Range Min.	41.4	40.9	7562	7649	9.5	9.5
Range Max.	46.8	46.8	7728	7739	12.0	11.9
No. of samples	4	4	3	3	4	8
A.M.	43.0	42.9	7646	7705	11.3	11.1
S.D.	2.6	2.7	83	49.1	1.2	0.7
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

### Summary of seam parameters and special observations

Seam is workable only in northern part of the block. In up dip areas either it is less than 1 m thick or not developed. Seam contains only less than 1 m dirt bands. Seam contains Grade G coals in the entire area, except in the northern most part where seam is ungraded.

4.23

### SEAM-VA

#### A. Intersections:

- |   |                                    |
|---|------------------------------------|
| i) No. of full seam intersections in boreholes                            | : 32 Nos.                          |
| ii) No. of incrop proving boreholes with part thickness                   | : Nil                              |
| iii) No. of boreholes with part thickness due to faulting                 | : Nil                              |
| iv) No. of boreholes where seam is totally omitted due to fault           | : Nil                              |
| v) No. of boreholes where seam is not encountered due to non development. | : 01 No.                           |
| vi) Total area of occurrence  | : 2.8559km <sup>2</sup>            |
| vii) Total workable area  | : 1.1580km <sup>2</sup><br>(40.5%) |

#### B. Depth of intersections (roof):

- |               |                         |
|---------------|-------------------------|
| i) Shallowest | : 16.90 m<br>(CSUE024)  |
| ii) Deepest   | : 223.83 m<br>(CSUE009) |

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4. 45

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**Dirt bands**

Seam contains nil to 2 bands, of less than 1 m thickness and free from 1m and above thick bands. The total thickness of bands varies from 0.10 to 0.88 m. Range of dirt bands is given below:

**Table – 4.50**  
**Dirt band in Seam VA, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	Nil	0.10 (CMTU101)	Nil	0.16 (CMTU146)	Nil	0.10 (CMTU101)	Nil	Nil
Max.	02 (CMTU249, UT016 & CSUE009)	0.88 (CMTU249)	01 (CMTU100 & 146)	0.19 (CMTU100)	02 (CMTU100, 249, UT016 & CSUE009)	0.88 (CMTU249)	Nil	Nil

**Proximate Analysis & Gross CV**

For I100 sample, seam contains mostly G and F grade coal, except in a small patch on south-east, where quality deteriorates to ungraded. Range of various parameters is provided below:

**Table – 4.51**  
**Range of Proximate analysis, grade and Gross CV,**  
**Seam VA, Utkal-E block, Talcher Coalfield**

Sample	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k. cal/kg)	UHV (k. cal/kg)	Grade on UHV
BCS	Range Min.	5.6	31.1	23.6	2060	1434	G
	Range Max.	7.0	50.1	31.2	4060	3656	E
	No. of samples	11	11	11	7	11	11
	A.M.	6.3	41.3	26.9	3476	2432	F
	S.D.	0.5	5.7	2.5	650.2	643.3	
I100	Range Min.	4.6	38.4	21.6	2060	827	UG
	Range Max.	6.9	53.9	31.2	3890	2718	F
	No. of samples	16	16	11	7	16	16
	A.M.	5.8	44.3	26.0	3355	1984	G
	S.D.	0.5	4.6	2.7	665.9	575.3	

### Ultimate analysis and special tests

Ultimate analysis is available from 2 boreholes only. The results summarised below:

**Table - 4.52**  
**Ultimate analysis VM and CV on dmmf basis, Seam VA,**  
**Utkal-E block, Talcher Coalfield**

Particulars	V.M.%	C.V. (k cal/kg)	C%	H%	N%	S%	Oxy% by diff
Min	36.8	5012	77.93	4.65	1.80	0.78	12.50
Max	53.3	7653	79.50	5.10	1.85	0.90	14.79
No. of samples	11	8	2	2	2	2	2
A.M.	46.6	7238	78.72	4.88	1.83	0.84	13.65
S.D.	4.7	902.5	1.1	0.3	0.0	0.1	1.6

### Phosphorus & Carbonate

Phosphorus and carbonate contents are 0.097 and 1.28-2.14% respectively.

### Hardgrove Grindability Index

HGI determined from only one borehole is 59.

### Long flame characteristics

Long flame characteristics of the seam do not largely match with the prescribed limits for long flame coal. Range of various parameters is given below:

**Table - 4.53**  
**Long flame parameters of Seam VA, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg		BCS	1100
	BCS	1100	BCS	1100		
Range Min.	36.8	37.0	5012	5012	10.1	10.1
Range Max.	53.3	53.3	7653	7653	12.9	12.9
No. of samples	11	11	8	8	11	17
A.M.	46.6	46.1	7238	7195	11.4	11.4
S.D.	4.7	4.5	902.5	895.5	1.0	0.7
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

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 19.2.2004  
 7-14

### Ash fusion temperature range

Ash fusion temperature range determined for one I100 sample under mild reducing atmosphere is as follows:

**Table - 4.54**  
**Ash fusion temperature range of Seam VA,**  
**Utkal-E block, Talcher Coalfield**

Sample type	Particulars	Ash fusion range (at MRA) °C		
		IDT	HT	FT
I100	Range	1190	1290	+ 1400
	No. of samples	1	1	1

### Summary of seam parameters and special observations

Seam VA shows existence in the entire block except in one borehole. Seam thickness ranges from 1.05 to 2.48 m & is workable on the north, east and south central parts. In rest of the area seam is less than 1 m in thickness. Seam contains 1 to 2 numbers, dirt bands of less than 1 m thickness having maximum total thickness of 0.88 m. Seam contains mostly G and F grade coal barring ungraded in a isolated patch in the south-east. Seam indicates long flame characteristics of B5 category of bituminous coal.

4.24

#### SEAM-VB (Ref. plate G-VII)

##### A. Intersections:

- |      |  |                                    |
|------|--|------------------------------------|
| i)   | No. of full seam intersections in boreholes                            | : 27 Nos.                          |
| ii)  | No. of incrop proving boreholes with part thickness                    | : Nil                              |
| iii) | No. of boreholes with part thickness due to faulting                   | : Nil                              |
| iv)  | No. of boreholes where seam is totally omitted due to fault            | : Nil                              |
| v)   | No. of boreholes where seam is not encountered due to non development. | : 04 Nos.                          |
| vi)  | Total area of occurrence   | : 2.7239km <sup>2</sup>            |
| vii) | Total workable area  | : 0.3886km <sup>2</sup><br>(14.3%) |

##### B. Depth of intersections (roof):

- |     |            |                         |
|-----|------------|-------------------------|
| i)  | Shallowest | : 12.15 m<br>(CSUE024)  |
| ii) | Deepest    | : 219.50 m<br>(CSUE009) |

**C. Floor reduced levels:**

- |     |         |                          |
|-----|---------|--------------------------|
| i)  | Minimum | : 143.43 m<br>(CSUE024)  |
| ii) | Maximum | : - 80.75 m<br>(CSUE009) |

**Stratigraphic position**

Seam VB is the twelfth seam from the bottom and is underlain and overlain by Seam VA and VIB respectively.

**Parting (with overlying seam)**

The parting with Seam VIB, ranging in thickness from 5.80 to 19.70 m is dominantly represented by grey shale and carbonaceous shale. Parting increases from low parting zone, in the north-eastern part towards up dip directions on the west where parting attains maximum thickness.

**Thickness**

Out of 27 boreholes, the workable thickness of the seam ranging from 1.12 to 4.84 m has been observed in only six boreholes. Seam is thickest in the north-eastern corner and thins down to less than 1 m in up dip region except on the eastern part. Seam is not developed in two patches, one in central part and other around borehole CMTU153. In balance area seam has thickness in between 0.30 to 0.95 m.

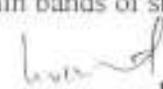
**Incrop**

Seam exhibiting WNW-ENE trends incrops along the entire strike length having less than 1 m thickness.

**Roof and floor**

Roof and floor of the seam are shaly in nature having carbonaceous shale, grey shale with thin bands of shaly coal/coal.

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**Dirt bands**

Seam is free from 1 m and above bands and contains generally 1 to 2 dirt bands of less than 1m thickness. The Details are given below :

**Table - 4.55**  
**Dirt band in Seam VB, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	Nil	0.06 (UT022)	Nil	0.11 (CMTU101)	Nil	0.06 (UT022)	-	-
Max.	04 (CSUE023)	1.07 (CSUE023)	2 (CMTU143 & CSUE023)	0.51 (CSUE023)	06 (CSUE023)	1.58 (CSUE023)	-	-

**Proximate Analysis & Gross CV**

Coal seam on I100 sample is largely of Grade G in quality, except in north-eastern area and in a patch along eastern boundary & in central part where seam becomes ungraded. The Quality improves to grade F in a localised area in northern part. The range of various parameters is given below:

**Table - 4.56**

**Range of Proximate analysis, grade and Gross CV,  
Seam VB, Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k. cal/kg)	UHV (k. cal/kg)	Grade on UHV
BCS	Range Min.	5.1	37.7	22.0	3020	1627	G
	Range Max.	6.9	47.6	34.1	3940	2745	F
	No. of samples	9	9	9	6	9	9
	A.M.	6.3	43.9	26.4	3446.7	1966.1	G
	S.D.	0.6	3.1	3.5	341.2	382.1	
I100	Range Min.	4.5	37.7	20.6	2960	1172	UG
	Range Max.	6.9	51.5	34.1	3940	2745	F
	No. of samples	11	11	9	5	11	11
	A.M.	5.7	46.9	25.6	3316	1642.5	G
	S.D.	0.8	4.2	4.1	391.8	477.5	

**Ultimate analysis**

The results of the ultimate analysis are available for one borehole only which are as follows:

**Table – 4.57**  
Ultimate analysis VM and CV on dmmf basis, Seam VB,  
Utkal-E block, Talcher Coalfield

Particulars	V.M.%	C.V. (K. cal/kg)	C%	H%	N%	S%	Oxy% by diff
Min.	39.9	7099	77.94	4.83	1.85	1.25	15.46
Max.	68.1	7700	77.94	4.83	1.85	1.25	15.46
No. of samples	9	6	1	1	1	1	1
A.M.	48.8	7533					
S.D.	8.9	219.8					

**Phosphorus and Carbonate**

Phosphorus and carbonate contents are 0.111% and 0.97% respectively.

**Hardgrove Grindability Index**

HGI determined for one sample is 62.

**Long flame characteristics**

Various parameters calculated for ascertaining long flame characteristics are given below. The coal of seam does not satisfy all the parameters of long flame characteristics.

**Table – 4.58**  
Long flame parameters of Seam VB, Utkal-E block, Talcher Coalfield

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg		BCS	I100
	BCS	I100	BCS	I100		
Range Min.	39.9	39.8	7099	7099	10.7	10.4
Range Max.	68.1	68.1	7700	7631	13.4	13.0
No. of samples	9	9	6	5	9	11
A.M.	48.8	48.4	7533	7497	12.2	11.8
S.D.	98.9	8.9	219.8	226	0.8	0.9
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

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Ministry of Education, Government of India  
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**Ash fusion temperature range**

Various parameters of ash fusion temperature range available from one borehole sample are given below:

**Table – 4.59**  
**Ash fusion temperature range, Seam VB,**  
**Utkal-E block, Talcher Coalfield**

Sample type	Particulars	Ash fusion range (at MRA) °C		
		IDT	HT	FT
H100	Range	1260	1360	+ 1400
	No. of samples	1	1	1

**Summary of seam parameters and special observations**

Seam attains workable thickness ranging from 1.12 m to 4.84 m only, along the northern limits, eastern boundary & in central part of the block. In rest of the area either seam is less than 1 m thick or not developed. Seam contains largely Grade G coal with the improvement upto Grade F in a small patch in northern part. The coal of the seam does not satisfy all the parameters of long flame characteristics.

4.25

**SEAM-VIB****A. Intersections:**

- |      |  |           |
|------|--|-----------|
| i)   | No. of full seam intersections in boreholes                            | : 07 Nos. |
| ii)  | No. of incrop proving boreholes with part thickness                    | : Nil     |
| iii) | No. of boreholes with part thickness due to faulting                   | : Nil     |
| iv)  | No. of boreholes where seam is totally omitted due to fault            | : Nil     |
| v)   | No. of boreholes where seam is not encountered due to non development. | : 25 Nos. |

**B. Depth of intersections (roof):**

- |     |            |                         |
|-----|------------|-------------------------|
| i)  | Shallowest | : 118.80 m<br>(CSUE003) |
| ii) | Deepest    | : 208.80 m<br>(CSUE009) |

**C. Floor reduced levels:**

- |     |         |                         |
|-----|---------|-------------------------|
| i)  | Minimum | : 38.71 m<br>(CSUE009)  |
| ii) | Maximum | : -69.41 m<br>(CSUE009) |





**Table - 4.60**  
**Dirt band in Seam VIB, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
No.	Thickness	No.	Thickness	No.	Thickness			
Min.	Nil	0.12 (CSUE009)	Nil	0.10 (CSUE009)	Nil	0.14 (CMTU249)	-	-
Max.	01 (CMTU249, CSUE009)	0.14 (CMTU249)	01 (CSUE009)	0.10 (CSUE009)	02 (CSUE009)	0.22 (CSUE009)	-	-

### Proximate Analysis & Gross CV

Overall analysis was carried out for one sample. Results are given below:

**Table - 4.61**  
**Range of Proximate analysis, grade and Gross CV,**  
**Seam VIB, Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k. cal/kg)	UHV (k. cal/kg)	Grade on UHV
BCS	Range Min.	5.3	42.6	24.4	-	2290	G
	Range Max.	5.3	42.6	24.4	-	2290	G
	No. of samples	1	1	1	-	1	1
I100	Range Min.	4.6	53.0	21.0	-	951	UG
	Range Max.	4.6	53.0	21.0	-	951	UG
	No. of samples	1	1	1	-	1	1

### Summary of seam parameters and special observations

Seam is largely not developed in the block, barring in north-eastern and north-western parts where it attains a thickness of less than 1m. Seam contains ungraded coal on I100 sample. **Seam is not workable in the entire area.**

4.26

### SEAM-VIIA (Ref. plate G-VIII)

#### A. Intersections:

- |   |                                    |
|---|------------------------------------|
| i) No. of full seam intersections in boreholes                            | : 25 Nos.                          |
| ii) No. of incrop proving boreholes with part thickness                   | : Nil                              |
| iii) No. of boreholes with part thickness due to faulting                 | : Nil                              |
| iv) No. of boreholes where seam is totally omitted due to fault           | : Nil                              |
| v) No. of boreholes where seam is not encountered due to non development. | : 03 Nos.                          |
| vi) Total area of occurrence  | : 2.2633km <sup>2</sup>            |
| vii) Total workable area  | : 0.3258km <sup>2</sup><br>(14.4%) |

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<b>B. Depth of intersections (roof):</b>	
i) Shallowest	20.70 m (UT022)
ii) Deepest	192.57 m (CSUE009)
<b>C Floor reduced levels:</b>	
i) Minimum	133.29 m (CSUE026)
ii) Maximum	-53.80 m (CSUE009)

#### Stratigraphic position

In sequence of coal seams, Seam VIIA attains the fourteenth position from the bottom and lies in between Seams VIIB and VIB.

#### Parting (with overlying seam)

Grey shale, carbonaceous shale and alternate bands of shale and sandstone generally constitute the parting between Seam VIIA and VIIB. Parting ranges from 3.02 to 6.60 m and shows increasing trends from the north-eastern and north-western parts towards up dip region. In two patches, one in the south-western part and other in the eastern part parting is more than 6m.

#### Thickness

Seam shows thickness variation from 0.00 to 2.10 m. It attains more than 1m thickness in northern and eastern parts with reducing trends towards updip regions, becoming less than 1 m in thickness. Seam also shows non-existence in two patches, one in central part and other near incrop. The workable thickness ranges from 1.13 to 2.10m.

#### Incrop

Seam incrops in the central part of the block.

#### Roof and floor

Roof of the seam is generally composed of grey shale, carbonaceous shale with thin coal bands and occasionally contain arenaceous sediments. Floor mostly contains medium to coarse grained sandstone, sandy shale and occasionally grey and carbonaceous shale.

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**Dirt bands**

Seam is free from 1 m and above thick bands and contains only 1 to 4 numbers less than 1 m thick bands. In few boreholes seam is free from dirt bands. Range of dirt bands is given below:

**Table – 4.62**  
**Dirt band in Seam VIIA, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	Nil	0.22 (CSUE020)	Nil	0.13 (CSUE012)	Nil	0.13 (CSUE012)	Nil	Nil
Max.	01 (CSUE020 & 023)	0.31 (CSUE023)	4 (CSUE004)	0.63 (CSUE004)	04 (CSUE004)	0.63 (CSUE004)	Nil	Nil

**Proximate Analysis & Gross CV**

Proximate overall analysis results indicate that coal seam is largely ungraded showing improvement upto Grade G around CMTU249 on the east and CSUE012 on the north-west, for I<sub>100</sub> sample. Range of various parameters is furnished below:

**Table – 4.63**  
**Range of Proximate analysis, grade and Gross CV,**  
**Seam VIIA, Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k cal/kg)	UHV (k cal/kg)	Grade on UHV
BCS	Range Min.	6.0	32.4	21.7	2850	1255	UG
	Range Max.	7.6	49.2	28.1	4330	3518	E
	No. of samples	5	5	5	3	5	5
	A.M.	6.7	40.7	24.3	3630	2356	G
	S.D.	0.7	6.2	2.4	743.2	855.5	
I100	Range Min.	5.2	45.7	20.0	2510	523	UG
	Range Max.	6.0	55.5	23.4	3270	1765	G
	No. of samples	7	7	5	2	7	7
	A.M.	5.8	51.7	20.8	2890	973	UG
	S.D.	0.3	3.4	1.5	537.4	443.3	

**Long flame characteristics**

Seam does not has long flame characteristics. The range of various parameters calculated for ascertaining long flame characters is given below:

**Table – 4.64**  
**Long flame parameters of Seam VIIA, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg			
	BCS	1100	BCS	1100	BCS	1100
Range Min.	37.2	36.5	7182	7188	10.3	12.1
Range Max.	44.7	44.5	7512	7478	14.1	14.5
No. of samples	5	5	3	2	5	7
A.M.	41.7	41.5	7397	7333	12.3	13.5
S.D.	2.8	3.1	186	205	1.8	0.9
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

**Summary of seam parameters and special observations**

Seam ranging in thickness from 0.00 to 2.10, attains workable thickness in northern part. Seam is not developed in two patches in the up dip regions. It contains nil to 4 numbers less than 1 m dirt bands with the maximum cumulative thickness of 0.63 m. In few cases dirt bands are not present in the seam. Seam contains ungraded coal, except in two patches, one in the east and other in the north-west where quality improves to G grade on 1100 sample.

4.27 **SEAM-VIIB (Ref. plate G-IX & G-XV)****A. Intersections:**

- |   |                                    |
|---|------------------------------------|
| i) No. of full seam intersections in boreholes                            | : 27 Nos.                          |
| ii) No. of incrop proving boreholes with part thickness                   | : Nil                              |
| iii) No. of boreholes with part thickness due to faulting                 | : Nil                              |
| iv) No. of boreholes where seam is totally omitted due to fault           | : Nil                              |
| v) No. of boreholes where seam is not encountered due to non development. | : Nil                              |
| vi) Total area of occurrence  | : 2.1772km <sup>2</sup>            |
| vii) Total workable area  | : 1.9343km <sup>2</sup><br>(88.8%) |

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No. 13016/8/2004 CA.  
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Govt. of Jh.





<b>B. Depth of intersections (roof):</b>		
i)	Shallowest	: 12.05 m (CMFU157)
ii)	Deepest	: 184.60 m (CSUE009)
<b>C Floor reduced levels:</b>		
i)	Minimum	: 139.29 m (CSUE026)
ii)	Maximum	: -49.20 m (CSUE009)

### Stratigraphic position

The existence of the seam has been recorded at the fifteenth position in column from the bottom in between Seams VIII Bottom and VIIA.

### Parting (with overlying seam)

Parting varying from 2.72 to 10.61 m, is mostly represented by grey shale, carbonaceous shale, sandy shale, and rarely by sandstones. The parting is around 5 to 8 m thick in the central part showing decreasing pattern towards north-west, becoming less than 3 m. In further north-west areas parting shoots up to 7.82 m.

### Thickness

Seam varies in thickness from 0.40 m to 4.95 m. Seam is thickest in the north and gradually thins down towards south becoming less than 1 m on the south-western part.

### Incrop

Following the strike direction, seam incrops in the central part of the block.

### Roof and floor

Roof and floor mostly consist of grey shale and carbonaceous shale with thin coal bands. Arenaceous contents are exceptionally present.

**Dirt bands**

Seam is free from dirt bands and only less than 1 m bands, 1 to 2 in numbers with maximum cumulative thickness of 0.60 m. Details of dirt band are given below:

**Table - 4.65**  
**Dirt band in Seam VIIB, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
Min.	No.	Thickness	No.	Thickness	No.	Thickness	No.	Thickness
	Nil	0.10 (CSUE017)	Nil	0.23 (UT021)	Nil	0.10 (CSUE017)	Nil	Nil
Max.	01 (UT021, CSUE004, 012, 015, & 017)	0.35 (CSUE015)	01 (UT021, CSUE002, 004, 006, 009 & 012)	0.45 (CSUE002)	02 (UT021, CSUE004, CSUE012)	0.60 (CSUE004)	Nil	Nil

**Proximate Analysis & Gross CV**

Proximate overall analysis available for the 25 boreholes shows that seam largely contains F to E grade coal with the extreme variation of grade from G to D for I<sub>100</sub> sample. The grade improves in patches on the east and west. The range of various parameters is given below:

**Table - 4.66**  
**Range of Proximate analysis, grade and Gross CV,**  
**Seam VIIB, Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k. cal/kg)	UHV (k. cal/kg)	Grade on UHV
BCS	Range Min.	5.6	23.1	23.2	3015	1586	G
	Range Max.	10.2	46.8	32.2	4870	4760	D
	No. of samples	16	16	16	11	16	16
	A.M.	7.9	31.9	28.4	4126	3412	E
	S.D.	1.2	6.4	2.4	593.5	839.1	
I100	Range Min.	5.6	23.1	23.2	3015	1503	G
	Range Max.	10.0	47.8	32.2	4870	4760	D
	No. of samples	25	25	16	12	25	25
	A.M.	7.4	35.8	27.8	4069	2936	F
	S.D.	1.0	6.3	2.4	610.4	811.4	

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**Ultimate analysis and special tests**

The range of various parameters of ultimate analysis along V.M. and Gross CV on unit coal basis is given below:

**Table – 4.67**  
Ultimate analysis VM and CV on dmmf basis, Seam VIII B,  
Utkal-E block, Talcher Coalfield

Particulars	V.M.%	C.V. (k. cal/kg)	C%	H%	N%	S%	Oxy% by diff.
Min.	36.9	7107	77.39	4.64	1.85	0.78	13.84
Max.	51.3	7812	78.61	5.20	2.20	1.28	14.84
No. of samples	16	11	7	7	7	7	7
A.M.	44.5	7481	77.95	4.83	1.92	0.97	14.33
S.D.	4.1	272.2	0.5	0.2	0.1	0.2	0.4

**Phosphorus and Carbonate**

Phosphorus and carbonate are 0.074 to 0.111% and 0.55 to 1.97% respectively.

**Hardgrove Grindability Index**

Hardgrove Grindability indices, available from six boreholes show variation between 52 to 62 for I<sub>100</sub> sample.

**Long flame characteristics:**

Seam partially contains long flame coal of B5 group. The range of parameters is given below:

**Table – 4.68**  
Long flame parameters of Seam VIII B, Utkal-E block, Talcher Coalfield

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg			
	BCS	I100	BCS	I100	BCS	I100
Range Min.	36.9	36.9	7107	7107	9.3	9.3
Range Max.	51.3	51.3	7812	7812	15.2	15.7
No. of samples	16	16	11	14	16	25
A.M.	44.5	44.7	7481	7465	12.2	12.3
S.D.	4.1	4.1	272.2	259	1.8	1.5
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

**Ash fusion temperature range**

The range of softening, hemispherical and flow temperature determined under mild reducing atmosphere is given below:

**Table – 4.69**  
**Ash fusion temperature range, Seam VIIB,**  
**Utkal-E block, Talcher Coalfield**

Sample type	Particulars	Ash fusion range (at MRA) °C		
		IDT	HT	FT
BCS/1100	Range	1210 - 1260	1290 - 1320	+ 1400
	No. of samples	3	3	3

**Ash composition**

The ash composition for Seam VIIB sample, available for borehole CMTU145, is as follows:

SiO<sub>2</sub>% - 59.82, Al<sub>2</sub>O<sub>3</sub>% - 27.54, Fe<sub>2</sub>O<sub>3</sub>% - 3.97, TiO<sub>2</sub>% - 1.88, P<sub>2</sub>O<sub>5</sub>% - 0.40, CaO% - 2.42, MgO% - 1.37, MnO% - Trace, SO<sub>2</sub>% - 0.32, K<sub>2</sub>O% - 1.49 and Na<sub>2</sub>O% - 0.79.

**Summary of seam parameters and special observations**

Seam attains workable thickness varying from 1.40 to 4.95 m in the entire block except in south-western part. Seam is thickest (more than 4m) in the northern part and showing decreasing pattern towards south in updip areas. Seam contains mostly F to E grade coal with extreme variation from G to D grade for 1100 sample. Seam exhibits long flame characteristics of B5 group, up to some extent.

4.28

**SEAM-VIII BOTTOM (Ref. plate G-X & G-XVI)**

**A. Intersections:**

- i) No. of full seam intersections in boreholes : 21 Nos.
- ii) No. of incrop proving boreholes with part thickness : Nil
- iii) No. of boreholes with part thickness due to faulting : Nil
- iv) No. of boreholes where seam is totally omitted due to fault : Nil
- v) No. of boreholes where seam is not encountered due to non development : 02 Nos.
- vi) Total area of occurrence : 1.8710km<sup>2</sup>
- vii) Total workable area : 1.0614km<sup>2</sup>  
(56.7%)

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**B. Depth of intersections (roof):**

- |               |                         |
|---------------|-------------------------|
| i) Shallowest | : 17.86 m<br>(CSUE018)  |
| ii) Deepest   | : 178.40 m<br>(CSUE009) |

**C Floor reduced levels:**

- |             |                          |
|-------------|--------------------------|
| i) Minimum  | : 132.03 m<br>(CMTU159)  |
| ii) Maximum | : - 38.73 m<br>(CSUE009) |

**Stratigraphic position**

The seam is overlain by seam-VIII Top and underlain by seam-VIIB and occupies the sixteenth position in the column in ascending order from bottom.

**Parting (with overlying seam)**

Parting with overlying VIII Top seam is less than 1 m in northern and north-eastern parts & exhibits increasing trend towards up dip region. Parting becomes more than 10 m in the area, close to incrop. The range of parting is from 0.50 to 15.83 m. Parting is mostly represented by grey shale and carbonaceous shale in northern parts, while in up dip areas shaly facies changes into arenaceous

**Thickness**

The stratigraphic thickness ranges from 0.00 to 3.55m. The seam is workable (1.28 to 3.35 m) except in a narrow stretch in north-western part and in up dip region up to the incrop. The seam is not developed in a patch in the central part

**Incrop**

Seam incrops in the eastern and western parts only.

**Roof and floor**

Carbonaceous shale, grey shale with thin coal bands generally form the roof of the seam. At places, roof is also composed of medium grained sandstone and intercalations of shale and sandstone. Floor is characterised by carbonaceous shale with thin coal bands and grey shale, at places.

**Dirt bands**

Seam contains only less than 1 m thick dirt bands ranging in number from 1 to 5 with cumulative thickness from 0.10 to 0.94 m. Seam is free from 1 m and above thick bands. Details of dirt bands is furnished below:

**Table – 4.70**  
**Dirt band in Seam VIII Bottom, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
Min.	No.	Thickness	No.	Thickness	No.	Thickness	No.	Thickness
	Nil	0.10 (CSUE015)	Nil	0.32 (CSUE023)	Nil	0.10 (CSUE015)	Nil	Nil
Max.	03 (CSUE012 & 023)	0.90 (CSUE012)	03 (UT021)	0.63 (UT021)	05 (CSUE023)	0.94 (CSUE023)	Nil	Nil

**Proximate Analysis & Gross CV**

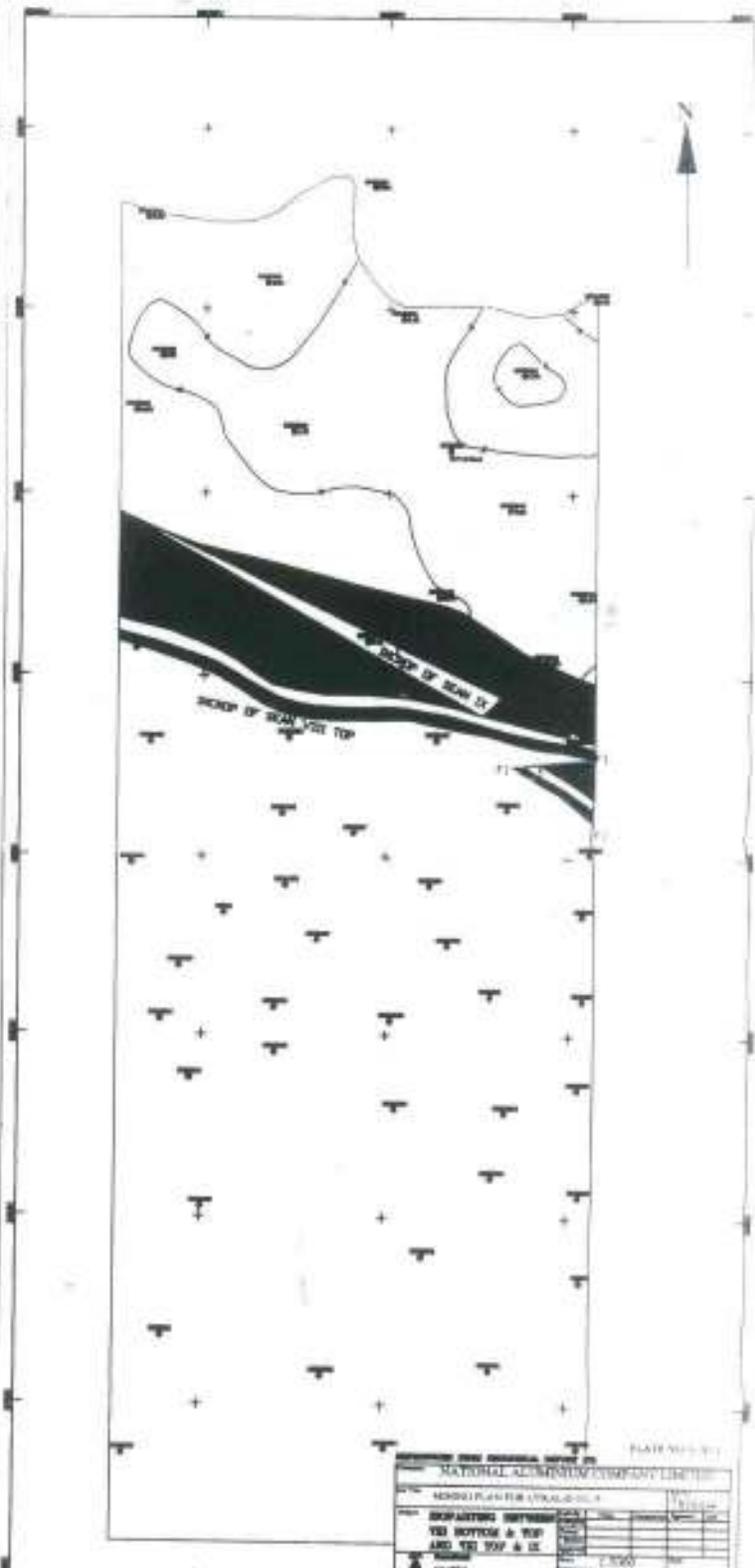
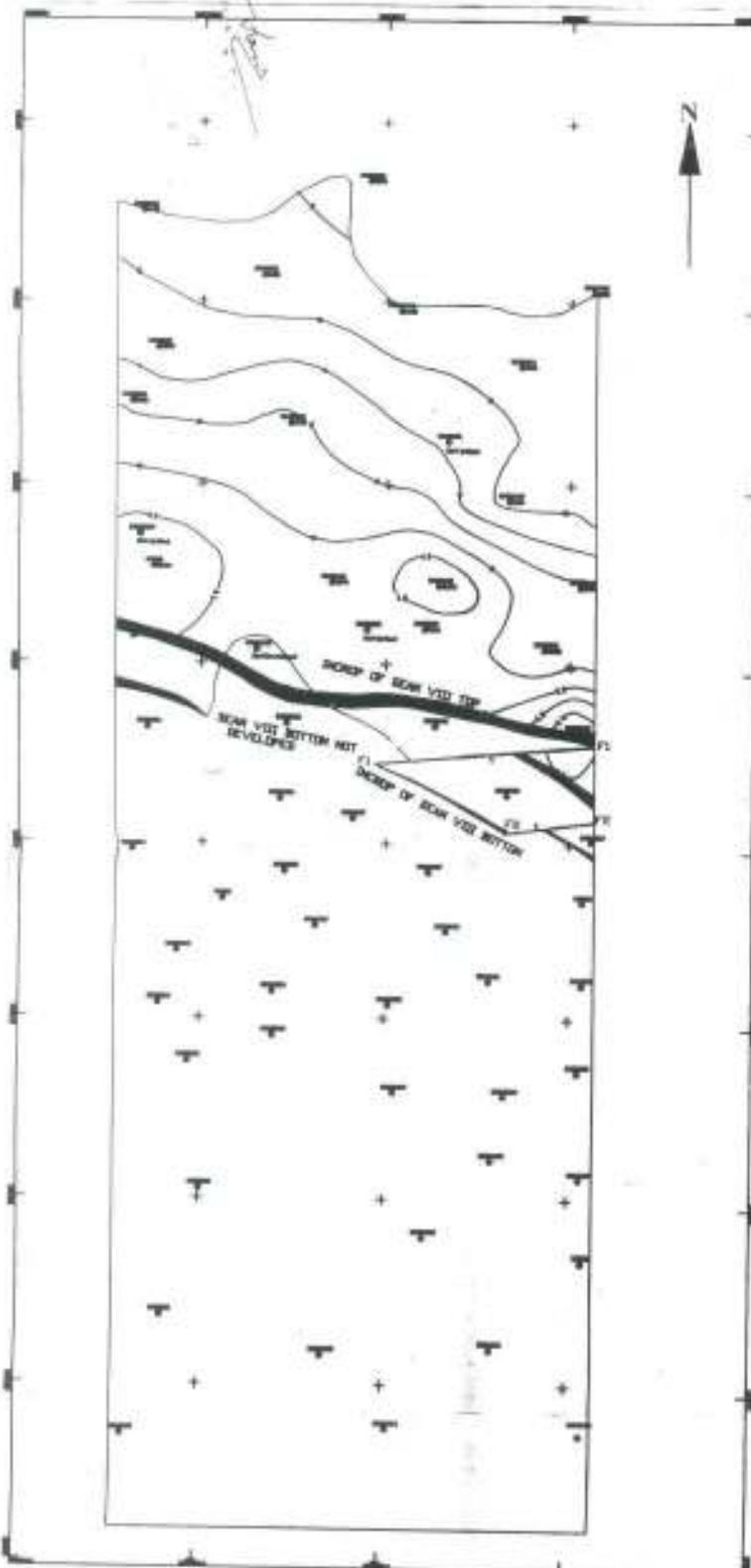
Results of proximate analysis show that for I100 sample seam is largely in G to F in grade. Seam also becomes ungraded in three patches, located in northern, western and south-eastern parts. Range of various parameters is given below

**Table - 4.71**  
**Range of Proximate analysis, grade and Gross CV,**  
**Seam VIII Bottom, Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k cal/kg)	UHV (k cal/kg)	Grade on UHV
BCS	Range Min.	6.4	30.1	23.2	3620	1600	G
	Range Max.	8.8	46.5	29.0	4370	3601	E
	No. of samples	6	6	6	2	6	6
	A.M.	7.7	36.7	27.0	3995	2773	F
	S.D.	0.8	6.6	2.1	530.3	805.4	
I100	Range Min.	5.0	30.1	22.6	3620	427	UG
	Range Max.	8.7	56.4	29.0	4370	3601	E
	No. of samples	13	13	6	2	13	13
	A.M.	7.1	41.7	25.9	3995	2169	G
	S.D.	1.1	8.4	2.7	530.3	1021.4	

Job No. 780004

Udaya Kumar Mohanty  
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Order No. 13016/8/2004 C  
2004 of Dept. of Geology  
& M. Govt. of India



INDEX

- Symbol for Contour Interval of 10m
- Symbol for Contour Interval of 20m
- Symbol for Contour Interval of 50m
- Symbol for Contour Interval of 100m
- Symbol for Contour Interval of 200m
- Symbol for Contour Interval of 500m
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MINISTRY OF GOAL. GOVT. OF INDIA NATIONAL BUREAU OF SOIL & WATER CONSERVATION NEW DELHI	
PROJECT NAME PROJECT LOCATION PROJECT NO.	SHEET NO. DATE OF SURVEY SCALE
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INDEX

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PROJECT NAME PROJECT LOCATION PROJECT NO.	SHEET NO. DATE OF SURVEY SCALE
CMPDI	

Udaya Kumar Mohanty  
 Recognised Qualified Person  
 Under Rule 22C of MCR 1980

**Ultimate analysis and special tests**

Range of various parameters of ultimate analysis is given below :

**Table – 4.72**  
**Ultimate analysis, VM and CV on dmmf basis, Seam VIII Bottom, Utkal-E block, Talcher Coalfield**

Particulars	V.M.%	C.V. (k. cal/kg)	C%	H%	N%	S%	Oxy% by diff.
Min.	43.7	7322	77.98	4.65	1.70	0.92	13.30
Max.	47.5	7584	78.90	5.10	1.85	1.00	14.60
No. of samples	6	3	2	2	2	2	2
A.M.	45.1	7475	78.44	4.88	1.78	0.96	13.95
S.D.	1.8	136.3	0.7	0.3	0.1	0.1	0.9

**Phosphorus and Carbonate**

Seam contains 0.061% phosphorus and 0.82 to 1.87% carbonate.

**Hardgrove Grindability Index**

HGI determined for two boreholes ranges between 59 and 68 for I100 sample.

**Long flame characteristics**

Seam appears to contain long flame coal of B5 group. The range of various parameters calculated is given below:

**Table – 4.73**  
**Long flame parameters of Seam VIII Bottom, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg		BCS	I100
	BCS	I100	BCS	I100		
Range Min.	43.7	43.4	7322	7518	12.2	12.2
Range Max.	47.5	47.2	7584	7584	13.7	14.6
No. of samples	6	6	3	2	6	13
A.M.	45.1	44.8	7475	7551	13.0	13.1
S.D.	1.8	1.5	136.3	46.7	0.6	0.6
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

**Ash fusion temperature range**

Various parameters of ash fusion temperature range are given below :

**Table – 4.74**  
**Ash fusion temperature range, Seam VIII Bottom,**  
**Utkal-E block, Talcher Coalfield**

Sample type	Particulars	Ash fusion range (at MRA) °C		
		IDT	HT	FT
BCS/I100	Range	1210	1290	+ 1400
	No. of samples	1	1	3

**Summary of seam parameters and special observations**

Except in narrow stretch in north-western part and in updip region upto incrop, seam attains workable thickness ranging from 1.28 to 3.35 m. On I100 sample basis seam contains mostly G to F grade coal with exception, being ungraded in northernmost, western and south-eastern parts in patches. Seam appears to contain characteristics of B5 group of long flame coal.

4.29

**SEAM-VIII TOP (Ref. plate G-XI & G-XVI)**

**A. Intersections:**

- i) No. of full seam intersections in boreholes : 19 Nos.
- ii) No. of incrop proving boreholes with part thickness : 01 No.
- iii) No. of boreholes with part thickness due to faulting : Nil
- iv) No. of boreholes where seam is totally omitted due to fault : Nil
- v) No. of boreholes where seam is not encountered due to non development. : Nil
- vi) Total area of occurrence : 1.6448km<sup>2</sup>
- vi) Total workable area : 1.6448km<sup>2</sup>  
(100%)

**B. Depth of intersections (roof):**

- i) Shallowest : 19.30 m  
(CSUE028)
- ii) Deepest : 171.45 m  
(CSUE009)

**C. Floor reduced levels:**

- i) Minimum : 131.67 m  
(CSUE028)
- ii) Maximum : -35.15 m  
(CSUE009)

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No. 13016/8/2004-CA,  
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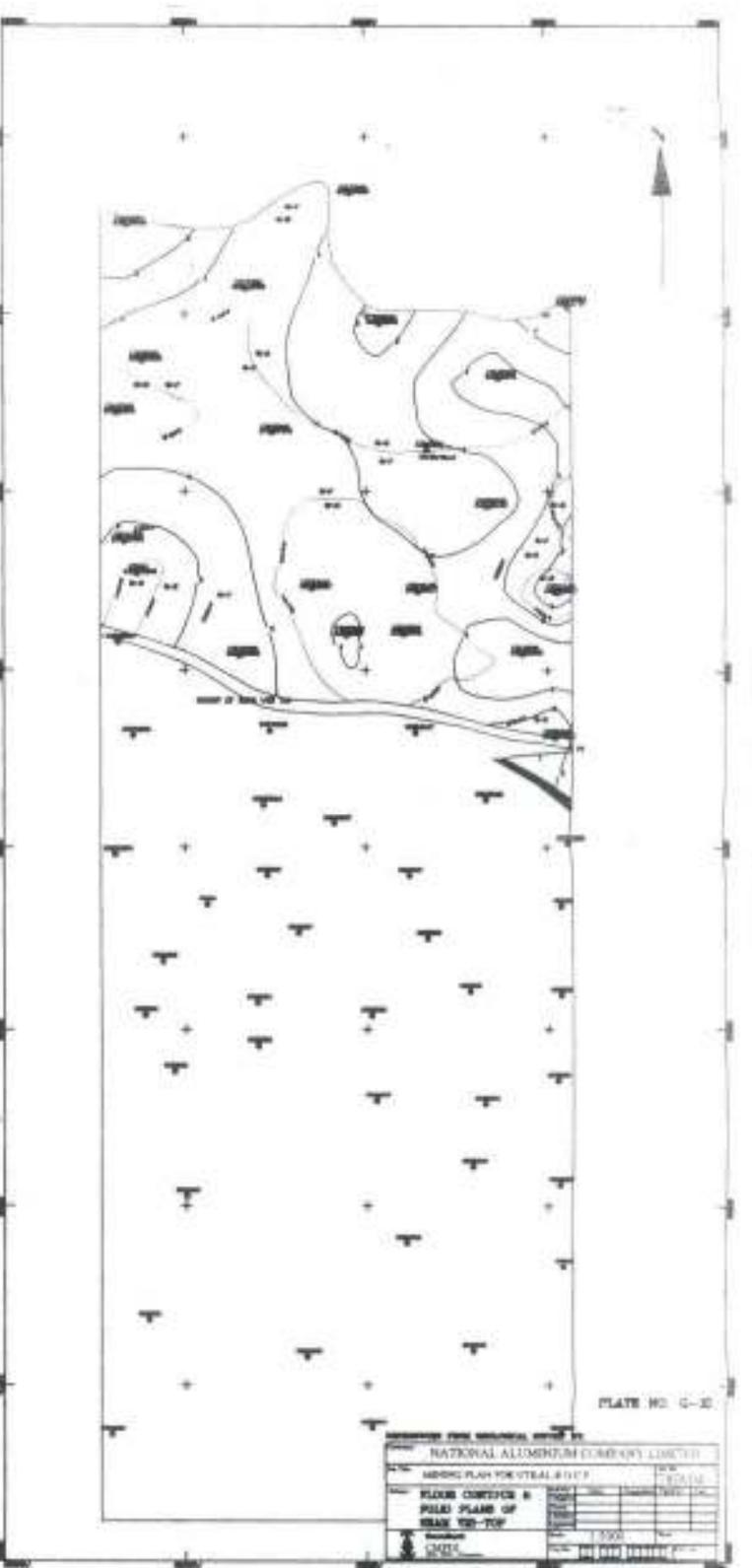
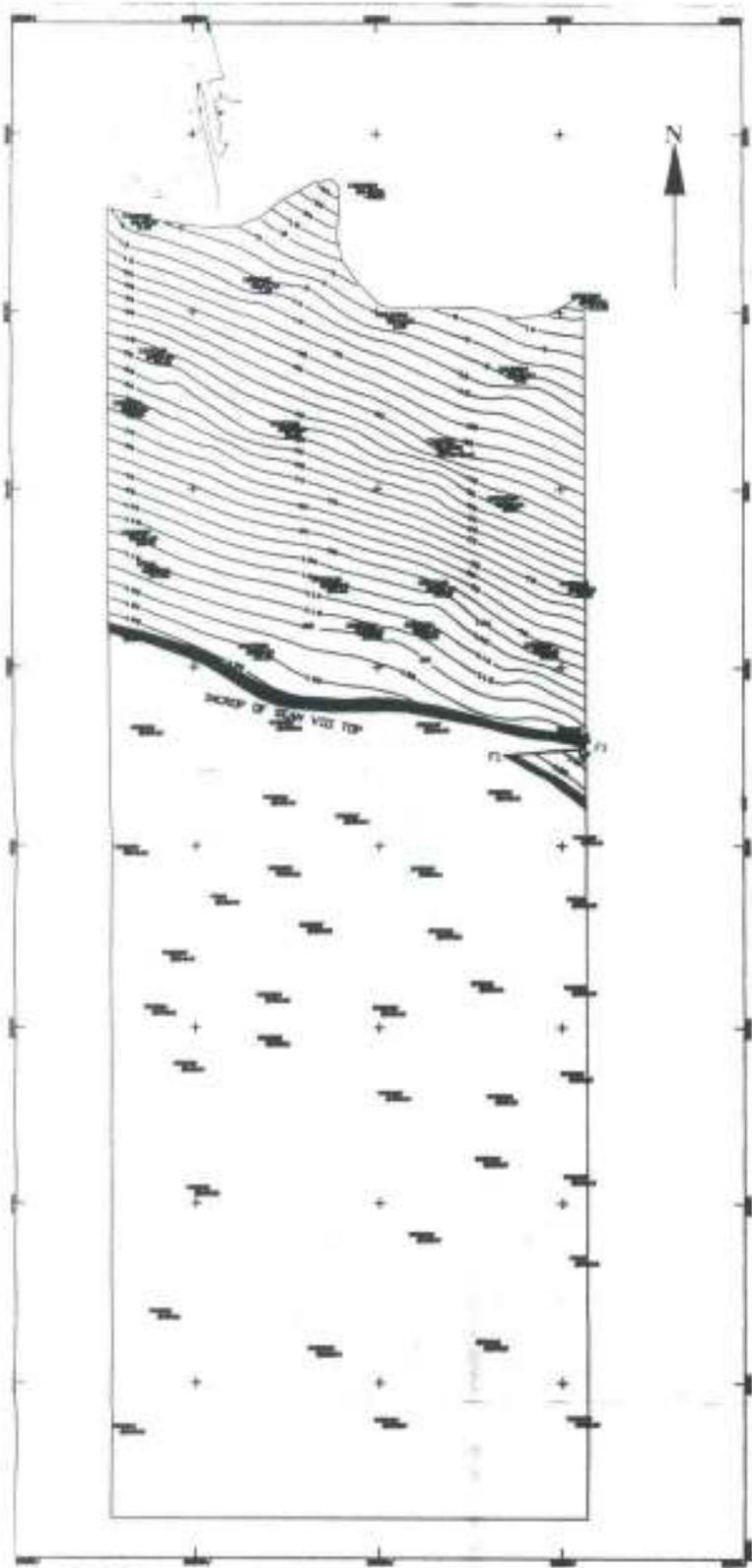


PLATE NO. C-2

NATIONAL ALUMINIUM COMPANY LIMITED	
PROJECT NAME	INDIAN ALUMINIUM PROJECT
PROJECT NO.	1000
SCALE	1:5000
DATE	1955

**INDEX**

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- RIVER
- DAM
- ROAD
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- TELEPHONE
- RAILWAY
- BOUNDARY
- SETBACK OF THE ROAD
- FERRY CROSSING

INDUSTRY OF COAL, GOVT. OF INDIA	
PROJECT NAME	INDIAN ALUMINIUM PROJECT
PROJECT NO.	1000
SCALE	1:5000
DATE	1955

**INDEX**

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INDUSTRY OF COAL, GOVT. OF INDIA	
PROJECT NAME	INDIAN ALUMINIUM PROJECT
PROJECT NO.	1000
SCALE	1:5000
DATE	1955

### Stratigraphic position

Seam attaining the seventeenth level in column from bottom is overlain by the thickest coal seam of the block, namely seam-IX and underlain by seam-VIII Bottom.

### Parting (with overlying seam)

Parting, ranging from 0.28 to 4.70 m is represented dominantly by carbonaceous shale with thin shaly coal/coal bands and grey shale. Parting exhibits low zone, being less than 1 to 2m, in a north-west south-east trending zone in central part and high zone more than 4 m in a patch on the north-east. In rest of the area, parting variations are gradual, in between 2 to 4 m.

### Thickness

The seam depicts uniform thickness, around 3-5m, almost in the entire area with low zone of less than 2 m in thickness on the south-west. Seam is workable in the entire area with extreme effective thickness range of 1.32 to 5.90 m.

### Incrop

Seam incrop, showing WSW-ENE trend is consistent throughout the strike length having around 50 m width on the east which thins down to about 15 m on the west.

### Roof and floor

Roof is mostly constituted of carbonaceous shale with thin shaly coal/ coal bands, while floor is largely made up of carbonaceous shale and grey shale. At places, floor is also represented by intercalations of shale and sandstone and fine grained sandstone.

**Dirt bands**

Out of the 19 boreholes, intersecting the full thickness of the coal seam, only one dirt band of more than 1 m thickness, having maximum thickness of 1.60 m is present in 5 boreholes. Seam, generally contains less than 1 m bands, ranging in number from 1 to 5 and in total thickness from 0.22 to 1.62 m. Seam is free from dirt bands in 4 boreholes. Details of bands are given below:

**Table - 4.75**  
**Dirt band in Seam VIII Top, Utkal-E block, Talcher Coalfield**

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min	Nil	0.20 (CSUE028)	Nil	0.12 (CMTU249)	Nil	0.22 (CMTU145)	Nil	1.15 (CSUE028)
Max	04 (CMTU249, CSUE020 & CSUE023)	1.46 (CMTU249)	02 (CSUE006)	0.55 (CSUE020)	05 (CMTU249, CSUE006 & CSUE020)	1.62 (CSUE020)	01 (CSUE002, 006, 015, 019, 028)	1.60 (CSUE019)

**Proximate Analysis & Gross CV**

Overall analysis results indicate that the seam is generally G to F grade in quality, having improvement up to Grade D in eastern and south-western parts for 1100 sample. Range of various parameters is given below:

**Table - 4.76**  
**Range of Proximate analysis, grade and Gross CV,**  
**Seam VIII Top, Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (kcal/kg)	UHV (kcal/kg)	Grade on UHV
BCS	Range Min.	6.0	19.5	24.3	3580	2207	G
	Range Max.	9.6	42.5	32.2	5310	4967	C
	No. of samples	4	4	4	3	4	4
	A.M.	8.4	30.1	28.7	4390	3598	E
	S.D.	1.6	9.6	3.6	870.2	1138.6	
1100	Range Min.	6.0	19.5	24.0	3580	1696	G
	Range Max.	9.1	46.1	32.2	5310	4967	C
	No. of samples	19	19	4	3	19	19
	A.M.	7.1	38.6	27.5	4390	2593	F
	S.D.	0.9	6.9	4.0	870.2	831.3	

Job No. 7800Q4  
Kumar Mohanty  
Qualified Person  
No. 22C of MCR 1960  
No. 13016/8/2004 CA  
2004 of Dept. of Coal  
& M. Govt. of India

**Ultimate analysis**

Ultimate analysis is available for one borehole sample. The results are given below :

**Table – 4.77**

**Ultimate analysis, VM and CV on dmmf basis, Seam VIII Top,  
Utkal-E block, Talcher Coalfield**

Particulars	V.M.%	C.V. (k. cal/kg)	C%	H%	N%	S%	Oxy% by diff
Min.	42.4	7496	78.59	4.65	3.92	0.74	12.10
Max.	45.9	7738	78.59	4.65	3.92	0.74	12.10
No. of samples	4	3	1	1	1	1	1
A.M.	43.9	7604					
S.D.	1.5	123.2					

**Phosphorus and Carbonate**

Phosphorus and carbonate, as determined for one sample are 0.084% and 1.32% respectively.

**Hardgrove Grindability Index**

HGI determined for two samples are 57 and 61.

**Long flame characteristics**

Values of the various parameters required for ascertaining long flame characters of the coal show that seam marginally belongs to B5 group. The range of parameters is given in table-4.78.

*Kans*  
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 भारत सरकार, नई दिल्ली  
 अधिकांश उद्योग, भारत सरकार  
 कोयला विभाग, भारत सरकार  
 नई दिल्ली

*Kans*  
**Udaya Kumar Mohanty**  
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 Vide letter No. 13016/8/2004 CA,  
 Dt. 1.9.2004 of Dept. of Coal,  
 MOC & M. Govt. of India

**Table – 4.78**  
**Long flame parameters of Seam VIII Top, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in kcal/kg			
	BCS	I100	BCS	I100	BCS	I100
Range Min.	42.4	42.4	7496	7496	11.3	11.3
Range Max.	45.9	45.9	7738	7738	13.7	13.4
No. of samples	4	4	3	3	4	20
A.M.	43.9	44.2	7604	7604	12.5	12.3
S.D.	1.5	1.5	123.2	123.2	1.3	0.5
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

**Ash fusion temperature range**

Data available for various stages of coal ash fusion is given below:

**Table – 4.79**  
**Ash fusion temperature range, Seam VIII Top, Utkal-E block, Talcher Coalfield**

Sample type	Particulars	Ash fusion range (at MRA) °C		
		IDT	HT	FT
BCS/I100	Range	1240 – 1270	1310 – 1340	+ 1400
	No. of samples	2	2	2

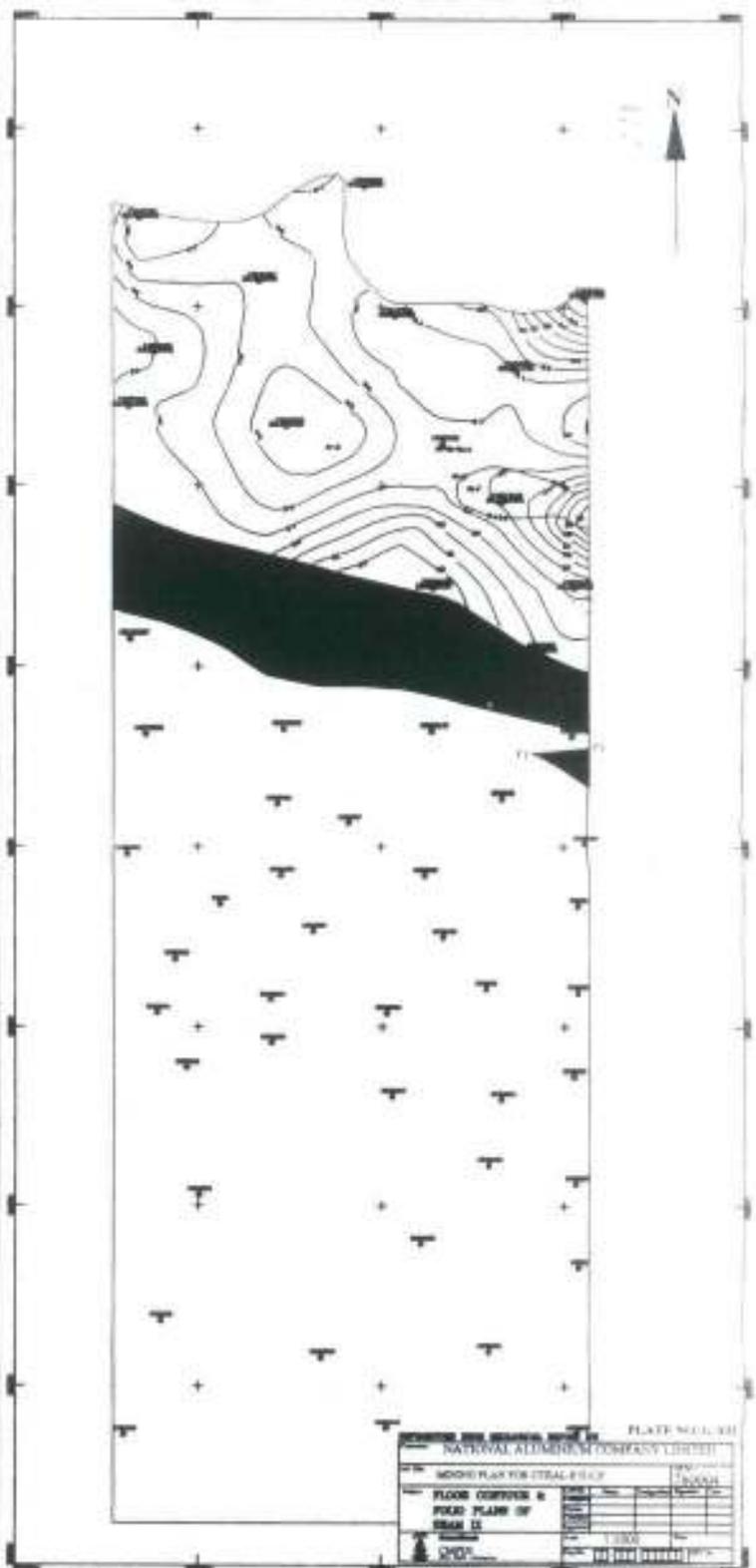
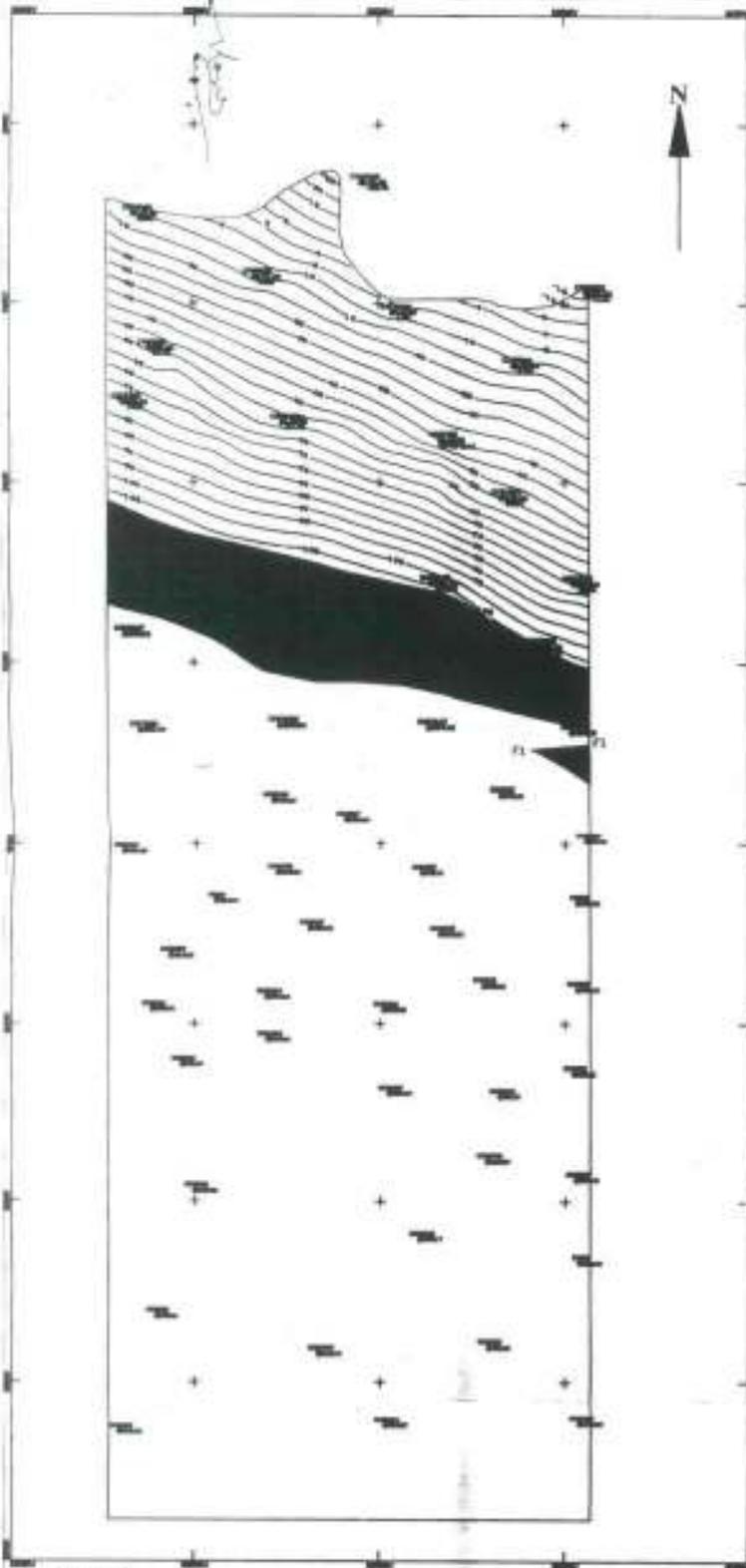
**Summary of seam parameters and special observations**

Seam incrop is also available along full strike length. Effective seam thickness ranges from 1.32 to 5.90 m with extreme quality variations from Grade G to C. General thickness and quality of the seam is 3 to 5 m and G to F grade respectively. Coal seam marginally satisfies the stipulated norms of B5 group of long flame coal.

**4.30 SEAM-IX (Ref. plate G-XII & G-XVII)**

**A. Intersections:**

- i) No. of full seam intersections in boreholes : 13 Nos.
- ii) No. of incrop proving boreholes with part thickness : 06 Nos.
- iii) No. of boreholes with part thickness due to faulting : Nil
- iv) No. of boreholes where seam is totally omitted due to fault : Nil
- v) No. of boreholes where seam is not encountered due to non-development : Nil
- vi) Total area occurrence : 1.5406km<sup>2</sup>
- vii) Total workable area : 1.4909km<sup>2</sup>  
(96.8%)



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- FLOOR MINERAL LEVEL IN METRE
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- FAULT WITH SHOWN

MINISTRY OF COAL, GOVT. OF INDIA	
NATIONAL ALUMINIUM COMPANY LIMITED	
BLOCK PLAN FOR CTRAL BLOCK	
FLOOR CONTOUR & FLOOR PLAN OF BLOCK II	
SCALE	
C.M.P.D.I.	

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MINISTRY OF COAL, GOVT. OF INDIA	
NATIONAL ALUMINIUM COMPANY LIMITED	
BLOCK PLAN FOR CTRAL BLOCK	
FLOOR CONTOUR & FLOOR PLAN OF BLOCK II	
SCALE	
C.M.P.D.I.	

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Recognised Qualified Person  
Under Rule 23r

<b>B.</b>	<b>Depth of intersections (roof):</b>	
i)	Shallowest	: 18.12 m (CSUE021)
ii)	Deepest	: 139.50 m (CSUE009)
<b>C</b>	<b>Floor reduced levels:</b>	
i)	Minimum	: 138.52 m (CSUE028)
ii)	Maximum	: -28.75 m (CSUE009)

#### Stratigraphic position

Seam IX is the thickest seam of the area and is preserved at eighteenth position from bottom and third position from top in the column. It lies in between Seams X and Seam VIII Top.

#### Parting (with overlying seam)

Parting with overlying seam ranges from 30.37 to 53.50m and characterised by the arenaceous sediment mainly medium to fine grained sandstone. Coarse grained sandstone and intercalations of shale and sandstone rarely occur as parting. Parting is maximum (more than 50 m) in a north-west and south-east trending narrow zone in northern part with reducing trends towards all directions. It becomes less than 40 m in south-western part and in between 40 to 50 m in the remaining area.

#### Thickness

Stratigraphic thickness of the seam varies from 25.19 to 34.52 m while effective thickness ranges from 19.30 to 32.22 m. Seam is thickest at the north-eastern corner showing decreasing trends towards west and south. Thickness of the seam is largely in between 24 to 27 m in the entire area except in central part in updip regions where it is less than 20m. In incrop region effective thickness ranges from 3.00 to 20.55 m.

**Incrop**

Seam incrop, measuring about 1350 m strike length is spread over around 25% area of the seam occurrence. Width of the incrop is about 300 m on west, becomes slightly more in central part and then reduces to less than 200 m on the east.

**Roof and floor**

Roof and floor of the seam are mostly composed of carbonaceous shale with thin shaly coal / coal bands. Grey shale also constitutes roof at places.

**Dirt bands**

Seam is highly banded. In full thickness zone, seam contains 1 to 4 number more than 1 m bands with the cumulative thickness of 1.80 to 5.89 m and sharing 6 to 23% of seam thickness. Less than 1 m thick bands ranging in number and total thickness from 8 to 21 and 2.96 to 6.24 respectively, occupy 12 to 22% of seam thickness. All the bands are generally composed of carbonaceous shale with thin shaly coal / coal bands and occasionally grey shale. In incrop zone, more than 1 m bands are nil to 2 in number with total thickness ranging from 1.48 to 4.05 m & share 34% of seam thickness. Less than 1m bands are present in all boreholes, in 3 to 14 numbers with total thickness of 1.05 to 5.22 m and share 11 to 24% of seam thickness. Details of band for full seam thickness zone and incrop zone are given below:

**Table – 4.80**  
**Dirt band in Seam IX, Utkal-E block, Talcher Coalfield**

**Full thickness zone:**

	Dirt bands							
	< 1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	05 (CMTU145)	2.20 (CMTU145)	Nil	0.25 (CSUE012)	08 (CMTU145)	2.96 (CMTU145)	01 (CSUE002, 015, & 023)	1.80 (CSUE002)
Max.	15 (CMTU249, CSUE003, 006, 012 & 023)	5.74 (CSUE023)	06 (CSUE021)	1.56 (CSUE021)	21 (CMTU249)	6.24 (CSUE003)	04 (CSUE004)	5.89 (CMTU145)

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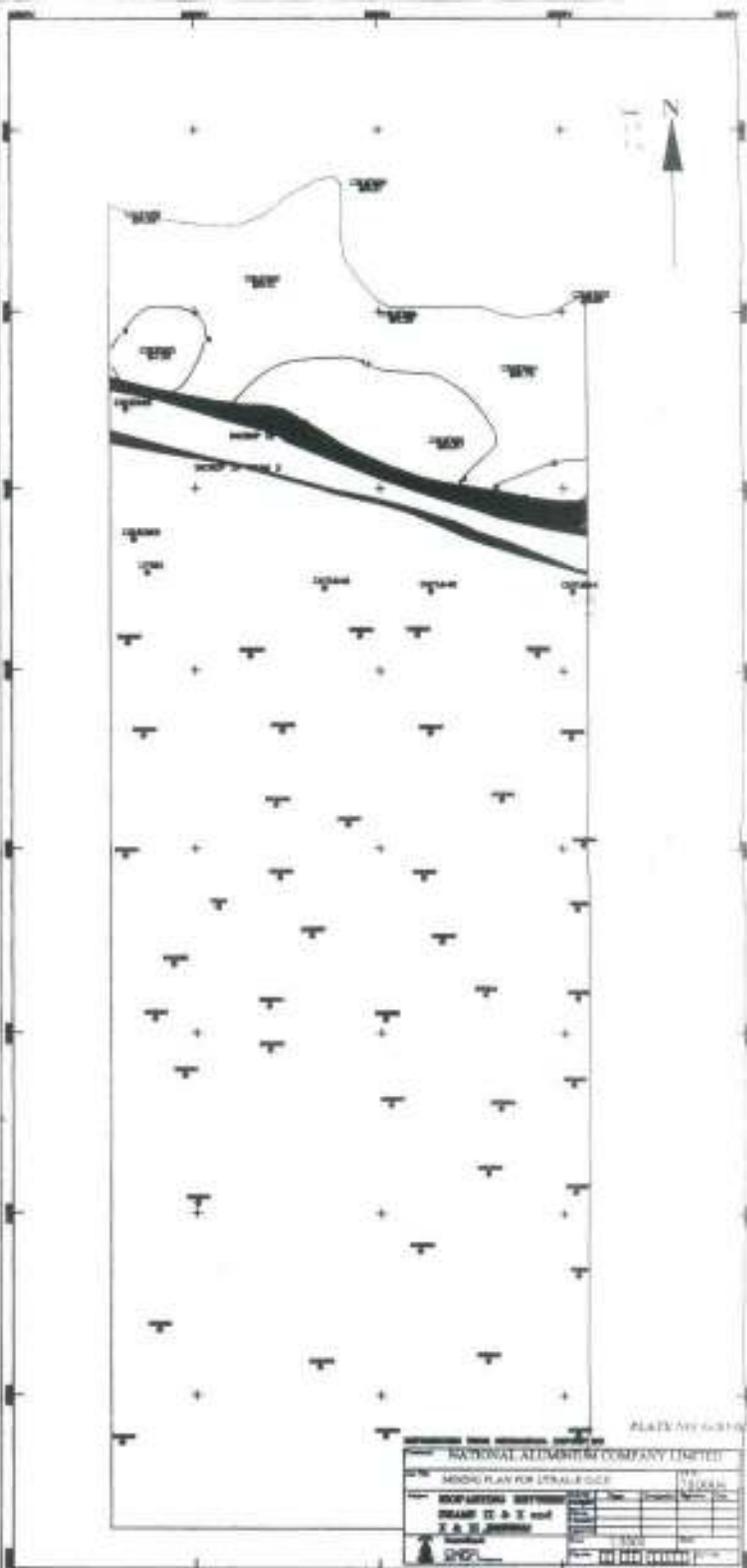
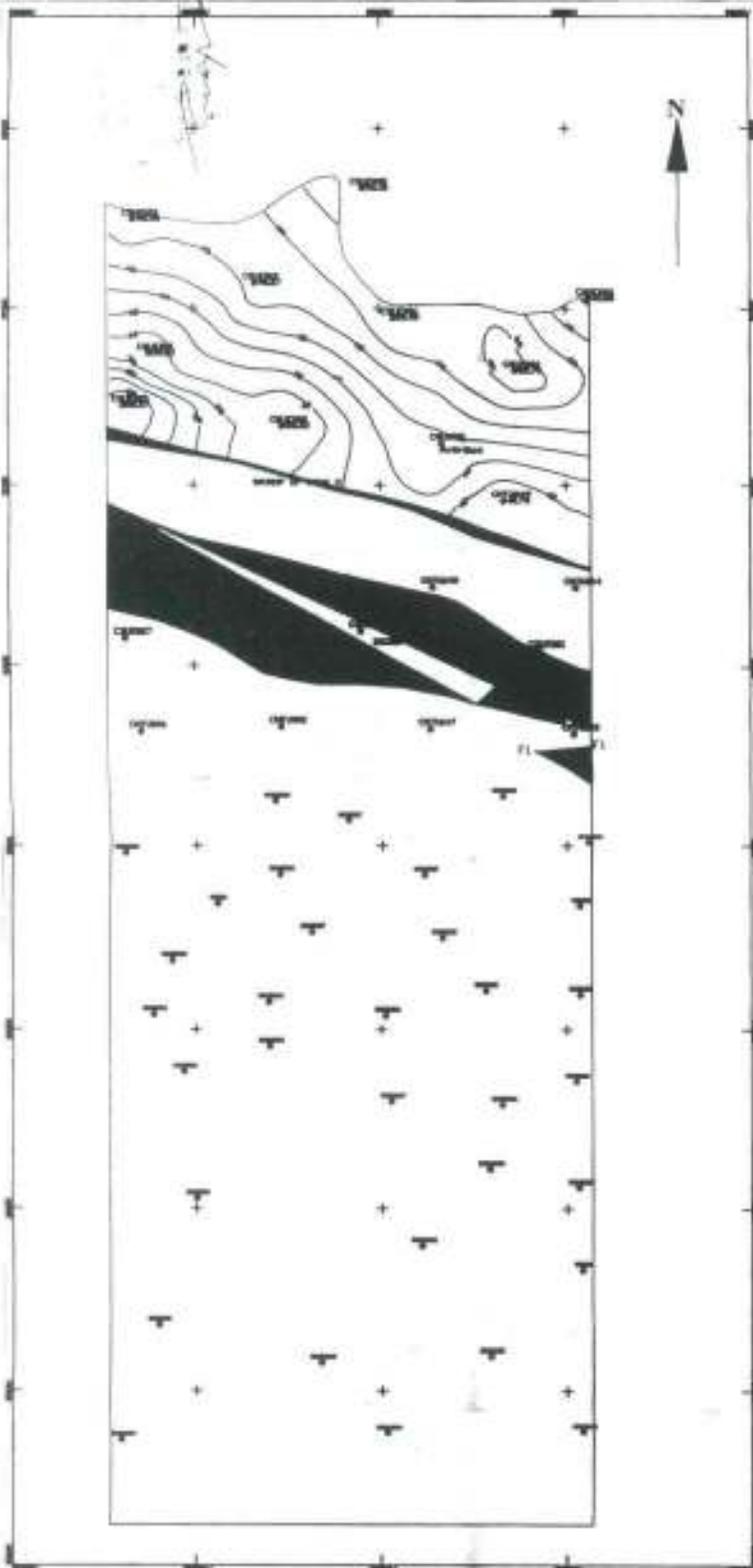


PLATE No. 6310

NATIONAL ALUMINIUM COMPANY LIMITED	
MODELS FOR LITERATURE	
DESIGNATION	SCALE
DATE	NO.
DRAWN BY T. A. S. JAYARAM	
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MINISTRY OF GOVT. OF INDIA	
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DATE	NO.
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MINISTRY OF GOVT. OF INDIA	
NATIONAL ALUMINIUM COMPANY LIMITED	
MODELS FOR LITERATURE	
DESIGNATION	SCALE
DATE	NO.
DRAWN BY T. A. S. JAYARAM	
C.M.P.D.I.	

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**Incrop zone (part thickness) :**

	Dirt bands							
	- 1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	01 (CSUE028)	0.70 (CSUE028)	01 (CSUE019)	0.26 (CSUE019)	03 (CSUE028)	1.05 (CSUE028)	Nil	1.40 (CSUE029)
Max.	11 (CSUE029)	4.14 (CSUE029)	08 (CMTU146, UT021)	2.46 (CMTU146)	14 (CSUE029)	5.22 (CSUE029)	02 (CMTU146, UT021 & CSUE019)	4.05 (CSUE019)

**Proximate Analysis & Gross CV**

Overall analysis data available for full seam thickness zone reveals that seam is largely of Grade G in quality on I<sub>100</sub> basis. The seam is of Grade F in a limited area on the east. In the incrop zone also, seam is grade G in quality. Range of various quality parameters for full thickness and part thickness in incrop zone is furnished below:

**Table – 4.81**  
**Range of Proximate analysis, grade and Gross CV,**  
**Seam IX, Utkal-E block, Talcher Coalfield**

**Full thickness zone:**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k. cal/kg)	UHV (k. cal/kg)	Grade on UHV
BCS	Range Min.	6.5	33.0	26.6	3330	2580	F
	Range Max.	7.4	38.4	28.3	3330	3449	E
	No. of samples	2	2	2	1	2	2
	A.M.	7.0	35.7	27.5	-	3015	F
	S.D.	0.6	3.8	1.2	-	614.5	
I100	Range Min.	5.0	38.7	24.8	4350	1310	G
	Range Max.	7.3	49.2	24.8	4350	2552	F
	No. of samples	13	13	2	1	13	13
	A.M.	6.3	45.3	24.8		1779	G
	S.D.	0.6	2.9	-		333.7	
IP	Range Min.	6.7	46.8	24.4		1517	G
	Range Max.	6.7	46.8	24.4		1517	G
	No. of samples	1	1	1		1	1

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**Incrop zone (part thickness):**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k. cal/kg)	UHV (k. cal/kg)	Grade on UHV
BCS	Range Min.	7.6	41.3	25.4	3500	2152	G
	Range Max.	7.6	41.3	25.4	3500	2152	G
	No. of samples	1	1	1	1	1	1
I100	Range Min.	5.7	42.6	23.8	3020	1227	UG
	Range Max.	6.7	49.9	23.8	3020	2097	G
	No. of samples	6	6	1	1	6	6
	A.M.	6.4	46.0			1674	G
	S.D.	0.4	2.7			330	
IP	Range Min.	6.5	49.8	22.7	2795	1131	UG
	Range Max.	6.5	49.8	22.7	2795	1131	UG
	No. of samples	1	1	1	1	1	1

**Ultimate analysis**

Ultimate analysis is available only from one borehole. Volatile matter and calorific value on "dmmf" basis and details of ultimate analysis are given below:

**Table - 4.82**  
**Ultimate analysis, VM and CV on dmmf basis, Seam IX,**  
**Utkal-E block, Talcher Coalfield**

Particulars	V.M.%	C.V. (k. cal/kg)	C%	H%	N%	S%	Oxy% by diff
Min.	43.7	7452	78.52	4.63	1.81	0.72	14.32
Max.	45.3	7715	78.52	4.63	1.81	0.72	14.32
No. of samples	3	2	1	1	1	1	1
A.M.	44.7	7584					
S.D.	0.9	186.0					

**Phosphorus and Carbonate**

Phosphorus and carbonate contents are 0.111% and 1.17% respectively

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### Hardgrove Grindability Index

Hardgrove grindability index, as determined for one sample on I<sub>100</sub> basis is 61.

### Long flame characteristics

Parameters, calculated for ascertaining long flame characteristics, indicate that seam may contain B5 group of coal upto some extent. Details are given below:

**Table – 4.83**  
**Long flame parameters of Seam IX, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg		BCS	I100
	BCS	I100	BCS	I100		
Range Min.	43.7	45.8	7452	7240	10.2	10.4
Range Max.	45.3	46.6	7715	7730	13.9	13.8
No. of samples	3	3	2	2	3	19
A.M.	44.7	46.3	7584	7485	12.3	12.7
S.D.	0.9	0.4	186.0	347	1.9	0.7
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

### Ash fusion temperature range

Ash fusion temperature range determined under mild reducing atmosphere for one sample is given below:

**Table – 4.84**  
**Ash fusion temperature range, Seam IX, Utkal-E block, Talcher Coalfield**

Sample type	Particulars	Ash fusion range (at MRA) °C		
		IDT	HT	FT
I100	Range	1290	1340	+ 1400
	No. of samples	1	1	1

### Summary of seam parameters and special observations

Seam IX, the thickest seam of block, ranging in thickness from 25 to 34 m in dip side areas is highly banded. The seam contains 1-4 bands of more than 1 m with cumulative thickness to a maximum of 5.89 m whereas less than 1 m bands are 8 to 21 in number with the maximum thickness of 6.24 m. The effective thickness,

in full thickness zone is around 24 m on an average. The seam largely contains Grade G showing improvement to Grade F in a limited area on the east.

Seam incrops in the entire strike length with the width about 300 m on the west and less than 200 m on the east. In incrop zone seam contains G grade coal. Incrop occupies about 25% area of seam occurrence. Seam may contain B5 group of long flame coals upto some extent. This is the main seam which substantially contributes power grade coal reserve.

4.31 **SEAM-X (Ref. plate G-XIII & G-XVII)**

**A. Intersections:**

i)	No. of full seam intersections in boreholes	: 11 Nos.
ii)	No. of incrop proving boreholes with part thickness	: Nil
iii)	No. of boreholes with part thickness due to faulting	: Nil
iv)	No. of boreholes where seam is totally omitted due to fault	: Nil
v)	No. of boreholes where seam is not encountered due to non development.	: Nil
vi)	Total area of occurrence	: 0.8639km <sup>2</sup>
vii)	Total workable area	: 0.7752km <sup>2</sup> (89.7%)

**B. Depth of intersections (roof):**

i)	Shallowest	: 15.05 m (CSUE003)
ii)	Deepest	: 82.60 m (CSUE009)

**C. Floor reduced levels:**

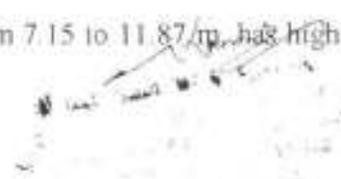
i)	Minimum	: 133.51 m (CSUE0003)
ii)	Maximum	: 54.35 m (CSUE009)

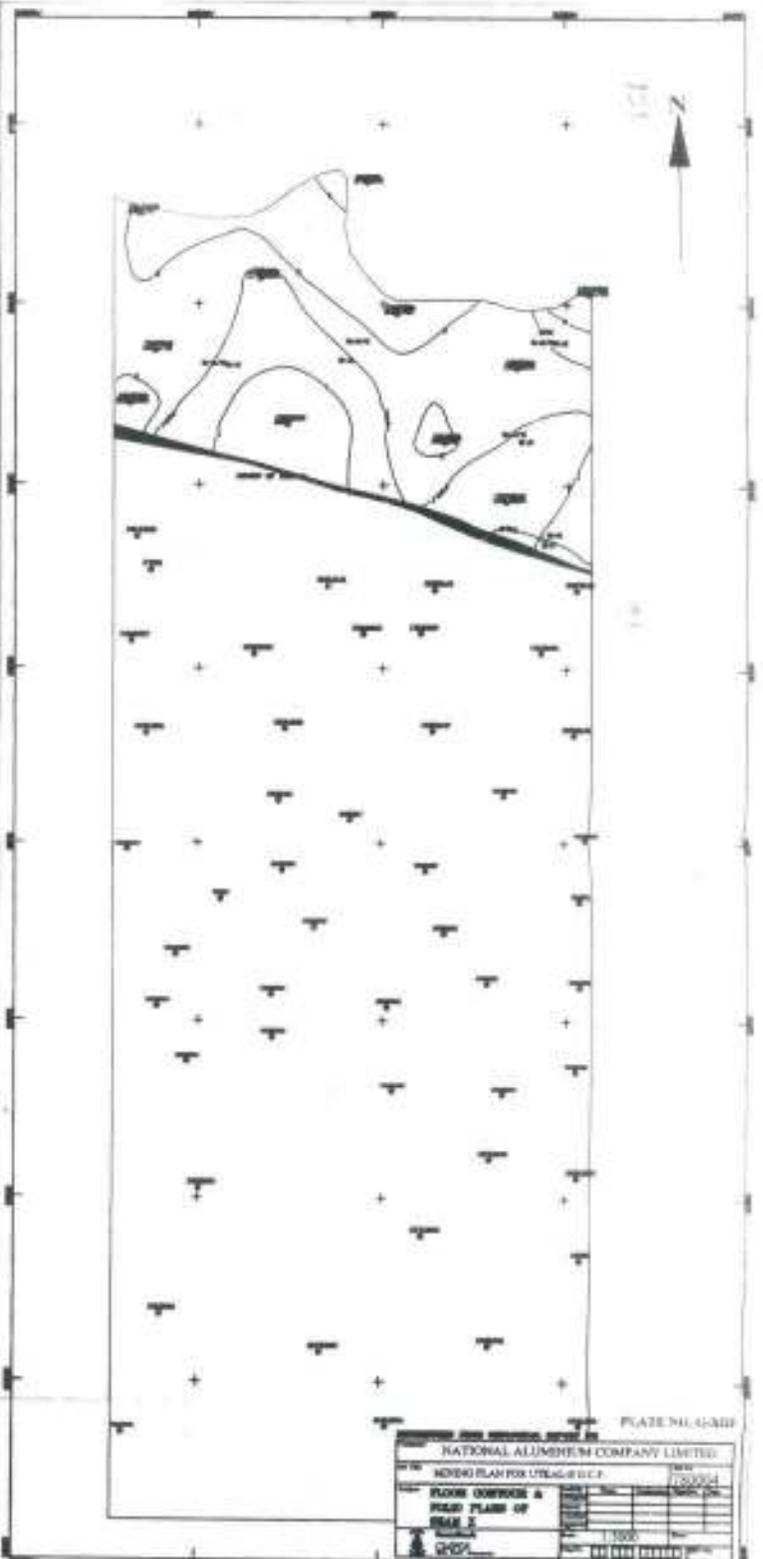
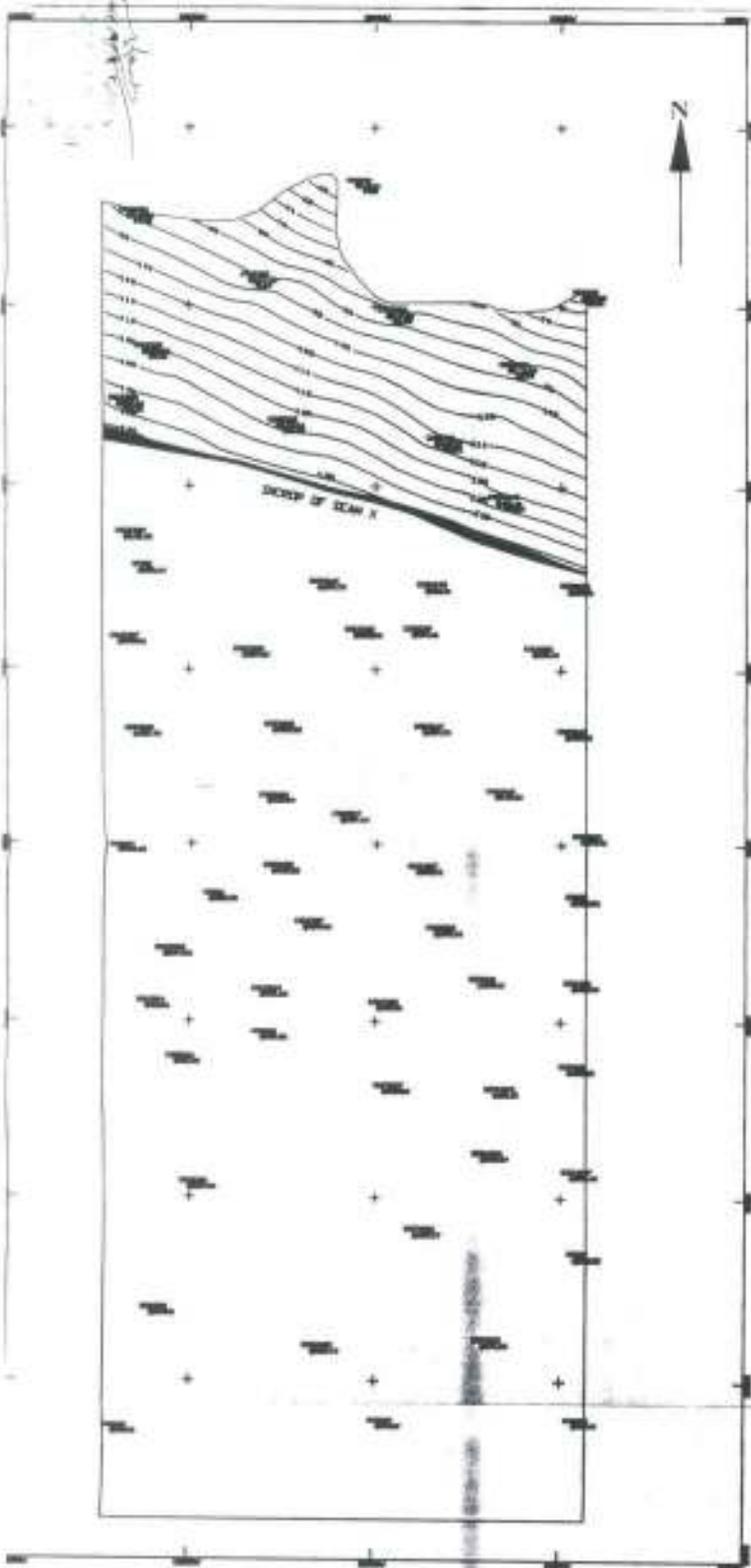
**Stratigraphic position**

Seam lies at the nineteenth position from bottom, in the sequence of coal seams. It is preserved in between overlying seam-XI and underlying seam-IX.

**Parting (with overlying seam)**

Parting is mainly constituted of grey shale and intercalations of shale and sandstone. Parting ranging in thickness from 7.15 to 11.87 m, has high thickness





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CMPDI COAL MINING DIVISION	

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MINISTRY OF COAL, GOVT. OF INDIA NATIONAL BUREAU OF GEOL. & MIN. SURVY PLATE NO. 4423	
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CMPDI COAL MINING DIVISION	

*Udaya Kumar Mohanty*  
 Udaya Kumar Mohanty  
 Recognized Qualified Person

zone (more than 10 m) in central part, from where it reduces in all directions. In northern most part parting is around 9 m while on south-western and south-eastern parts, it is less than 8 m.

### Thickness

Seam thickness ranges from 0.40 to 3.40 m. Seam becomes less than 2 m in eastern and western parts and less than 1 m near incrop in central and south-eastern parts. Workable thickness is from 1.02 to 3.40 m.

### Incrop

Seam incrops along the entire strike length. Width of the incrop is more on the west in comparison to the east.

### Roof and floor

Roof is characterised by the carbonaceous shale with thin shaly coal/ coal bands. Alternate bands of shale and sandstone, sandy shale and grey shale generally constitute the floor.

### Dirt bands

Seam is free from dirt bands of 1m and above in thickness. Number and cumulative thickness of less than 1 m bands ranges from 1 to 4 and from 0.17 to 0.95 m respectively. Seam is also found free from bands in few cases. Details of bands are given in table-4.85.

Table - 4.85  
Dirt band in Seam X, Utkal-E block, Talcher Coalfield

Range	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	Nil	0.10 (CSUE001)	Nil	0.17 (CMTU249)	Nil	0.17 (CMTU249)	Nil	Nil
Max.	02 (CSUE020)	0.32 (CSUE020)	03 (CSUE009)	0.80 (CSUE009)	04 (CSUE009)	0.95 (CSUE009)	Nil	Nil

Job No.: 780004

Utkal Coalfield  
Talcher Coalfield  
Secretary  
Ministry of Coal  
Government of India  
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Vide letter No. 13016/8/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
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**Proximate Analysis & Gross CV**

Based on overall analysis data, for including band samples, seam is ungraded in quality in the northern part improving to Grade G in north-eastern and in updip region. In incrop region seam is largely ungraded.

**Table - 4.86**  
**Range of Proximate analysis, grade and Gross CV,**  
**Seam X, Utkal-E block, Talcher Coalfield**

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k cal/kg)	UHV (k cal/kg)	Grade on UHV
BCS	Range Min	7.2	35.6	23.9	3850	2138	G
	Range Max	7.4	41.7	27.6	3850	2994	F
	No. of samples	4	4	4	1	4	4
	A.M	7.3	38.4	26.3	-	2597	F
	S.D.	0.1	3.0	1.7		408	
I100	Range Min	5.5	41.4	21.6	2500	703	UG
	Range Max	7.3	53.9	25.8	2500	2304	G
	No. of samples	10	10	4	1	10	10
	A.M	6.0	50.2	22.8		1138	UG
	S.D	0.5	4.2	2.0		523	

**Ultimate analysis and special tests**

At present, results of ultimate analysis are available for one borehole only which are as follows:

**Table - 4.87**  
**Ultimate analysis, VM and CV on dmmf basis, Seam X,**  
**Utkal-E block, Talcher Coalfield**

Particulars	V.M.%	C.V. (k cal/kg)	C%	H%	N%	S%	Oxy% by diff.
Min.	37.9	7294	77.20	5.00	1.90	2.00	13.90
Max.	49.6	7315	77.20	5.00	1.90	2.00	13.90
No. of samples	4	2	1	1	1	1	1
A.M.	44.7	7305					
S.D.	4.9	14.8					

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### Long flame characteristics

Coal seam does not satisfy the stipulated parameters of long flame coals. Range of various parameters is given below:

**Table - 4.88**  
**Long flame parameters of Seam X, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg		BCS	I100
	BCS	I100	BCS	I100		
Range Min.	37.9	37.4	7294	6686	11.8	11.8
Range Max.	49.6	48.8	7315	7078	13.5	14.6
No. of samples	4	4	2	2	4	10
A.M.	44.7	44.6	7305	6882	12.7	13.5
S.D.	4.9	5.0	14.8	277.2	0.8	0.7
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

### Summary of seam parameters and special observations

It is a thin seam in comparison to the overlying and underlying seams and ranges in effective thickness from 0.40 to 3.40 m. Seam is less than 1m only in the close vicinity of the incrop, in central part and south-eastern part. It incrops over the entire strike length. Seam is free from 1m and above dirt bands and contains only 1 to 4 less than 1m bands with the maximum cumulative thickness of 0.95 m. In some cases seam does not contain dirt bands. Seam is mostly ungraded in the property. Coal quality also improves to Grade G in limited area.

4.32

### SEAM - XI (Ref. plates G-XIV)

#### A. Intersections:

- |      |  |                                   |
|------|--|-----------------------------------|
| i)   | No. of full seam intersections in boreholes                            | : 08 Nos.                         |
| ii)  | No. of incrop proving boreholes with part thickness                    | : 02 Nos.                         |
| iii) | No. of boreholes with part thickness due to faulting                   | : Nil                             |
| iv)  | No. of boreholes where seam is totally omitted due to fault            | : Nil                             |
| v)   | No. of boreholes where seam is not encountered due to non development. | : Nil                             |
| vi)  | Total area of occurrence   | : 0.7529km <sup>2</sup>           |
| vii) | Total workable area  | : 0.7529km <sup>2</sup><br>(100%) |

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<b>B.</b>	<b>Depth of intersections (roof):</b>	
i)	Shallowest	18.52 m (CSUE001)
ii)	Deepest	65.28 m (CSUE009)
<b>C.</b>	<b>Floor reduced levels:</b>	
i)	Minimum	136.59 m (CSUE002)
ii)	Maximum	65.90 m (CSUE009)

**Stratigraphic position**

Seam XI, the youngest and topmost seam of Barakar Formation having twentieth position in the column in ascending order, overlies seam-X.

**Parting (with overlying seam)**

Seam is overlain by 18.52 to 65.28 m thick strata containing soil, alluvium and weathered rocks in upper part. The strata below weathered rock is mainly composed of medium to coarse grained sandstone with intercalations of shale and sandstone. Fine grained sandstone and grey shale are rarely present. In incrop zone, overlying strata is 8.00 to 11.55 m thick having soil, alluvium and weathered strata.

**Thickness**

Stratigraphic and effective thickness of the seam ranges from 1.15 to 9.56 m and 1.15 to 6.89 m respectively for full thickness. Effective thickness is more than 5 m in the northernmost area and reduces towards south and north-east. Seam thins down to around 3 m on south east, north-east and to less than 1 m on the south-west. In incrop area 3.64 and 1.05 m part effective thickness has been intersected in two boreholes only.

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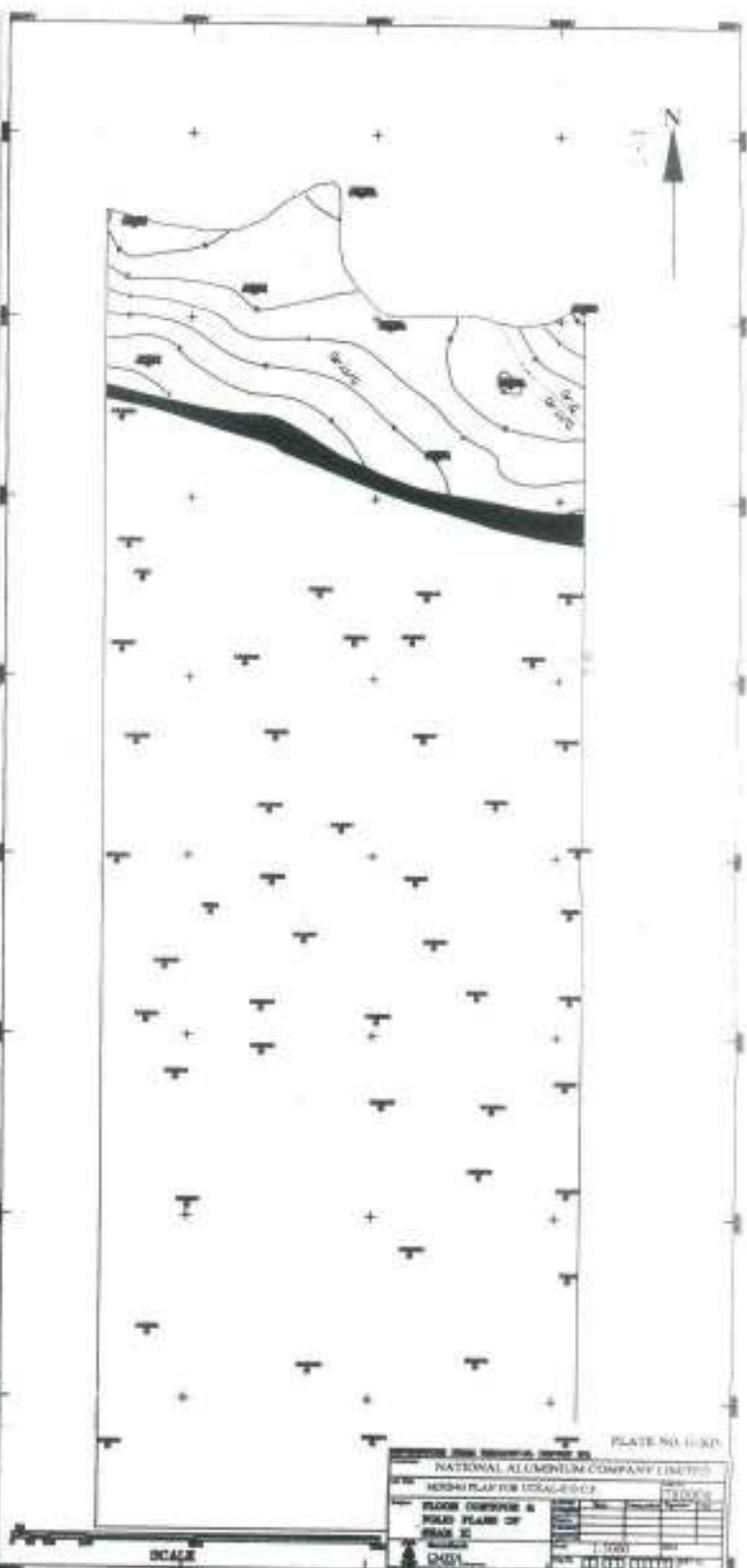
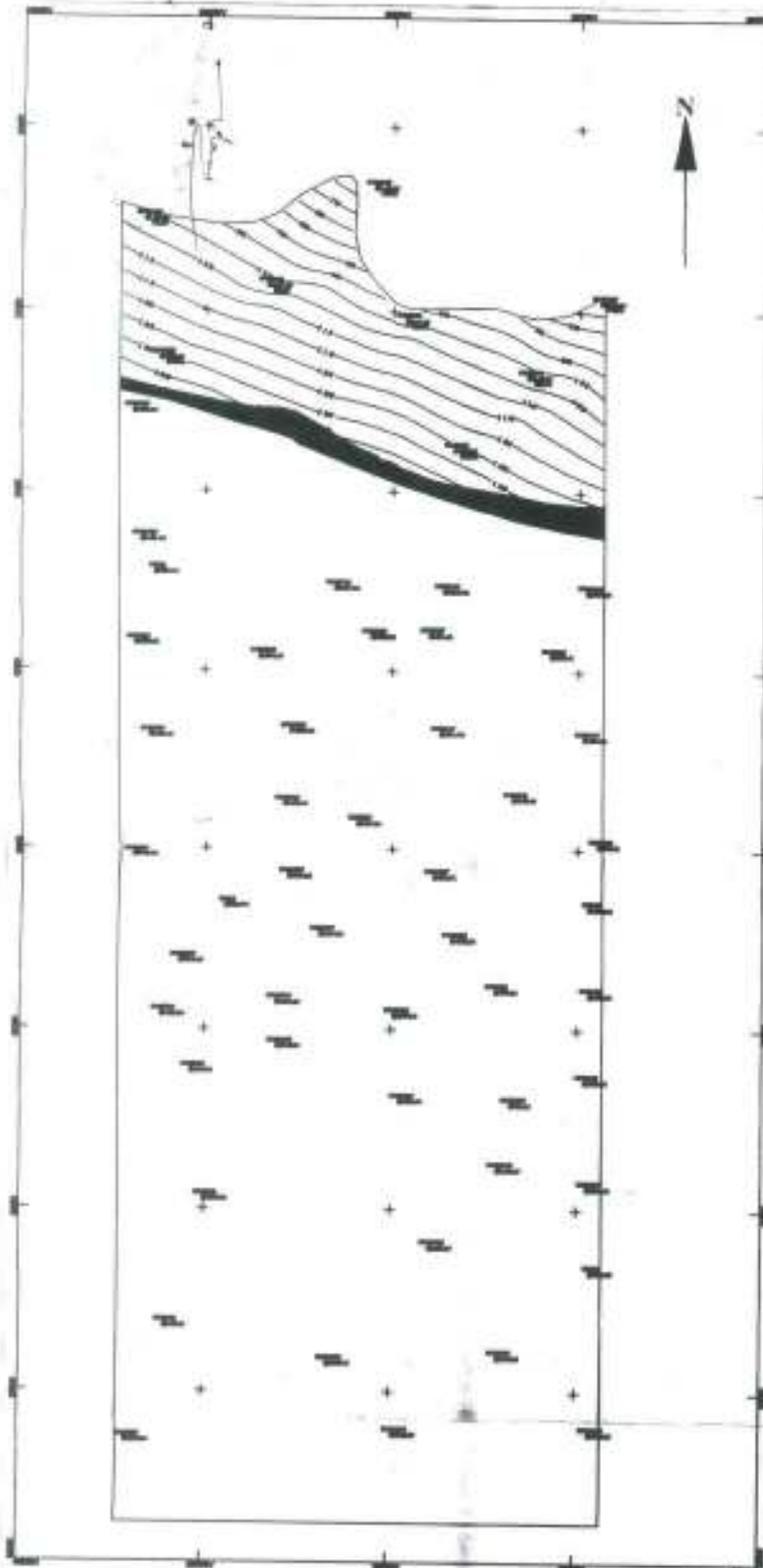


PLATE NO. 1000  
 NATIONAL ALUMINIUM COMPANY LIMITED  
 FLOOR CONTOUR & ROAD PLAN OF ROAD NO. 1000  
 SCALE 1:5000  
 DATE 10/11/2004

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Geological Report of Ural & Block, Talcher Coalfield, Orissa.

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### Incrop

Seam incrops along the entire strike length. The incrop occupies around 100 m width on the east, which narrows down to about 50 m and again becomes about 75 m in central part. Further, width of incrop decreases to the extent of about 25 m on the west.

### Roof and floor

Roof of seam is represented by carbonaceous shale with thin shaly coal/coal bands and grey shale. Carbonaceous shale, grey shale and alternate band of shale and sandstone usually form the floor.

### Dirt bands

Seam contains 1 to 2 number dirt bands having thickness more than 1m with the cumulative thickness variation of 1.05 to 4.52 m. Such bands share 13 to 50% height of the seam. Seam is also free from such bands in two boreholes. Number of less than 1 m bands reaches to a maximum of 9 with the total maximum thickness of 2.59 m. These bands occupy 13 to 33% of seam thickness. All bands are composed of carbonaceous shale with shaly coal / coal bands, grey shale. Details of bands are given below:

Table - 4.89

Dirt band in Seam XI, Utkal-E block, Talcher Coalfield

	Dirt bands							
	<1m thick						1m & above thick	
	Combustible		Non-combustible		Total		No.	Thickness
	No.	Thickness	No.	Thickness	No.	Thickness		
Min.	Nil	0.15 (CSUE001)	Nil	0.15 (CSUE015)	Nil	0.15 (CSUE015)	Nil	1.05 (CSUE020)
Max.	05 (CSUE004)	1.39 (CSUE020)	05 (CSUE020)	1.20 (CSUE020)	09 (CSUE004 & 020)	2.59 (CSUE020)	02 (CSUE006 & 009)	4.52 (CSUE006)

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**Proximate Analysis & Gross CV**

Based on overall proximate analysis seam is ungraded in the entire block except in north-eastern corner where quality improves to Grade G for I100 sample.

**Table - 4.90**  
Range of Proximate analysis, grade and Gross CV,  
Seam XI, Utkal-E block, Talcher Coalfield

	Particulars	On 60% RH & 40°C					
		M%	A%	V.M.%	C.V. (k cal/kg)	UHV (k cal/kg)	Grade on UHV
BCS	Range Min.	7.0	40.3	24.6	3490	1710	G
	Range Max.	7.4	45.1	26.9	3490	2317	G
	No. of samples	3	3	3	1	3	3
	A.M.	7.2	42.9	25.6		1981	G
	S.D.	0.2	2.4	1.2		309	
I100	Range Min.	5.9	43.3	21.8	2425	510	UG
	Range Max.	7.3	54.7	25.2	2425	1917	G
	No. of samples	8	8	3	1	8	8
	A.M.	6.4	50.7	23.0		1022	UG
	S.D.	0.5	3.6	1.9		435	
IP	Range Min.	5.4	53.2	20.2	1995	13	UG
	Range Max.	6.3	59.0	22.3	1995	689	UG
	No. of samples	2	2	2	1	2	2
	A.M.	5.9	56.1	21.3		351	UG
	S.D.	0.6	4.1	1.5		478	

**Ultimate analysis**

Data available for ultimate analysis is given below:

**Table - 4.91**  
Ultimate analysis, VM and CV on dmmf basis, Seam XI,  
Utkal-E block, Talcher Coalfield

Particulars	V.M.%	C.V. (i. cal/kg)	C%	H%	N%	S%	Oxy% by diff.
Min.	46.3	7230	79.80	5.30	2.10	0.60	12.20
Max.	47.4	7294	79.80	5.30	2.10	0.60	12.20
No. of samples	3	2	1	1	1	1	1
A.M.	46.7	7262	-	-	-	-	-
S.D.	0.6	45.3	-	-	-	-	-

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### Long flame characteristics

Seam does not contains long flame characteristics. Data calculated for ascertaining long flame characteristics is given below:

**Table - 4.92**

**Long flame parameters of Seam XI, Utkal-E block, Talcher Coalfield**

Particulars	On dmmf basis				Moisture % at 60% RH & 40°C (on mineral free basis)	
	V.M. %		Gross C.V. in k. cal/kg		BCS	I100
	BCS	I100	BCS	I100		
Range Min.	46.3	46.1	7230	7189	13.3	13.9
Range Max.	47.4	48.4	7294	7272	13.9	15.3
No. of samples	3	3	2	2	3	3
A.M.	46.7	46.9	7262	7231	13.7	14.5
S.D.	0.6	1.3	45.3	58.7	0.3	0.7
Long flame parameters for B5 bituminous coal	Over 32		7500-8000		7-14	

### Summary of seam parameters and special observations

Effective thickness of the seam generally varies from 3 to 5 m. However, the extreme range is 1.15 to 6.59 m. Seam is more than 5 m thick in a small area in northern part and thins down to around 3 m in south-eastern and north-eastern parts. At south-western corner thickness reduces to less than 1 m. Seam incrops all along the strike length. On I100 basis seam contains ungraded coal in the entire block with the exception in north-eastern corner where quality improves to Grade G. Seam does not satisfy the stipulated parameter of long flame coal.

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### QUALITY OF COAL SEAMS

Various quality parameters of all the coal seams viz. IIA to XI are summarised below in table- 4.93.

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**Table - 4.93**  
**Summarized Quality Details of the Coal Seams**

Coal Seams Parting	Thickness (m)		Depth of occurrence (roof)		Proximate analysis for T <sub>20</sub> samples on 60% RH & 40° C				Gross CV Kcal/kg	UHV Kcal/kg	Grade on UHV
	Stratigraphic	Effective	From (m)	To (m)	MP%	AP%	VMP%	LVMP%			
XI	1.15-9.56	1.15-6.89	18.52	65.28	5.9-7.3	43.3-54.7	21.8-25.2	46.1-48.4	2425	510-1917	UG-G
Parting	7.15-11.87										
X	0.40-3.40	0.40-3.40	15.05	82.60	5.5-7.3	41.4-53.9	21.6-25.8	37.4-48.8	2500	703-2304	UG-G
Parting	30.37-53.50										
IX	25.19-34.52	19.30-32.22	18.12	129.50	5.0-7.3	38.7-49.2	24.8	45.8-46.0	4350	1510-2552	G-E
Parting	0.28-4.70										
VIII Top	1.32-6.53	1.32-5.90	19.70	171.45	6.0-9.1	19.5-46.1	24.0-32.2	42.4-45.9	3580-5710	1696-4967	G-C
Parting	0.50-15.83										
VIII Bot	0.00-3.35	0.00-3.35	17.86	178.40	5.0-8.7	30.1-56.4	22.6-29.0	43.4-47.2	3620-4370	427-3601	UG-E
Parting	2.72-10.61										
VIII	0.40-4.95	0.40-4.95	12.05	184.60	5.6-10.0	23.1-47.8	23.2-32.2	36.9-51.3	3015-4870	1503-4760	G-D
Parting	3.02-6.60										
VIIA	0.00-2.10	0.00-2.10	20.70	192.57	5.2-6.0	45.7-55.5	20.0-23.4	36.5-44.3	2510-3270	525-1765	UG-G
Parting	9.15-20.45										
VII	0.00-0.96	0.00-0.96	111.80	208.80	4.6	53.0	21.0	42.5	N/A	951	UG
Parting	5.80-19.70										
VI	0.00-4.84	0.00-4.84	12.15	219.30	4.5-6.9	37.7-51.5	20.6-34.1	39.9-68.1	2960-3940	1172-2743	UG-F
Parting	1.79-6.65										
V	0.00-2.48	0.00-2.48	16.90	223.83	4.6-6.9	38.4-53.9	21.6-31.2	37.0-53.3	2060-3890	827-2718	UG-F
Parting	1.73-7.16										
IV	0.00-5.64	0.00-5.64	27.70	231.15	4.3-5.9	43.1-56.1	21.3-26.6	40.9-46.8	3510-5640	565-2262	UG-G
Parting	3.50-11.91										
III Top	0.00-4.90	0.00-4.90	17.46	239.00	3.7-7.1	33.7-52.1	20.2-29.6	37.9-47.0	2975-4030	1020-3325	UG-F
Parting	0.78-8.19										
III Bot	0.00-5.30	0.00-5.30	25.87	243.90	4.2-6.8	33.9-49.1	20.5-26.4	36.0-45.6	3150-4110	1434-3283	G-F
Parting	0.65-19.03										
IID	0.00-10.90	0.00-10.90	29.41	251.00	4.7-7.6	27.6-50.8	20.8-28.3	35.9-46.8	2980-4160	1227-4042	UG-E
Parting	0.40-8.65										
IIA Top	0.00-2.05	0.00-2.05	33.50	262.30	4.6-7.5	29.0-58.4	18.7-27.5	37.0-46.8	2150-4260	178-3863	UG-E
Parting	0.80-7.02										
IIA Bot	0.00-4.60	0.00-3.15	19.35	266.00	4.7-7.0	26.4-46.0	23.7-31.2	35.0-44.9	3180-4940	1903-4291	G-D
Parting	0.40-12.40										
II	0.00-3.15	0.00-3.15	32.00	271.20	3.6-6.4	33.7-52.8	22.6-29.2	43.0-46.6	3290-4220	1117-3366	UG-E
Parting	26.25-42.23										
IC	0.00-0.70	0.00-0.70	67.10	300.45	4.9	46.6	24.8	45.9	3400	1793	G
Parting	3.36-18.72										
IIB	0.00-3.22	0.00-3.22	80.85	305.00	3.5-6.6	32.9-59.1	19.2-30.0	41.5-55.8	2290-4630	261-3725	UG-E
Parting	0.56-17.14										
IA	0.00-1.46	0.00-1.46	95.65	306.60	4.2-7.8	27.0-50.9	22.0-34.3	37.5-50.6	3550-3810	1296-4098	UG-E

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**COAL RESERVES**

Total twenty coal seams, viz. IIA, IIB, IIC, IIE, IIIA Bottom, IIIA Top, IIID, IIIE Bottom, IIIE Top, IVB, VA, VB, VIB, VIIA, VIIB, VIII Bottom, VIII Top, IX, X and XI, are present in the block. Out of which only three coal seams XI, IX and VIII Top show consistent development with more than 1 m thickness over the entire area of occurrence in the block. All other coal seams, barring Seams X and VIIB, exhibit impersistent development. Seams X and VIIB, though developed in the entire area, also have thickness below 1m in a patch. Seams IIC and VIB are thin and attain unworkable thickness through out the area. Development of coal seams with maximum thicknesses has been observed on the northern part of the block whereas in southern part, the thicknesses of all the coal seams have been reduced and unworkable even not developed at places.

The assessment of quarriable potentialities of the block has been worked out taking floor of Seam IIIA Bottom as quarry base.

It may, however, be noted that Seam IIIA Bottom shows wide variations in its thickness over the block, being well developed in the down dip side and becoming even unworkable / not developed in the up dip side areas. As a result this seam does not have workable thickness over major part of the block on up dip side. The overlying seams - Seam IIIA Top, IIID, IIIE Bottom, IIIE Top, IVB, VA and VB also show similar characteristics, particularly on the up dip regions. This has made substantial parts of these seams including Seam IIIA Bottom unworkable starting from their incrop positions in the up dip side to a distance of about 350 to 1800 m in the down dip side. These seams, including Seam IIIA Bottom therefore, offer workable thicknesses not from their incrop position but from a depth of about 65 to 200 m, in respect to quarry base on the floor of IIIA Bottom.

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**Basic Assumptions**

1. Coal shaly coal of 1 m and above thickness occurring at roof and floor of the seam have been considered well within the seam, in those cases also where underlying and overlying dirt band is thicker than the coal.
2. Quantitative and qualitative assessment of seam is based on the effective thickness  
  
(i) all the combustible and non-combustible bands 1 m and above in thickness and (ii) thin coal/shaly coal band sandwiched in thick dirt bands with the cumulative thickness of 1 m and above have been excluded from the seam thickness to calculate effective thickness. Quality data available from the boreholes falling in unworkable areas has also been taken into account at the time of drawing the isograde lines.
3. All reserve estimated from the block have been considered as proved category.
4. Since all the coals seams contain high volatile, high moisture, non-coking bituminous coal, the grade of coal has been ascertained on useful heat value in accordance to Notification No. 28072/1/82A dt. 07.01.84 issued by Ministry of Energy, Department of Coal.
5. Useful heat value has been calculated by using formula  $UHV = 8900 - 138(A\% - M\%)$  where A% and M% are ash and moisture contents of the coal determined at 60% RH and 40 °C/ calculated on equilibrated basis respectively.
6. Barriers have not been left anywhere in the block and reserves estimates are for the entire block.
7. Volume of coal has been computed grade-wise, depth-wise, coal:overburden cut off ratio-wise by measuring the area between the two successive isochores and multiplying the same by the average thickness value of corresponding isochores.
8. Specific gravity for each grade of coal has been calculated for 1100 sample by the formula: Specific gravity =  $1.28 + 1\%$  Ash content of the seam.
9. The grade-wise specific gravity considered for converting volume of coal into tonnage is as follows :

(for Grade C 1.47, Grade D 1.53, Grade E 1.58, Grade F 1.66, Grade 1.73 and Ungraded 1.81)

10. Computation of gross seam-wise coal reserves has been done through in-house reserve estimation module by using effective thickness, useful heat value and specific gravity grid generated in MINEX.
11. Net coal reserves have been obtained after reducing gross reserves by 10%.
12. The reserves have been estimated separately for full thickness and incrop zones.
13. No reserves estimation has been made from the areas where seam is less than 1 m thick or for the seams having less than 1m thickness in the entire block.

The details of the seam-wise & grade-wise coal reserves are given in Table 4.94.

**Table – 4.94**  
**Seam-wise and grade-wise coal reserves (Net proved),**  
**Utkal-E block, Talcher Coalfield**

Coal seam	Net proved reserves in Mt.						Ungraded
	Grade C	Grade D	Grade E	Grade F	Grade G	Total	
XI					0.3206	0.3206	4.2566
X				0.0143	0.6696	0.6839	1.4812
IX				1.3948	48.6569	50.0517	
VIII Top	0.0010	0.0776	0.4332	4.3129	5.8936	8.7183	
VIII Bot			0.0462	1.0649	1.3172	2.3683	0.2362
VIII		0.2614	1.0575	5.3242	1.2342	7.8773	
VIIA					0.1023	0.1023	0.6615
VII				0.0143	0.5942	0.6085	0.3705
VA			0.0111	0.7651	1.4933	2.2715	0.0434
IVB					0.6079	0.6079	0.8520
IIIE Top			0.0005	0.4629	5.9037	6.3671	0.8395
IIIE Bot			0.0661	2.6940	6.9604	9.7205	
IIID			0.9316	4.3874	7.7641	13.0831	0.1506
IIIA Top			0.1652	1.1139	0.6317	1.9108	0.1202
IIIA Bot		0.0463	1.3023	3.0767	0.2767	4.702	
IIIE			0.0338	0.3982	0.6114	1.0434	0.0184
IIIB			0.0115	0.4607	1.8857	2.3579	0.0599
IIA				0.1028	0.5151	0.6179	0.0016
<b>Total</b>	<b>0.0010</b>	<b>0.3853</b>	<b>4.0590</b>	<b>25.5270</b>	<b>83.4206</b>	<b>113.393</b>	<b>9.0916</b>
% of total reserves	-	0.34	3.58	22.51	73.57	100.00 (92.58)	(7.42)

Sum total 113.393 Mt net proved coal reserves from seam-XI to IIA (9.0916 Mt of 'ungraded' coal reserves is shown separately) have been estimated in Geological Report for Utkal 'E' block, out of which 109.37 Mt are from seam XI to IIIA Bottom. 96% of the total coal reserves are of the grade G & F.

## CHAPTER - V

### MINING TECHNOLOGY

#### 5.1 Deposit Appraisal

Utkal-E block is rectangular in shape with north-south length of 3.5 km and east-west width of about 1.3 km. This block contains 20 seam sections, from youngest seam XI Top to seam IIA. General dip of seams is towards north, with seams incropping in the south. General topography is undulating, sloping towards north with many small ravines covering the total area. These flow channels are carried by two main nalas towards north and meet Singhada Jhor River which forms the northern boundary of the block. The area is traversed by two minor faults in east-central part with maximum throw of 10 m. The dip is varying from 5-6°.

Seam IIA to Seam VIIA are generally thin (upto 3 m) and are not developed in many parts of the block, particularly in southern part. Younger seams (VIIB to XI except VIII Bottom) are well developed and occur in the northern part only. Seam IX is thick (average 32 m) but highly interbanded. As already explained in chapter IV, seam XI has been sub-divided in three sections namely, XI Top, XI Middle and XI Bottom. Seams IIC & VIB are not developed in entire block and seams IIA, IIB and IIE are not developed in the quarry area and are not considered. In effect, there are 15 coal sections for extractions. The effective quarry floor will be seam III-A Bottom or III-D whichever occurs with workable thickness and quality. Seam III-A Bottom occurs at a maximum depth of about 227 m within the mine area proposed. Quality of coal is mainly grade G.

Due to improper development and thinning of coal seams in the south, it is suggested that few bore holes be drilled to prove precisely the incrop of workable coal seams before commencing mining operation.

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 Utkal-E  
 Quarry  
 of Coal  
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5.1

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 Dt. 1.9.2004 of Dept. of Coal,  
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Thickness of weathered mantle including soil is around 15 to 20 m. Thickness of inter-burden between seams vary in different horizons. Prominently, thick inter-burden is observed between seams VB & VII B (25.35 m to 37.50 m) and seams IX & X (30.37 m to 53.50 m).

Seam-wise and grade-wise *net geological reserve* within block area (113.39 Mt) has been given in table 4.94 (p.4.87) with 10% geological loss. Details of net geological and mineable reserves within quarry have been given later in this chapter.

Durgapur reserve forest occurs along the entire width of the block on the south. There are patches of village forest all over the block and a village named Gopiballavpur is situated at north central part.

5.2 **Mine Boundaries**

It is observed that coal seams are gradually thinning down towards south, even to less than one meter, while there is increase in all parting thicknesses. No coal seam below VII-B is consistent in southern part. Thus, incrop of seam VII-B has been considered as southern surface working limit of quarry. Stripping ratio in area between incrops of seams VII-B and VIII Top is very high but has been included in mine boundary, keeping conservation in view. This part will be worked in last phase of quarry working.

The HFL data of Singhada Jhor is not available. The HFL value has been estimated by survey from existing road-bridge about 1.5 km downstream. Central and eastern areas along Singhada Jhor fall below estimated HFL. As a protective measure, an embankment has been proposed along southern river bank. Top of embankment is at least 1.5 m above estimated HFL. The details of mine boundaries adopted are given below:

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### **Mine Floor:**

Floor of **seam IIIA Bottom** has generally been considered as the mine floor. However, in the southern part where the seam is less than 1 m thick, **seam III D** has been taken as mine floor.

### **Surface Boundaries:**

**North:** Quarry surface boundary is drawn after provision of embankment, 5 m away from southern bank of Singhada Jhor and 5 m safety width from toe of the embankment. Thus the width of barrier on surface from Singhada Jhor varies from 18.15 m to 28.43 m.

**East:** Quarry surface boundary is 15 m away from the block boundary to accommodate service road, power line and fencing.

**South:** Quarry surface boundary is surface projection of quarry slope to fully excavate seam VII-B and extending down to seam III-D.

**West:** About 30m barrier is kept to accommodate nala diversion statutory barrier & safety distance.

## **5.3 Mineable Reserves**

Within the mine boundaries detailed in the previous paragraph, the mineable coal is estimated as 67.49 Mt with corresponding overburden of 205.96 Mcum. The overall stripping ratio works out to 3.05 cum/t. Mine life works out to 36 years at the target capacity of 2.0 Mtp with build-up and tapering of production in initial and closing years of mining activity.

### **5.3.1 Methodology**

Following procedure is adopted for assessing mineable coal, overburden and partings.

- i) Extent of each coal seam and intervening partings are projected on the quarry slopes. Grade wise areas between two successive iso-chores/ iso-parting lines are measured and multiplied by average thickness to arrive at volume. Coal volume is multiplied by grade wise specific gravity to arrive at *Gross Geological Reserve*. Coal

  
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seams having thickness less than 1 m and grade below G are also separately calculated and added to overburden volume. Band volumes for seams XI, IX & VIII Top have been estimated and added to overburden volume.

Grade-wise specific gravity is shown in the following table 5.1

Table - 5.1

Seam Name	Specific gravity (t/cum)
C	1.47
D	1.53
E	1.58
F	1.66
G	1.73

- ii) *Net Geological Reserve* has been arrived after providing 10% loss on Gross Reserve to account for geological uncertainties.

Following Table - 5.2 is the Net Geological Reserve as calculated for the quarry profile.

Table-5.2

NET GEOLOGICAL RESERVE IN QUARRY (Mt)

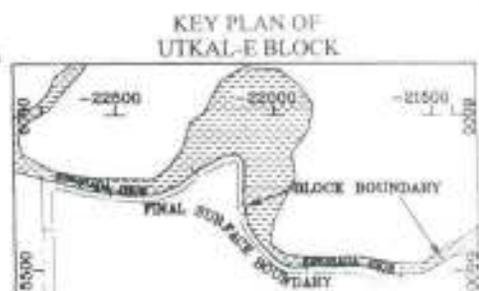
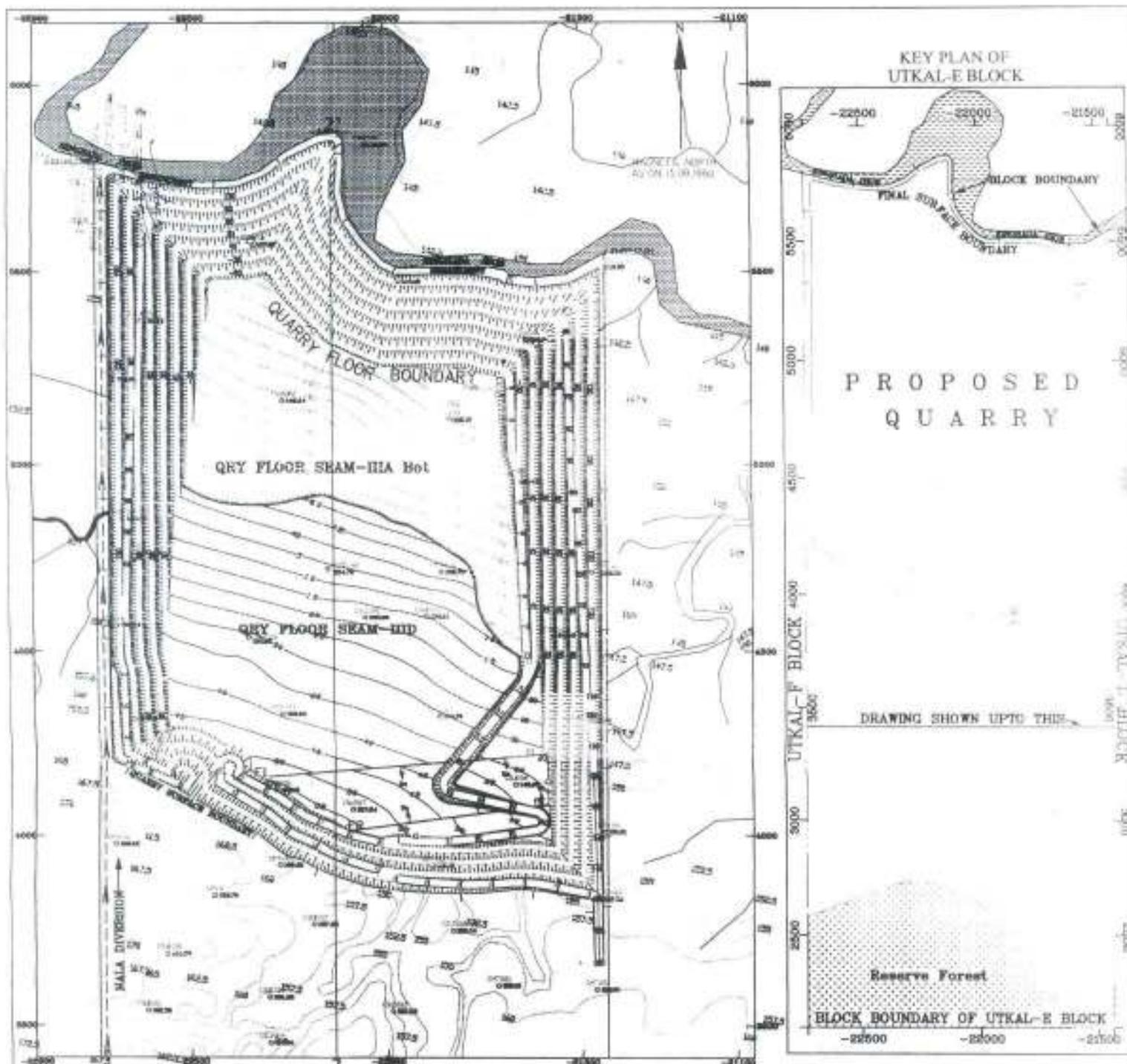
	GRADE-C	GRADE-D	GRADE-E	GRADE-F	GRADE-G	SUBTOTAL
SEAM-XI	0.00	0.00	0.00	0.00	0.10	0.10
SEAM-X	0.00	0.00	0.00	0.00	0.58	0.58
SEAM-IX	0.00	0.00	0.00	1.10	37.28	38.38
SEAM-VIII TOP	0.00	0.07	0.31	3.42	2.58	6.38
SEAM-VIII BOT	0.00	0.00	0.05	0.69	0.87	1.61
SEAM-VIIB	0.00	0.24	0.85	3.20	1.09	5.38
SEAM-VIIA	0.00	0.00	0.00	0.00	0.06	0.06
SEAM-VB	0.00	0.00	0.00	0.00	0.14	0.14
SEAM-VA	0.00	0.00	0.00	0.51	0.67	1.18
SEAM-IVB	0.00	0.00	0.00	0.00	0.24	0.24
SEAM-III E TOP	0.00	0.00	0.00	0.20	3.56	3.76
SEAM-III E BOT	0.00	0.00	0.00	1.03	4.23	5.26
SEAM-III D	0.00	0.00	0.46	3.00	2.21	5.67
SEAM-III A TOP	0.00	0.00	0.17	0.20	0.20	0.57
SEAM-III A BOT	0.00	0.00	0.54	1.02	0.02	1.58
TOTAL	0.00	0.31	2.38	14.37	53.83	70.89

- iii) Due to multiple seams of different thicknesses and in-seam bands of more than 1 m thickness, *Mining Loss* has been estimated for each seam separately to arrive at *Mineable Coal* quantity. Mining loss depends on -

- losses of coal in roof and floor of seam
- losses of seam while cleaning roof of bench
- losses of coal during selective mining for >1m bands
- losses of coal during transportation

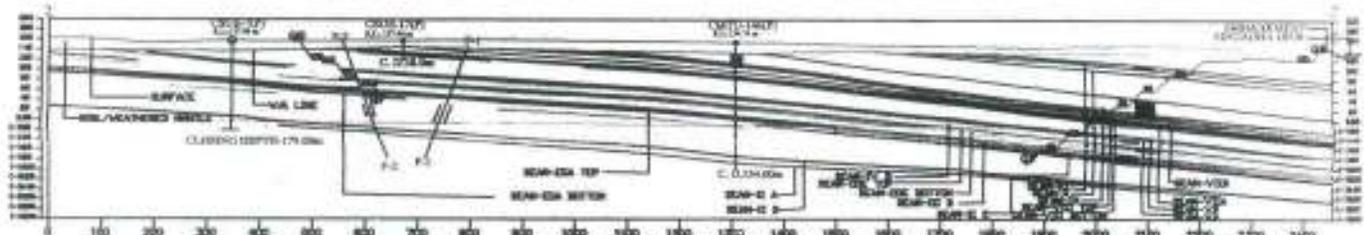
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MOC & M. Govt. of India

Dr. J. K. Singh  
Secretary  
Department of Coal  
Government of India  
New Delhi



PROPOSED QUARRY

DRAWING SHOWN UPTO THIS



CROSS-SECTION - 2-2 CROSS-SECTION SCALE IS 1:5000

REFERENCE NO.	DESCRIPTION	REFERENCE NO.
1.	Floor Contour Plans of seams II to III A Top of Geological Report for Utkal-E Block	Drg nos. 86-V/Exp/05/05 to 42
2.	Seam Tilt Plans of seams II to III A Top of Geological Report for Utkal-E Block	Drg nos. 86-V/Exp/05/05 to 50
3.	Inter-getting Plans between seams II to III A Top of Geological Report for Utkal-E Block	Drg nos. 86-V/Exp/05/05 to 51
4.	Geology & Surface Features of Geological Report for Utkal-E Block	Drg no. 86-V/Exp/05/05
5.	Cross-section 2-2 of Geological Report for Utkal-E Block	Drg no. 87/P&D/200328
6.	Cadastral Map of area in and around Utkal-E Block (revised from customer)	Drg no. 86
7.	OD Department 1:50000 scale	Drg no. 73/0/03
8.	Final Stage Descriptive Plan of Mining Plan for Utkal-E OCP	Drg no. 87/P&D/200328

SYMBOL	DESCRIPTION
(Symbol)	Benchmarks drilled by OMPD-1st Phase
(Symbol)	Benchmarks drilled by S.S.I.
(Symbol)	Benchmarks drilled by OMPD-2nd Phase
(Symbol)	Surface contours with Reduced Level (m)
(Symbol)	With Road Road
(Symbol)	River, Nala, Pond etc.
(Symbol)	Nala (Shallow) Route
(Symbol)	Floor Contour of Seam-III A Bottom
(Symbol)	Floor Contour of Seam-III B
(Symbol)	Quarry Floor Boundary
(Symbol)	Quarry Surface Boundary

SL	DESCRIPTION	QUANTITY
1.	Total Coal	87,487 Mt
2.	Total Overburden	205.98 Mton
3.	External Dump - I	86.48 Mton
4.	Internal Dump - I	11.75 Mton
5.	Internal Dump	81.88 Mton

NOTES:  
 1. All dimensions are in meters.  
 2. This plan is subject to minor modification in all best condition.

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PLATE NO. MN-1

NATIONAL ALUMINIUM CO. LTD.

MINING PLAN FOR UTKAL-E OCP

MINI STAGE PLAN  
 FINAL YEAR

DATE	APPROVED BY	DESIGNED BY	CHECKED BY

REDUCED COPY

Seam-wise mining losses are given in table 5.3 below.

**Table - 5.3**  
**Seam-wise Mining Losses for each seam**

Grade	Mining Loss (%)
Seam-XI	6.75
Seam-X	13.80
Seam-IX	2.15
Seam-VIII Top	7.15
Seam-VIII Bot.	12.80
Seam VII B	7.75
Seam-VII A	13.65
Seam-VB	13.65
Seam-VA	12.55
Seam-IV B	12.95
Seam-III E Top	9.25
Seam-III E Bot.	6.10
Seam-III D	5.70
Seam-III A Top	11.95
Seam-III A Bot.	8.55

Table 5.4 shows seam-wise, grade-wise mineable coal while tables 5.5 and 5.6 show strata-wise overburden within the quarry configuration.

**Table 5.4**  
**Seam wise Grade Wise Mineable Coal Reserves**

	Fig. in Mt					
	GRADE-C	GRADE-D	GRADE-E	GRADE-F	GRADE-G	SUBTOTAL
SEAM-XI	0.00	0.00	0.00	0.00	0.09	0.09
SEAM-X	0.00	0.00	0.00	0.00	0.50	0.50
SEAM-IX	0.00	0.00	0.00	1.08	36.47	37.55
SEAM-VIII TOP	0.00	0.07	0.29	3.16	2.40	5.92
SEAM-VIII BOT	0.00	0.00	0.04	0.61	0.76	1.41
SEAM-VIIB	0.00	0.22	0.78	2.94	1.02	4.96
SEAM-VIIA	0.00	0.00	0.00	0.00	0.05	0.05
SEAM-VB	0.00	0.00	0.00	0.00	0.13	0.13
SEAM-VA	0.00	0.00	0.00	0.44	0.58	1.02
SEAM-IVB	0.00	0.00	0.00	0.00	0.21	0.21
SEAM-III E TOP	0.00	0.00	0.00	0.18	3.24	3.42
SEAM-III E BOT	0.00	0.00	0.00	0.96	3.98	4.94
SEAM-III D	0.00	0.00	0.43	2.83	2.09	5.35
SEAM-III A TOP	0.00	0.00	0.15	0.17	0.18	0.50
SEAM-III A BOT	0.00	0.00	0.49	0.93	0.02	1.44
<b>TOTAL</b>	<b>0.00</b>	<b>0.29</b>	<b>2.18</b>	<b>13.30</b>	<b>51.72</b>	<b>67.49</b>

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**Table 5.5**  
**Seam wise Top Overburden and Parting**

Fig in Mcum

Particulars	Top OB	Parting
Above Seam XI	16.15	-
Above Seam X	2.10	5.39
Above Seam-IX	15.17	25.54
Above Seam-VIII Top	1.45	2.29
Above Seam-VIII Bottom	6.07	8.65
Above Seam VII B	6.63	9.53
Above Seam-VII A	-	7.05
Above Seam-V B	-	47.17
Above Seam-VA	-	5.65
Above Seam-IVB	-	6.70
Above Seam-III E Top	-	9.00
Above Seam-III Bottom	-	2.46
Above Seam-III D	-	15.68
Above Seam-III A Top	-	1.27
Above Seam-III A Bottom	-	1.68
Sub-total	47.57	148.06

Seam wise quantities of coal, which is considered as waste is given below :

**Table 5.6**  
**Seam wise Un-graded coal, less than 1 m coal and bands (Mcum)**

Particulars	Ungraded coal	Less than 1m coal	Inseam band	Total
Seam-XI	2.08	0.03	0.87	2.98
Seam-X	0.67	0.06	-	0.73
Seam-IX	-	-	2.97	2.97
Seam-VIII Top	-	-	0.24	0.24
Seam-VIII Bottom	0.09	0.33	-	0.42
Seam-VII B	-	0.04	-	0.04
Seam-VII A	0.15	0.65	-	0.80
Seam-VB	0.09	0.60	-	0.69
Seam-VA	-	0.76	-	0.76
Seam-IV B	0.09	0.34	-	0.43
Seam-III E Top	0.04	0.13	-	0.17
Seam-III E Bottom	-	0.03	-	0.03
Seam-III D	-	0.01	-	0.01
Seam-III A Top	-	0.06	-	0.06
Seam-III A Bottom	-	-	-	0.00
Sub-total	3.21	3.04	4.08	10.33
<b>Total overburden</b>	<b>205.96</b>			
<b>Stripping Ratio</b>	<b>3.05</b>			

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## 5.4 Geo-mining Characteristics

**Table 5.7**  
**Geo-mining characteristics**

Sl. No.	Particulars	Unit	Value
1.	Quarry floor area	ha	110.59
2.	Quarry surface area	ha	211.18
3.	Mineable reserve	Mt	67.49
4.	Overburden	Meum	205.96
5.	Stripping ratio	cum/t	3.05
6.	No. of seams/sections*	No	15
7.	Capacity	Mty	2
8.	Life	Years	36
9.	Average seam gradient	Degrees	5.86
10.	Strike length (along floor)		
	Maximum	m	875
	Minimum	m	792
11.	Strike length (along surface)		
	Maximum	m	1399
	Minimum	m	1220
12.	Quarry depth		
	Maximum	m	227.50
	Minimum	m	99.50
13.	Quarry perimeter	m	6458
14.	Dip-rise length		
	Along floor	m	1275
	Along surface	m	1750

\* including bottom and top sections of seams

## 5.5 Mining Scheme

**Justification for Open Cast Mining**

More than 75% of coal in Utkal-E block falls under grade-G and occur up to a depth of 227.50 m. In view of multi seam deposit, coal quality, mine depth, opencast mining is envisaged. Tables 5.8 & 5.9 show thickness ranges and average values of various strata.

**Table - 5.8**  
**Thickness of coal seams**

Seam name	Range (m)	Average thickness (m)
Seam-XI Top	1-1.90	1.63
Seam-XI Middle	1-1.90	1.25
Seam-XI Bottom	1-1.75	1.35
Seam-X	1-3.40	1.50
Seam-IX	25.19-34.52	23.98
Seam-VIII Top	1.32-6.53	3.40
Seam-VIII Bot.	1-3.35	1.60
Seam VII B	1-4.95	2.68

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Seam name	Range (m)	Average thickness (m)
Seam-VII A	1-2.10	1.50
Seam-VB	1-4.84	1.50
Seam-VA	1-2.48	1.63
Seam-IV B	1-3.64	1.58
Seam-III E Top	1-4.90	2.24
Seam-III E Bot.	1-5.30	3.46
Seam-III D	1-10.90	3.72
Seam-III A Top	1-2.05	1.72
Seam-III A Bot.	1-4.60	2.43

**Table – 5.8**

**Thickness of partings above different seams**

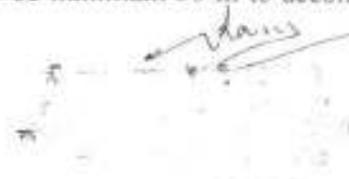
Particulars	Range (m)	Average thickness (m)
Above Seam X	7.15-11.87	9.56
Above Seam IX	30.37-53.50	43.42
Above Seam-VIII Top	1.03-2.85	2.08
Above Seam-VIII Bottom	1.05-15.83	7.80
Above Seam-VII B	2.72-10.61	7.00
Above Seam VII A	3.02-6.60	4.28
Above Seam-V B	25.35-37.50	30.53
Above Seam-V A	1.79-6.65	4.26
Above Seam-IVB	1.72-7.16	5.09
Above Seam-IIIE Top	4.37-11.91	5.62
Above Seam-IIIE Bottom	1-2.89	1.45
Above Seam-III D	1.80-17.09	12.31
Above Seam-III A Top	1.25-8.65	2.94
Above Seam-III A Bottom	1.85-7.62	4.10

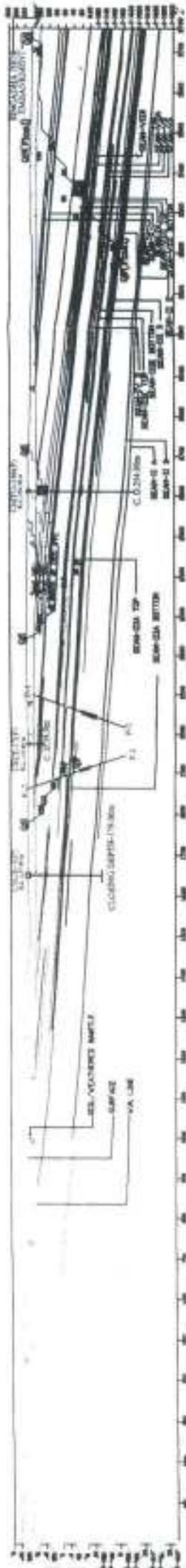
**5.5.1 Mining System**

Multi-seam deposit, varying seam thickness, great initial depth (Seam III D at 128 m depth) requires flexible mining operations. Hence shovel-dumper system is envisaged. This system also offers convenient mining operations to deal with sudden occurrence of unworkable and poor quality zones and offers flexibility for easy up-gradation. The technology is well-known and advantageous to get skilled manpower.

As the average dip of seam is around 6°, mining parallel to coal seam strata is suggested. Thick parting horizons would be worked by developing level benches to reduce OB exposure. Maximum bench height will be 10 m while bench width for working benches will be minimum 30 m to accommodate

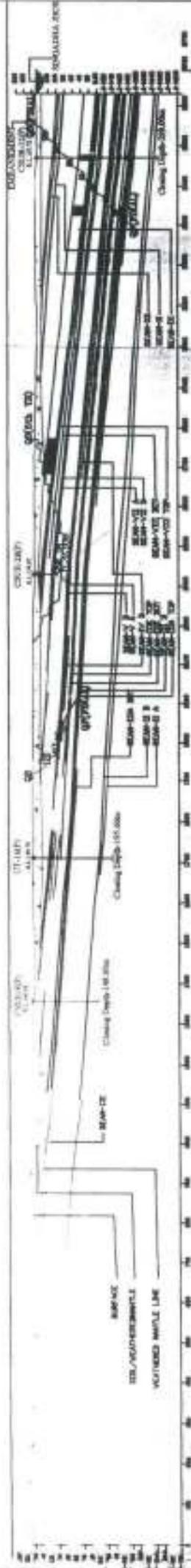
*hant*  
**Udaya Kumar Mohanty**  
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 Rule 22C of MCR 196  
 Reg No. 13016/8/2004 C  
 2004 of Dept. of S&P  
 M. Govt. of India





CROSS-SECTION - 2-2'

SECTION SHOWN IN STAGE PLANS STARTS FROM 0+00 LINE



CROSS-SECTION - 1-1'

REFERENCES:

- 1. FLOOR CONTOUR PLANS (PLATE NO. 1000)
- 2. ROOF CONTOUR PLANS (PLATE NO. 1000)
- 3. SOAM FOLD PLANS (PLATE NO. 1000 TO 1010)
- 4. DEPARTING PLANS (PLATE NO. 1010 TO 1020)

NOTE:-

- 1. ALL VALUES ARE IN METRE.
- 2. DISCONTINUITY OF COAL SEAMS INDICATE NON-DEVELOPMENT.
- 3. CROSS-SECTION LINES ARE SHOWN IN TOPOGRAPHICAL BODY PLAN (PLATE NO. 9-1)
- 4. SAME STAGE PROFILE IN HARBOR SEAMS SHOWN IN RESPECTIVE CROSS-SECTIONS AS PER OCCURRENCE

INDEX

- CENTER BURNABLE NAME
- BURNABLE POINT
- WALSLEY
- REDUCED LEVEL IN METRE
- COAL SEAM
- CROSS SECTION LINE
- SURFACE ELEVATION
- WALSLEY MAPLE
- PROJECTED VALUE
- FULL WITH DIRECTION OF VIEW

PLATE-NO: MIN-II

NATIONAL ALUMINIUM CO. LTD.	
MINING PLAN FOR UTKAL-E OCP	
QUARRY CROSS-SECTION	
ALONG 1-1' & 2-2'	
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BY	
CHECKED BY	
APPROVED BY	
SCALE	
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blasted material, haul road and cables. Thin horizons will be clubbed together up to a height of 10 m though each will be excavated separately. Angle of individual bench slope will be 70°.

In view of large number benches, inter-bench marching involved and varying thickness of strata, hydraulic shovels which have better maneuverability are envisaged. Considering the total annual workload, thick coal seam i.e., seam-IX and thick partings between VB/VIIA and IX/X, shovels with 6.0 to 6.5 cum bucket capacity are suggested for both coal and overburden as smaller shovels would increase the inventory if more shovels are to be deployed in working thick coal seams and parting where the work load is relatively high. 50T class of rear dumpers are chosen to match the above hydraulic shovels.

Quarry cross-sections showing year wise and final pit profiles have been shown in plate MIN-II.

#### Mine Layout

Quarry is proposed to start at about 1:5 thickness ratio for economic reasons. Coal in higher ratio zone will be extracted at later phase. Thick younger seams have in-crops in the central part of the block with a northerly dip. Quarry has been planned to extract thick younger seams and simultaneously deepening to reach seam IIIA Bottom to optimize production and stripping ratio. Benches will be laid along strike direction of the seams. The working benches will be laid such that a floor gradient of 1:200 towards east is maintained to facilitate mine drainage. The main sump is proposed to be developed on mine floor at eastern end of quarry. In general, working benches will be extended to full strike length from east to west. A group of benches will be worked by each shovel. Movement of

  
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 Secretary  
 Ministry of Coal  
 Government of India

shovels in each bench will be from east to west. Overall advance of working face will be towards dip direction i.e. north.

It is suggested to fill quarry void in the western part only and lay the haul road along eastern side to facilitate liquidating of barrier with adjacent block. Overburden will be transported by the flank roads laid on western batter while coal will be transported by flank roads laid on eastern batter. Entry to external dump is proposed at north western corner of the external dump.

Two nalas flowing across the property need to be diverted before any mining activity is started. Diversion has been proposed along western boundary of the block starting at 167.50 m and will terminate to Singhada Jhor River at 147 m. However, this requires further survey to decide the alignment.

Approach to the deposit will be from south east corner of the block. Infrastructure area containing office, workshop, store, sub-station, CHP etc has been planned near south east corner of the quarry, between initial access trench and External Dump-I (Plate GEN-III).

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### Design Criteria

Round the year working with 7 days a week is envisaged for coal production and overburden removal. However, for the purpose of assessing annual production of equipment, following schedule is assumed:

- i) Annual working days - 330
- ii) No. of shifts per day - 3
- iii) Duration of shift - 8 hours

Following categories of excavation have been assumed:

- i) Top soil - Cat. I/Cat. II
- ii) Overburden - 50% Cat. III + 50% Cat. IV
- iii) Coal - Cat. III

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### 5.7 Productivity

Based on the above factors and working regime, annual productivity of HEMM are given below.

- |     |  |   |           |
|-----|--|---|-----------|
| i)  | Electric Hydraulic Shovel-6.1 cum bucket with 50 T rear dumper in OVERBURDEN     | - | 1.54 Mcum |
| ii) | Electric Hydraulic Shovel-6.1 cum bucket with 50 T coal body rear dumper in COAL | - | 1.67 Mcum |

### 5.8 Mining Operations

#### 5.8.1 Overburden Excavation

Top soil (about 0.3 m) will be dozed, loaded and temporarily stored near south central part of quarry (ref. all stage plans), to be spread over dumps for reclamation progressively. The rock overburden below top soil will be excavated by 6.0-6.5 cum hydraulic shovels.

#### 5.8.2 Coal Extraction

Coal is also proposed to be extracted by using 6.0-6.5 cum hydraulic shovels. Same type of shovel has been suggested to provide the flexibility to excavate either coal or overburden.

#### 5.8.3 Transport Layout

It is seen that, it is not possible to develop a straight haul road due to an initial depth of 128 m up to mine floor (IIIA Bottom). This has necessitated development of the main haul road on the southern quarry slope. 25 m wide haul road has been proposed from surface at mine entry up to the quarry floor. This road would be extended along the eastern batter at a gradient of 6% up to the end of mine. Level flank roads have been proposed on both eastern and western batters at 30 m vertical intervals with necessary connecting roads.

Dumpers from working faces would travel along the bench and temporary ramps to reach nearest flank road connecting to either dump areas or CHP. Overburden will be transported along western flank directly to external or

internal dump. Two inclined flank roads cut across the horizontal flank roads on eastern batter. Coal may either be transported directly to surface along eastern batter or through southern main haul road, depending up on the level (RL) at which it approaches the flank roads.

5.8.4 **Dump**

It is proposed to backfill overburden only on western side and lay the haul road on eastern side to facilitate working of barrier between Utkal-E and Utkal-D blocks. However, planning for liquidation of the barrier depends on the mining system, advance of working benches, transport system etc. of adjoining block. Narrow quarry width and high initial depth of 128 m has resulted in large external dump to an extent of 118.28 Mcum. It is proposed to accommodate this overburden at two sites (Plate MIN-VIII and GEN-III). Dump-I has been proposed south of planned quarry within block boundary of Utkal-E and Dump-II is located at south-west of Utkal-E block in Korada village.

In order to prove non-existence of coal at the site of Dump-II, three boreholes were drilled through Govt. of Orissa. No coal has been reported from any borehole drilled to an average depth of 140 m (refer Annexure-VII and MIN-IX).

Entire overburden is to be dumped externally in Dump-I for first 11 years, thereafter filling the Dump-II up to 24<sup>th</sup> year. Internal dumping is possible only from 12<sup>th</sup> year and will be concurrently done with external dumping.

Capacity of external Dump-I is 66.49 Mcum while that of Dump-II is 51.79 Mcum. Location of dump-II is shown in Plate MIN-VIII and GEN-III. Balance overburden of 87.68 Mcum can be accommodated in internal dump. While filling external Dump-I, a transport corridor will be left between western block boundary and Dump-I to access external Dump-II. After external Dump-II is filled to its capacity, external Dump-I will be extended to its ultimate configuration during Yr.25 and Yr.26 (Table - 5.9).

Individual tiers of O.B. dumps would have maximum height of 30 m at an angle of 37°. External dumps-I & II will have three such tiers. Overall slope

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EXT. O.B. DUMP

CROSS-SECTION 1-2

INTERNAL O.B. DUMP

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Vide letter No. 13B16/R/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
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INTERNAL O.B. DUMP

UTKAL-F BLOCK

UTKAL-F BLOCK

EXTERNAL O.B. DUMP

EXTERNAL O.B. DUMP - II  
LEVEL: +207.8

RESERVE FOREST

BLOCK BOUNDARY OF UTKAL-F

NORTHERN BLOCK BOUNDARY OF UTKAL-F  
DOTTED FROM GEOLOGICAL MAP OF  
DRAFT U.S. OF UTKAL-F

SYMBOL	DESCRIPTION
(Symbol)	Boundary of Block
(Symbol)	Boundary of Mine
(Symbol)	Boundary of Reserve Forest
(Symbol)	Block Boundary of Utkal-F
(Symbol)	Block Boundary of Utkal-B
(Symbol)	Block Boundary of Utkal-C
(Symbol)	Block Boundary of Utkal-D
(Symbol)	Block Boundary of Utkal-E
(Symbol)	Block Boundary of Utkal-F
(Symbol)	Block Boundary of Utkal-G
(Symbol)	Block Boundary of Utkal-H
(Symbol)	Block Boundary of Utkal-I
(Symbol)	Block Boundary of Utkal-J
(Symbol)	Block Boundary of Utkal-K
(Symbol)	Block Boundary of Utkal-L
(Symbol)	Block Boundary of Utkal-M
(Symbol)	Block Boundary of Utkal-N
(Symbol)	Block Boundary of Utkal-O
(Symbol)	Block Boundary of Utkal-P
(Symbol)	Block Boundary of Utkal-Q
(Symbol)	Block Boundary of Utkal-R
(Symbol)	Block Boundary of Utkal-S
(Symbol)	Block Boundary of Utkal-T
(Symbol)	Block Boundary of Utkal-U
(Symbol)	Block Boundary of Utkal-V
(Symbol)	Block Boundary of Utkal-W
(Symbol)	Block Boundary of Utkal-X
(Symbol)	Block Boundary of Utkal-Y
(Symbol)	Block Boundary of Utkal-Z

RELEVATION QUANTITY	DESCRIPTION
1. Block Area	1000000 Sq. M.
2. Block Perimeter	1000000 M.
3. Block Volume	10000000000 M <sup>3</sup>
4. Block Weight	10000000000000 N
5. Block Length	1000000 M.
6. Block Breadth	1000000 M.
7. Block Height	1000000 M.
8. Block Area	10000000000000 M <sup>2</sup>
9. Block Perimeter	10000000000000 M
10. Block Volume	10000000000000000 M <sup>3</sup>
11. Block Weight	100000000000000000 N
12. Block Length	10000000000000 M
13. Block Breadth	10000000000000 M
14. Block Height	10000000000000 M
15. Block Area	100000000000000000 M <sup>2</sup>
16. Block Perimeter	100000000000000000 M
17. Block Volume	100000000000000000000 M <sup>3</sup>
18. Block Weight	10000000000000000000000 N
19. Block Length	100000000000000000000 M
20. Block Breadth	100000000000000000000 M
21. Block Height	100000000000000000000 M

1. This plan is subject to other conditions to which land conditions are subject to.

2. All values are in meters.

NO.	DESCRIPTION	QUANTITY
1.	Total Area of Block	10000000000000 M <sup>2</sup>
2.	Total Perimeter of Block	100000000000000 M
3.	Total Volume of Block	10000000000000000000 M <sup>3</sup>
4.	Total Weight of Block	10000000000000000000000 N
5.	Total Length of Block	100000000000000000000 M
6.	Total Breadth of Block	100000000000000000000 M
7.	Total Height of Block	100000000000000000000 M
8.	Total Area of Block	1000000000000000000000 M <sup>2</sup>
9.	Total Perimeter of Block	10000000000000000000000 M
10.	Total Volume of Block	1000000000000000000000000 M <sup>3</sup>
11.	Total Weight of Block	10000000000000000000000000 N
12.	Total Length of Block	100000000000000000000000 M
13.	Total Breadth of Block	100000000000000000000000 M
14.	Total Height of Block	100000000000000000000000 M

SCALE

PLATE NO. MIN-111

NATIONAL ALUMINIUM CO. LTD.

MINE PLAN FOR UTKAL-F OCP

FINAL STAGE

DUMP PLAN

DATE: 10/10/2004

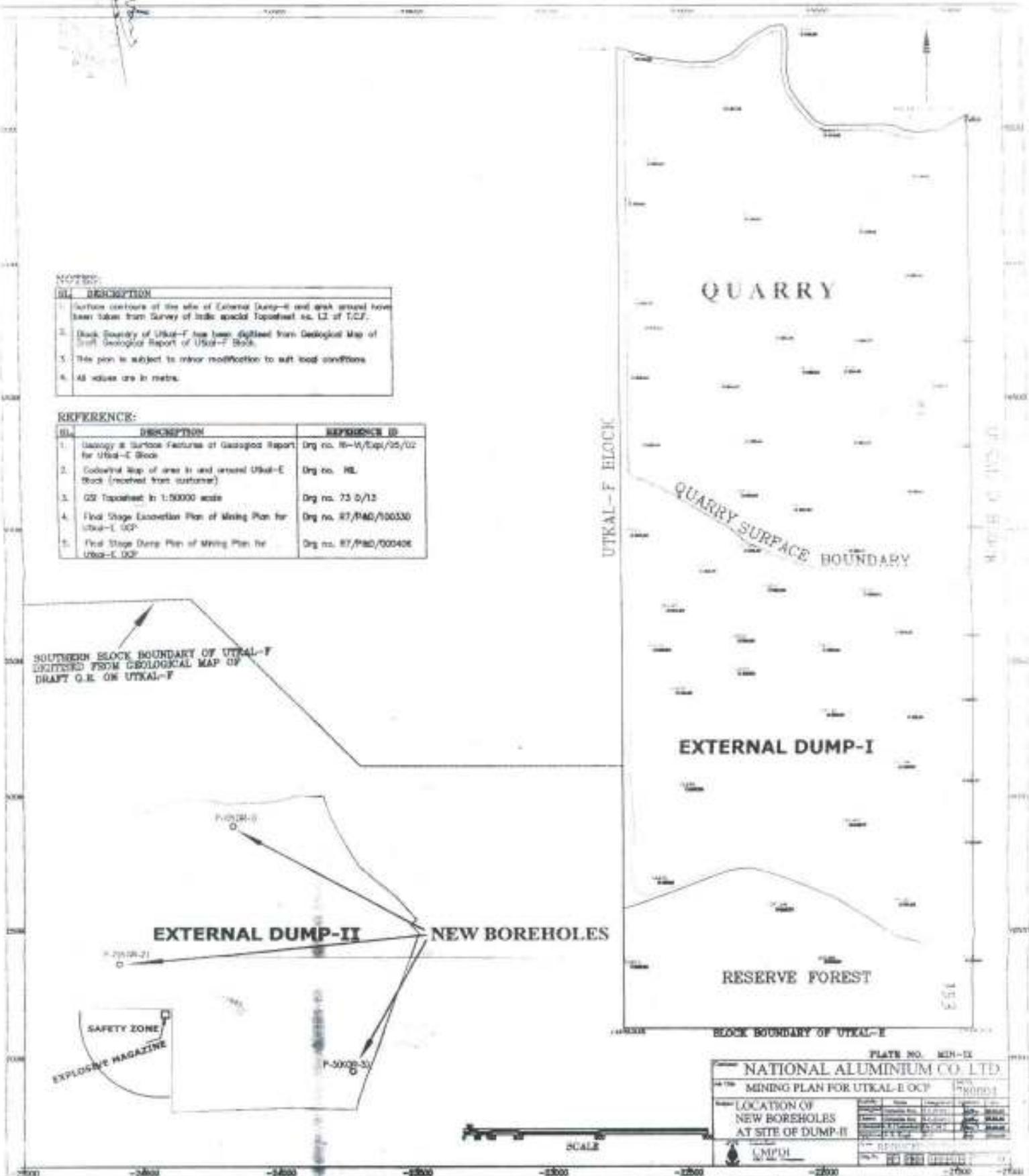
SCALE: 1:5000

**NOTES:**

Sl. No.	DESCRIPTION
1.	Surface contours of the site of External Dump-II and area around have been taken from Survey of India aerial Toposheet No. 12 of T.C.F.
2.	Block Boundary of UTKAL-F has been defined from Geological Map of India. Geological Report of UTKAL-F Block.
3.	This plan is subject to minor modification to suit local conditions.
4.	All values are in metre.

**REFERENCE:**

Sl. No.	DESCRIPTION	REFERENCE ID
1.	Geology & Surface Features of Geological Report for UTKAL-E Block.	Drig no. 16-W/Expl/05/02
2.	Geological Map of area in and around UTKAL-E Block (received from customer).	Drig no. RL
3.	OS Toposheet in 1:50000 scale.	Drig no. 73 0/13
4.	Final Stage Excavation Plan of Mining Plan for UTKAL-E OCP.	Drig no. 87/P&D/100330
5.	Final Stage Dump Plan of Mining Plan for UTKAL-E OCP.	Drig no. 87/P&D/100408



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angle of OB dump would be about  $28^{\circ}$ . Maximum top level of external Dump-I will be 245 m while that of external Dump-II will be 267.50 m. Internal dump will be raised to +120 m level. O.B. dumps shall be compacted with suitable moisture content by vibratory compactors for improved stability and will be covered with top soil for reclamation after it has reached its final configuration. Year wise dumping schedule is given in Table 5.9.

Table - 5.9  
YEAR WISE DUMP SCHEDULE (in Mcum)

	External Dump-I	External Dump-II	Internal Dump	Total
1	1.12			1.12
2	2.81			2.81
3	4.33			4.33
4	5.83			5.83
5	5.67			5.67
6	5.79			5.79
7	5.57			5.57
8	5.58			5.58
9	5.52			5.52
10	5.67			5.67
11	5.50			5.50
12	5.28		0.49	5.77
13	5.22		0.50	5.72
14		4.90	0.75	5.65
15		4.88	0.76	5.64
16		4.82	0.83	5.65
17		4.94	0.83	5.77
18		4.83	0.83	5.66
19		4.84	0.83	5.67
20		4.79	0.83	5.62
21		4.51	1.15	5.66
22		4.36	1.15	5.51
23		4.48	1.15	5.63
24		4.44	1.17	5.61
25	1.30		4.28	5.58
26	1.30		4.29	5.59
27			5.65	5.65
28			5.58	5.58
29			5.59	5.59
30			5.63	5.63
31			5.65	5.65
32			5.67	5.67
33			6.89	6.89
34			9.18	9.18
35			9.34	9.34
36			8.66	8.66
<b>Total</b>	<b>66.49</b>	<b>51.79</b>	<b>87.68</b>	<b>205.96</b>

श्री ०४ असा-४३३ NARA  
 Sr. 04 Assistant Secretary  
 Ministry of Coal  
 Government of India  
 New Delhi

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**5.8.5 Drilling & Blasting**

Coal, overburden and partings are to be drilled and blasted before excavation. Rotary blast hole drills of 150-170 mm drill dia has been proposed for both coal and O.B. benches.

A tentative blast pattern of 6.5 m spacing and 5 m burden is proposed for 10 m bench. Considering mining in adjoining block, optimum blast pattern will have to be arrived at for horizons of different thickness after necessary field trials to determine parameters viz., peak particle velocity, maximum charge per delay etc.

**5.9 Mining Sequence****5.9.1 Development of initial cut**

Access trench will be started 75 m north of borehole CMTU-151 near eastern block boundary at RL. +160 m. Main haul road will be driven down at 6% gradient towards north up to road level of 130 m. It will be advanced towards west to continue deepening while working benches will advance towards north and west. Initial length of access trench is about 500 m.

**5.9.2 Development of mine stages****First Year**

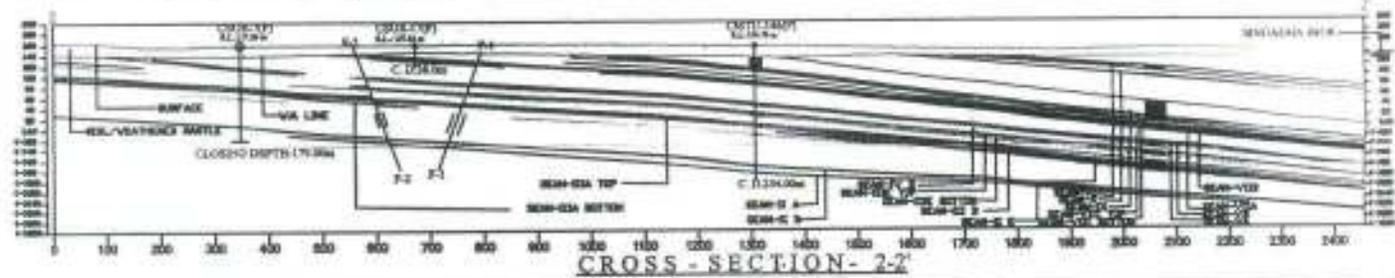
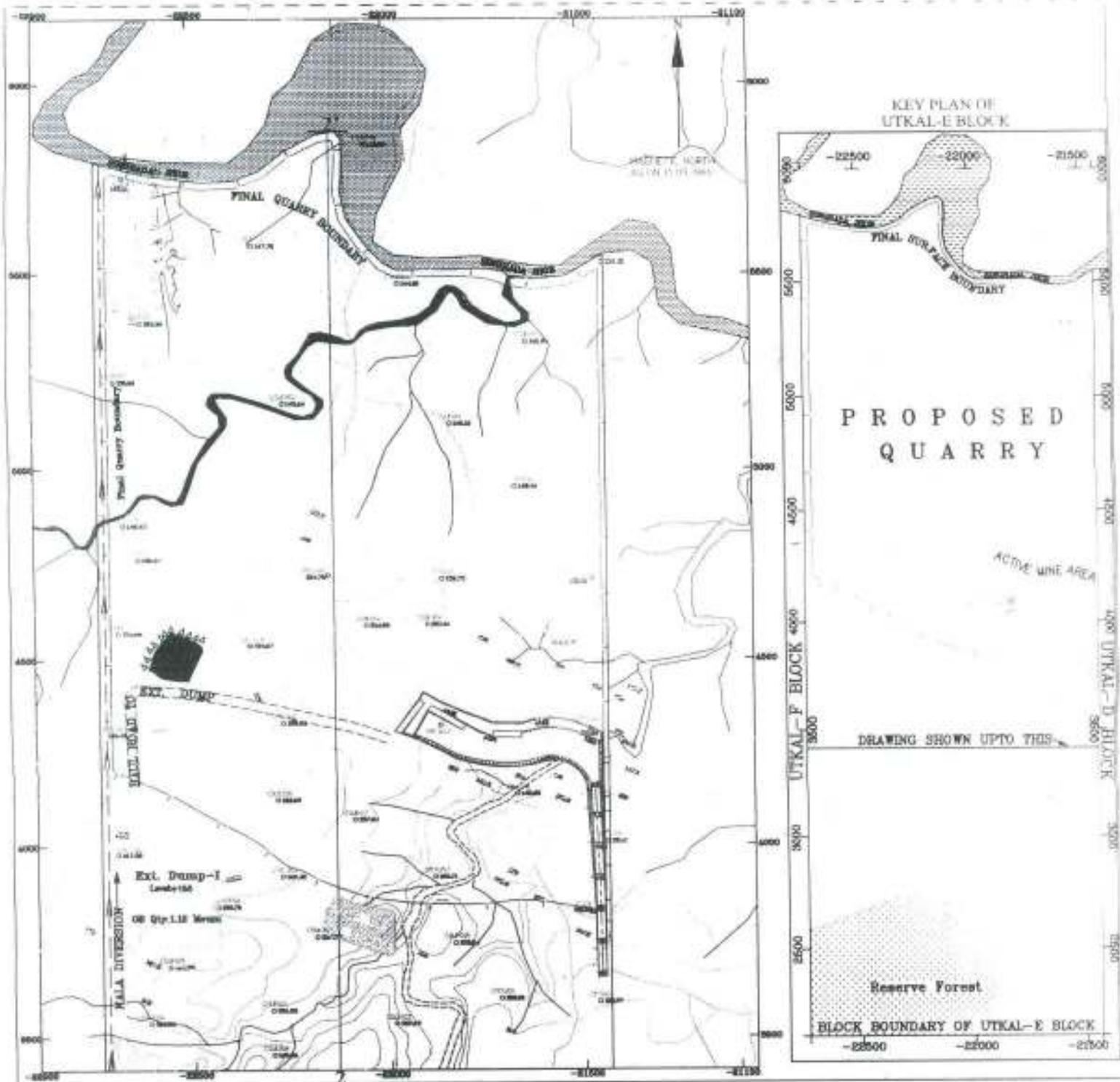
It is proposed to remove overburden only in the first year of mine operation. Weathered mantle of about 20 m thickness above coal seams will be removed in two benches by deploying one hydraulic shovel. Area of excavation is 0.12 sq. km. 1.12 Mcum overburden removed during first year will be taken to external dump-I to fill up to +185 m level (Plate MIN-III).

**Second Year**

Quarry is expanded towards west and benches are aligned along strike. East-west length of quarry is about 950 m while north-south length is about

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REFERENCE	DESCRIPTION	REFERENCE NO.
1.	Plan Contour of section X to B A Top of Geological Report for Utkal-E Block	Drg nos. 18-1/Exp/05/05 to 42
2.	Section Plan of section X to B A Top of Geological Report for Utkal-E Block	Drg nos. 18-1/Exp/05/05 to 42
3.	Interpolated Plan between section X to B A Top of Geological Report for Utkal-E Block	Drg nos. 18-1/Exp/05/05 to 42
4.	Geology & Surface Features of Geological Report for Utkal-E Block	Drg no. 18-1/Exp/05/05
5.	Drawings 2-2' of Geological Report for Utkal-E Block	Drg no. 17/P&O/200200
6.	Geological Map of area in and around Utkal-E Block (revised from customer)	Drg no. 18
7.	GS Toposheet in 1:50000 scale	Drg no. 73/0/13
8.	Final Stage Excavation Plan of Mining Plan for Utkal-E OCP	Drg no. 17/P&O/200200

SYMBOL	DESCRIPTION
	Boundary defined by GPO-1st Phase
	Boundary defined by G.S.
	Boundary defined by GPO-2nd Phase
	Surface contours with Reduced Level (m)
	Min. Road Road
	Road, Hole, Road etc.
	Min. Obstruction Route
	Quarry Floor Boundary
	Quarry Surface Boundary
	Overburden Dump

EXCAVATION QUANTITIES	DESCRIPTION	QUANTITY
1.	Total Cut	18
2.	Total Overburden	1.12 Moun
3.	External Dump	1.12 Moun
4.	Internal Dump	18

**NOTES:**

- All dimensions are in metre
- This plan is subject to minor modification to suit local condition

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SCALE

PLATE NO. -MIN-III

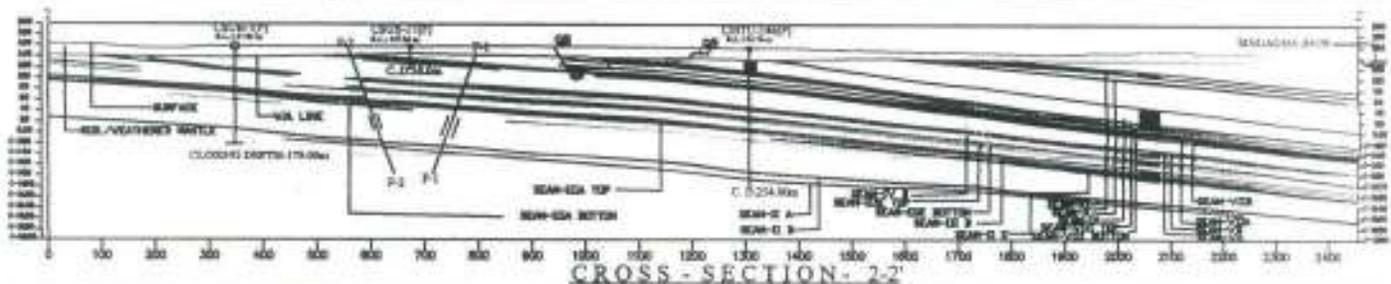
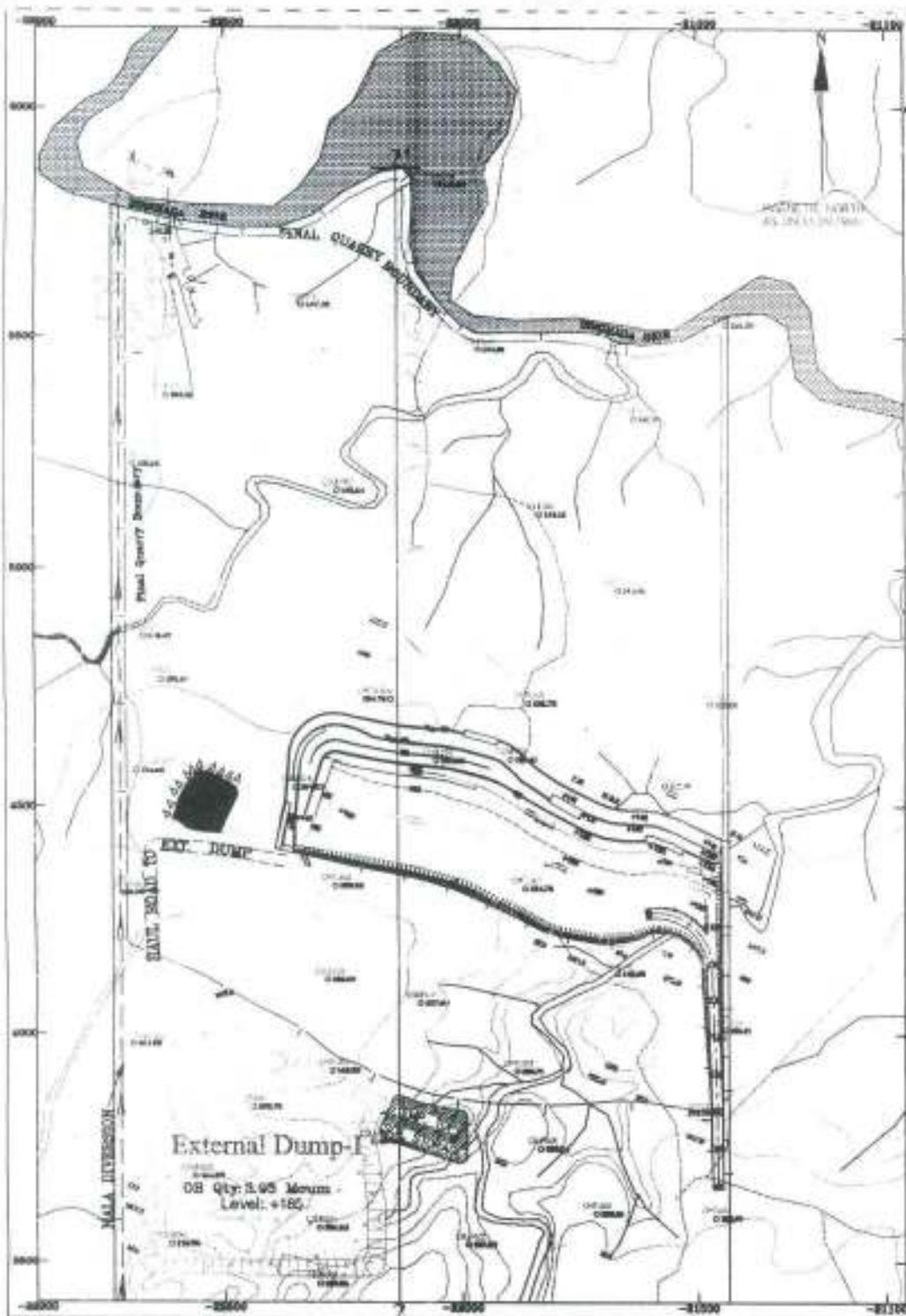
**NATIONAL ALUMINIUM CO. LTD.**

MINING PLAN FOR UTKAL-E OCP

MINE STAGE PLAN  
1ST YEAR

780004

REDUCED COPY



**REFERENCE:**

Sl. No.	DESCRIPTION	REFERENCE NO.
1.	Plan Contour Plans of seams 10 to 11 A Top of Geologial Report for Utkal-E Block	Dry nos. 16-W/Cpt/06/20 to 42
2.	Seam 10a Plan of seams 10 to 11 A Top of Geologial Report for Utkal-E Block	Dry nos. 16-W/Cpt/06/46 to 60
3.	Inter-parting Plan between seams 10 to 11 A Top of Geologial Report for Utkal-E Block	Dry nos. 16-W/Cpt/06/66 to 80
4.	Geology & Surface Features of Geologial Report for Utkal-E Block	Dry no. 16-W/Cpt/06/02
5.	Cross-section 2-2' of Geologial Report for Utkal-E Block	Dry no. 17/P40/300304
6.	Controlled Map of area in and around Utkal-E Block (revised from surface)	Dry no. 16
7.	08 Toposheet in 1:50000 scale	Dry no. 75/6/13
8.	Third Stage Connection Plan of Mining Plan for Utkal-E BCP	Dry no. 17/P40/300330

**LEGEND:**

SYMBOL	DESCRIPTION
(Dotted pattern)	Boundary defined by CMPD-1st Phase
(Dashed pattern)	Boundary defined by G.S.I.
(Solid line)	Boundary defined by CMPD-2nd Phase
(Thin solid line)	Surface contours with Reduced Level (m)
(Thick solid line)	Main Road Road
(Wavy line)	River, Nala, Pond etc.
(Dashed line)	Nala Diversion Route
(Dotted line)	Quarry Floor Boundary
(Dashed line)	Quarry Surface Boundary
(Hatched pattern)	Overburden Dump

**EXHAUSTION QUANTITIES**

Sl. No.	DESCRIPTION	QUANTITY
1.	Total Ore	5.32 Mt
2.	Total Overburden	5.83 Mcum
3.	Internal Dump	5.83 Mcum
4.	Internal dump	Nil

**NOTES:**

- All Dimensions are in metre
- This plan is subject to minor modification to suit local condition.



PLATE NO. - MEN-IV

**NATIONAL ALUMINIUM CO. LTD.**

MINING PLAN FOR UTKAL-E OCP

MINE STAGE PLAN 2ND YEAR

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Under Rule 22C of MCR 1960

300 m. Two seams namely seam VIII Top and seam IX would be extracted. Main haul is deepened to +120 m level during this year. 1.32 Mt coal will be extracted with corresponding overburden of 2.81 Mcum. External dump-I is expanded towards south and east with top level of 185 m (Plate MIN-IV).

### Third Year

Benches are extended towards dip (north) to take advantage of thick seam IX and simultaneously deepening the main haul road to +101 m. Coal is extracted up to seam VII B. Seam VIII Bottom is workable only in eastern end of quarry. Mine attains its target production capacity of 2.0 Mt per annum by end of this year. 4.33 Mcum overburden removed during third year is dumped externally in continuation of previous dump extending it towards south and west up to the top level of +185 m. Four shovels would continue to work in coal and overburden (Plate MIN-V).

### Fourth year

Quarry is expanded further towards dip direction. Top OB above seam IX is now taken in three benches. A 10 m bench of parting below seam VII B is developed and extended towards dip direction. Coal extracted is 2.0 Mt and overburden removed is 5.83 Mcum. Total overburden is dumped externally in dump-I (Plate MIN-VI).

### Fifth Year

Quarry is expanded up to the final pit limit on the west. Main haul road is deepened to +90m. All benches are aligned along strike direction. Extraction of coal will be up to seam VIIB. 5.67 Mcum O.B. is proposed to be removed during this year which is carried to external dump-I. Second dump tier up to +215 level is formed in this year (Plate MIN-VII).

During 11<sup>th</sup> year, main haul road would reach seam III D, the quarry floor, at +20 m level. Seam III-A Bottom & III- Top are not workable in this region but would be met after advancing about 115 m along dip.

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**5.10 Mining Schedule and HEMM**

Nine mine stages were considered to analyse the stripping ratio and determine mining schedule.

Based on the stage wise quantities, schedule of year wise coal and overburden quantities is prepared. Advance stripping is adopted in top overburden removal. Year wise schedule of coal production and overburden removal is given in table – 5.10.

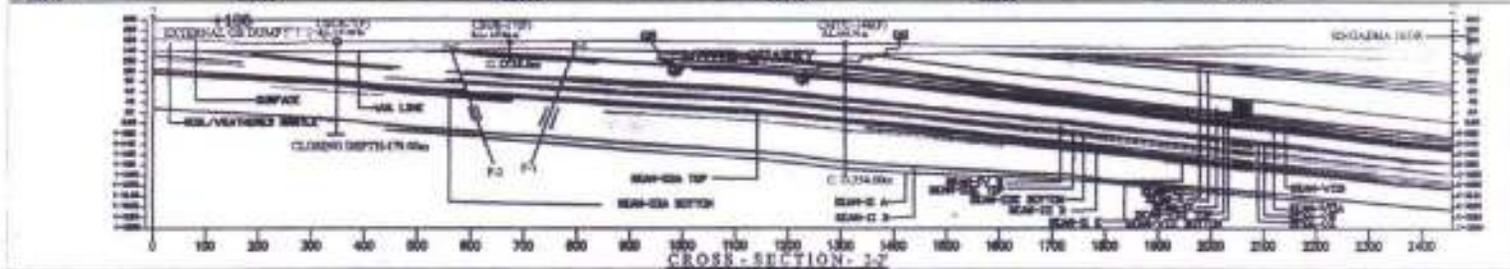
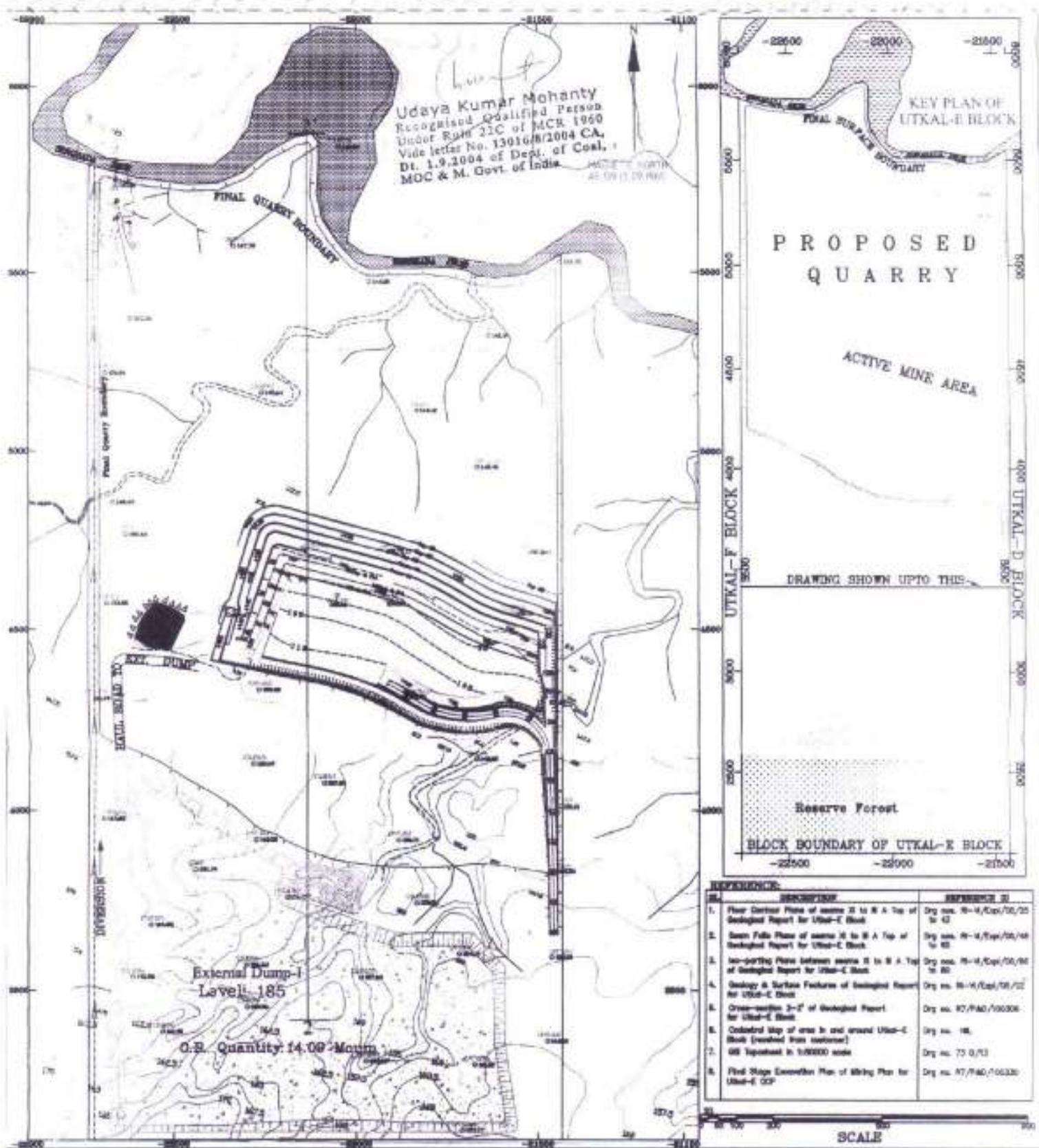
**Table – 5.10  
Year wise Coal Production & OB Removal programme**

Year	Coal in Mt	OB in Mcum	Stripping Ratio (cum/t)
Yr1	-	1.12	-
Yr2	1.32	2.81	2.13
Yr3	2.00	4.33	2.17
Yr4	2.00	5.83	2.92
Yr5	2.00	5.67	2.84
Yr6	2.00	5.79	2.90
Yr7	2.00	5.57	2.79
Yr8	2.00	5.58	2.79
Yr9	2.00	5.52	2.76
Yr10	2.00	5.67	2.84
Yr11	2.00	5.50	2.75
Yr12	2.00	5.77	2.89
Yr13	2.00	5.72	2.86
Yr14	2.00	5.65	2.83
Yr15	2.00	5.64	2.82
Yr16	2.00	5.65	2.83
Yr17	2.00	5.77	2.89
Yr18	2.00	5.66	2.83
Yr19	2.00	5.67	2.84
Yr20	2.00	5.62	2.81
Yr21	2.00	5.66	2.83
Yr22	2.00	5.51	2.76
Yr23	2.00	5.63	2.82
Yr24	2.00	5.61	2.81
Yr25	2.00	5.58	2.79
Yr26	2.00	5.59	2.80
Yr27	2.00	5.65	2.83
Yr28	2.00	5.58	2.79
Yr29	2.00	5.59	2.80
Yr30	2.00	5.63	2.82
Yr31	2.00	5.65	2.83
Yr32	2.00	5.67	2.84
Yr33	2.00	6.89	3.45
Yr34	2.00	9.18	4.59
Yr35	1.30	9.34	7.18
Yr36	0.87	8.66	9.95
<b>Total</b>	<b>67.49</b>	<b>205.96</b>	<b>3.05</b>

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LEGEND:		LEGEND (contd.):	
	Boundary defined by GPD-1st Phase		Main Road Road
	Boundary defined by G.S.I.		Main Shovel Road
	Boundary defined by GPD-2nd Phase		Floor Contour of Seam-III B
	Surface contours with Reduced Level (m)		Floor Contour of Seam-III B at
	River, Main, Flood etc.		Floor Contour of Seam-III Top
	External OB Dump		Floor Contour of Seam-III

REGISTRATION QUANTITIES:		NOTES:		
1.	Total Coal	0.32 Mt	1.	All dimensions are in metre
2.	Total Overburden	14.00 M-cum	2.	This plan is subject to other regulations in full force and effect.
3.	External Dump	14.00 M-cum		
4.	Internal Dump	16		

PLATE NO. - MIN-VI

**NATIONAL ALUMINIUM CO. LTD.**

MINING PLAN FOR UTKAL-E OCP

780004

MINE STAGE PLAN  
4TH YEAR

CMPDE

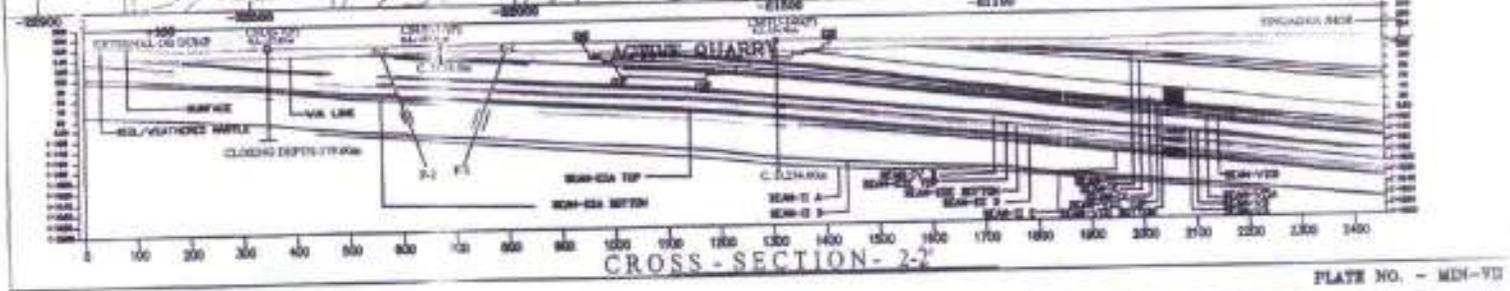
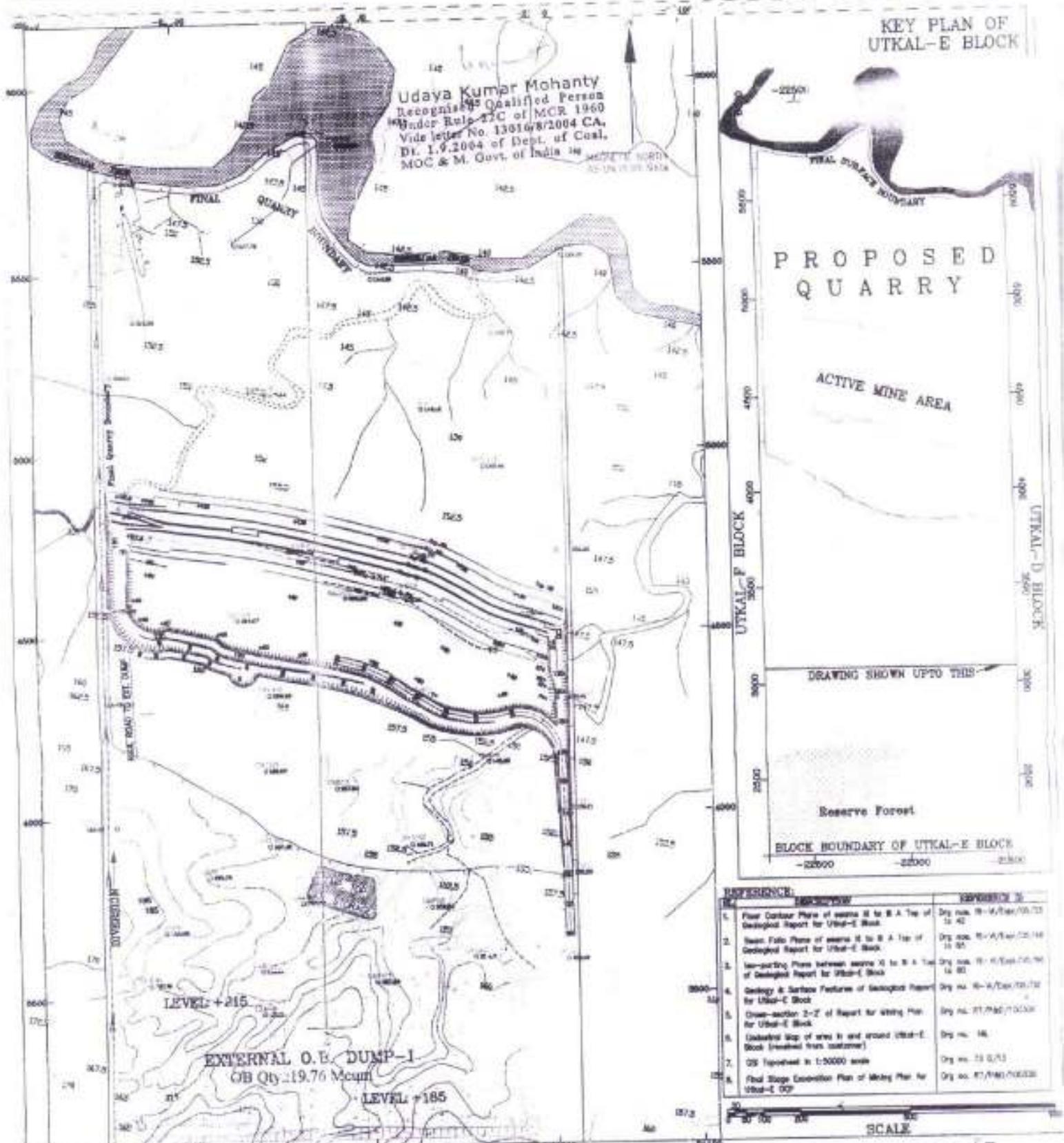


PLATE NO. - MDI-VD

LEGEND		LEGEND		EXPLANATION QUANTITIES		NOTES	
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	Sl. No.	DESCRIPTION	Sl. No.	DESCRIPTION
(Symbol)	Structure @Bd by OCPD-1st Phase	(Symbol)	1/40 Division Rule	1.	Total Coal	1.	All Dimensions are in metre
(Symbol)	Structure @Bd by G.S.I.	(Symbol)	Floor Contour of Seam-IV B	2.	Total Coalburden	2.	This plan is subject to other modification to full coal conditions
(Symbol)	Structure @Bd by OCPD-2nd Phase	(Symbol)	Floor Contour of Seam-IV B at	3.	External Dump		
(Symbol)	Carbon outcrop with Reduced Level (m)	(Symbol)	Floor Contour of Seam-IV Top	4.	Internal Dump		
(Symbol)	Water Head Road	(Symbol)	Quarry Floor Boundary				
(Symbol)		(Symbol)	Quarry Surface Boundary				

**NATIONAL ALUMINIUM CO. LTD.**

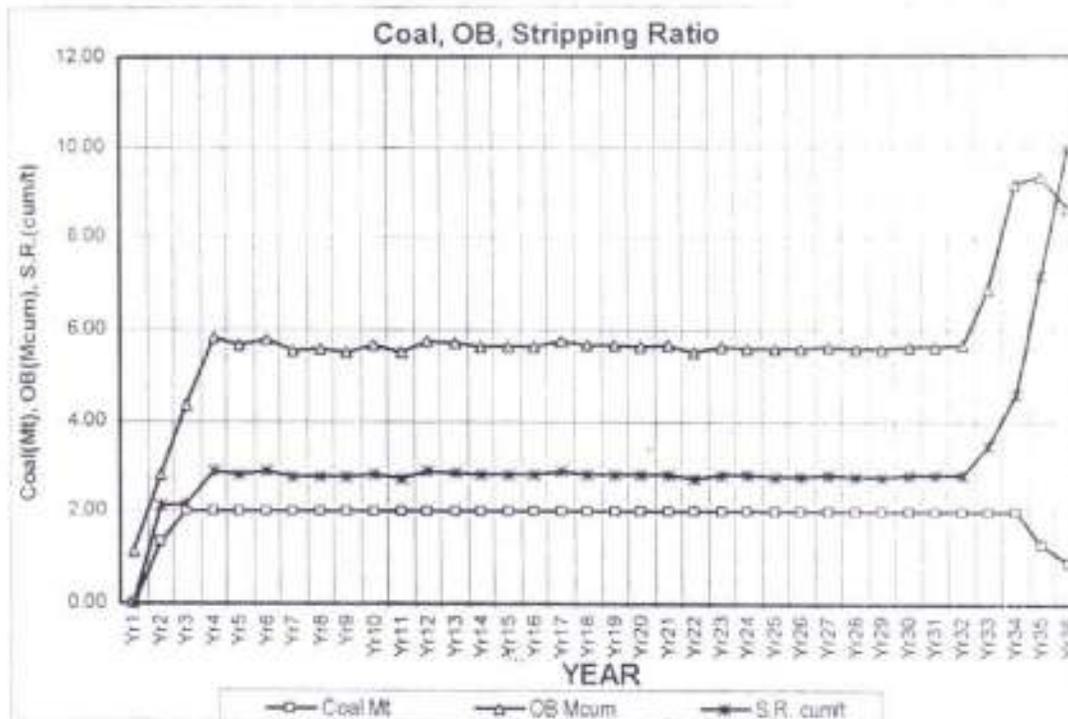
**MINING PLAN FOR UTKAL-E OCP**

**MINE STAGE PLAN 5TH YEAR**

**REDUCED COPY**

**78/0004**

Following graph shows the year wise representation of coal, overburden and stripping ratio.



#### 5.10.1 HEMM

Based on the yearly work load, HEMM requirement is assessed and given in table-5.11

**TABLE - 5.11**  
STATEMENT SHOWING THE REQUIREMENT OF HEMM WITH PHASING

SL. NO.	EQUIPMENT NAME	SIZE/ SPECIFICATIONS	TOTAL REQUIREMENT	YEAR WISE PHASING				
				Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
COAL (in Mt)					1.32	2.00	2.00	2.00
OVERBURDEN (in Mcum)				1.12	2.81	4.33	5.83	5.67
A:	<u>OVERBURDEN</u>		NO.	NO.	NO.	NO.	NO.	NO.
1	HYDRAULIC SHOVEL	6-6.5 cum	4	1	1	1	1	
2	REAR DUMPER	50 T	44	7	11	11	13	2
3	RBH DRILL	150-170 mm	5	1	3	1		
4	DOZER	410 HP	4	2	2			
5	RIPPER		2	1		1		

SL. NO.	EQUIPMENT NAME	SIZE/ SPECIFICATIONS	TOTAL REQUIREMENT	YEAR WISE PHASING				
				Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
<b>B: <u>COAL</u></b>								
1	HYDRAULIC SHOVEL	6-6.5 cum	1		1			
2	REAR DUMPER (Coal Body)	50 T	7		4	2	1	
3	RBH DRILL	130-170 mm	1		1			
4	WHEEL DOZER	300 HP	2		1		1	
<b>C: <u>COMMON</u></b>								
1	HYDRAULIC BACKHOE	0.9-1.2 cum	1	1				
2	HYDRAULIC MOBILE CRANE	20 T	1	1				
3	SERVICE CRANE	8 T	1	1				
4	FRONT END LOADER	3.5cum	1		1			
5	GRADER	280 HP	1	1				
6	WATER SPRINKLER	28 KL	2	1	1			
7	MAINTENANCE VAN		1	1				

The phasing of HEMM is shown for the requirement during the initial five years. Though shovels have been shown under separate heads of coal and overburden, all shovels will work in either coal or O.B. as per occurrence of different strata and physical deployment of machines.

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## CHAPTER – VI

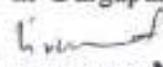
## COAL HANDLING PLANT

6.0 The coal handling plant is planned to handle 2.00 Mtp and shall have the following facilities (Plate ENG-1):

- 2 nos. of receiving pits to receive ROM coal brought by dumpers envisaged.
- 1 no. rock breaker to break coal/stone over (+) 1200 mm size.
- 2 nos. of slow moving belt conveyors to remove big lumps of shale and stone pieces by a trolley mounted grab running over a monorail across the above conveyors.
- 2 nos. of 2 stage 4 roll crushers to reduce size of coal to (-) 100 mm size.
- The coal crushed to (-) 100 mm size will be fed to 2 nos. of vibrating screen to separate coal into (-) 75 and (+) 75 mm fractions.
- Manual picking of shale and stone pieces shall be carried on (+)75 mm size of coal.
- Both (-) 75 and (+) 75 mm size coal shall be elevated and stored in a 6000 tonne over ground coal storage bunker.
- Coal from the over ground coal storage bunker shall be reclaimed by vibro feeders and shall be fed into the out bye coal transport system.
- Either pre-weigh hopper or volumetric system of loading shall be provided if rail transport from the mine is envisaged.
- Other facilities like dust control, industrial and drinking water supply, fire fighting and plant cleaning, tramp iron and metal detector cum removers, coal sampler etc are also envisaged.
- Rejects from screening and picking plant shall be carried and stored in a reject hopper for further disposal by tipping trucks.

Shunt-back system of railway along the eastern block boundary has been proposed. This arrangement will minimize requirement of land in Durgapur Reserve Forest.

  
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 Government of India  
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**CHAPTER - VII**

**POWER SUPPLY, ILLUMINATION & COMMUNICATION  
MANAGEMENT**

**7.1 Introduction**

This chapter deals briefly with the source of incoming power supply, project substation, power distribution arrangement, illumination, automation and communication facilities required for the project.

**7.2 Source of Supply**

The following alternative sources of power have been examined.

a) Power from the Captive power plant of NALCO:

The project may get 33 kV power by drawing double circuit overhead lines from the CPP to the project. This alternative is not suitable considering the distance and the cost involved in it. Moreover as the generation is at 11 kV the cost of stepping up the voltage at the generation end is also involved.

b) Power at 220/132 kV from Meramandali GRID sub-station:

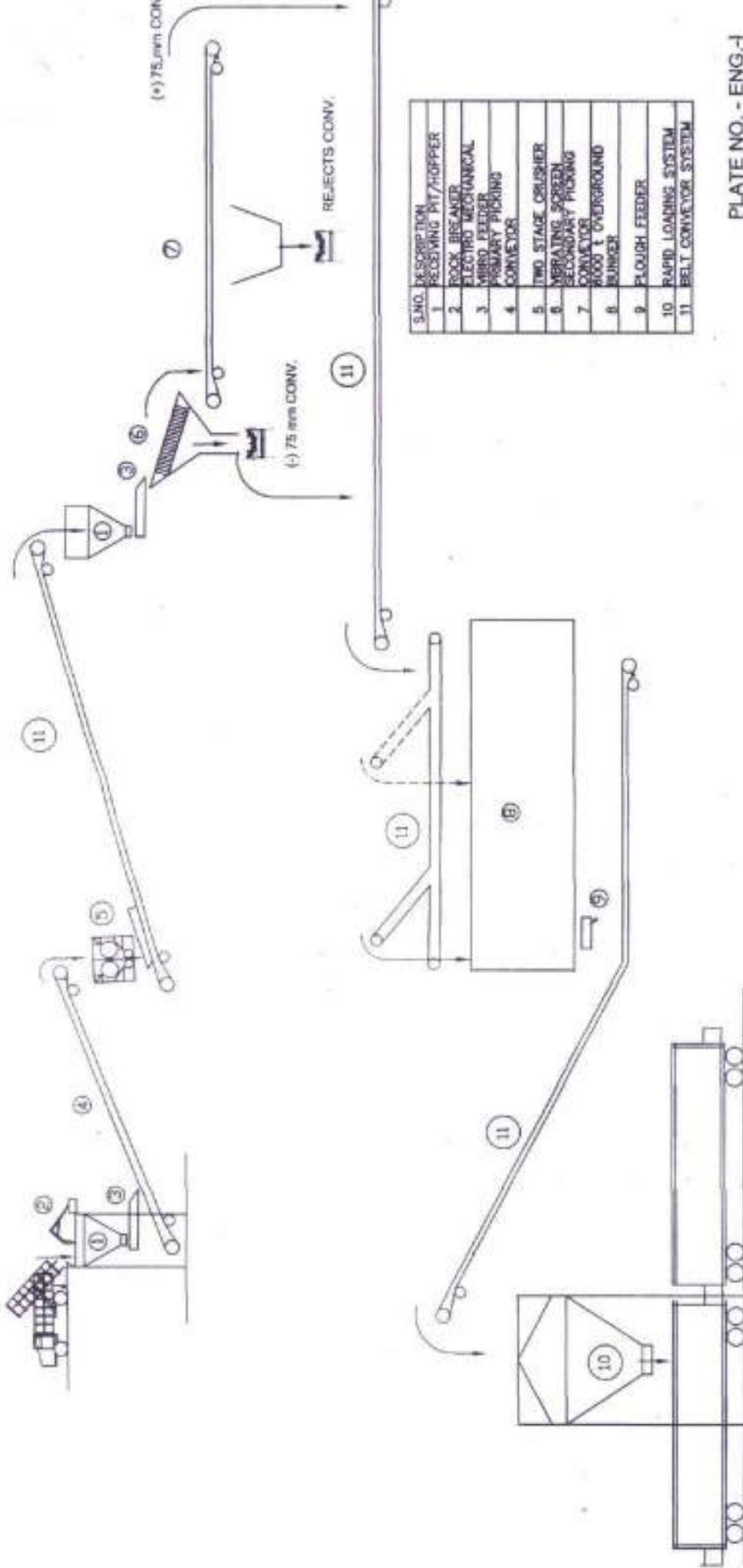
The project may also get power from Meramandali GRID sub-station as NALCO is having a drawal/evacuation arrangement with GRIDCO. Under this agreement NALCO evacuates their surplus power to the Grid or draws power from Grid in case of drop in generation in their Captive power plant. This alternative is also not considered for the prohibitive cost.

c) 11 kV power from CESCO:

As 11 kV power of CESCO being rural and is highly disturbed and vulnerable to frequent breakdowns, availing 11 kV power is also ruled out.

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*[Signature]*



S.NO.	DESCRIPTION
1	RECEIVING PIT/HOPPER
2	ROCK BREAKER
3	ELECTRO MECHANICAL FEEDER
4	PRIMARY PICKING CONVEYOR
5	TWO STAGE CRUSHER
6	VIBRATING SCREEN SECONDARY PICKING
7	CONVEYOR
8	BUNKER
9	FLOUGH FEEDER
10	RAPID LOADING SYSTEM
11	BELT CONVEYOR SYSTEM

Customer: NATIONAL ALUMINIUM COMPANY  
 Plate No. - ENG-1

Job Title	MINING PLAN FOR UTKAL-E OCP			Job No.	780004
Subject	COAL FLOW DIAGRAM OF CHP			Signature	
	Activity	Name	Designation	Date	
	Designed	P. K. GHOSH	DY. CE (EAM)	MAY	
	Drawn	P. K. GHOSH	DY. CE (EAM)		
	Checked	P. K. GHOSH	DY. CE (EAM)		
	Approved	S. V. NARAYAN	DY. CE (EAM)		
	Scale	NTS		Sheet	
	Dwg No.	97	EAM	300759	REV No.
<b>CMPDI RI-VII</b>					

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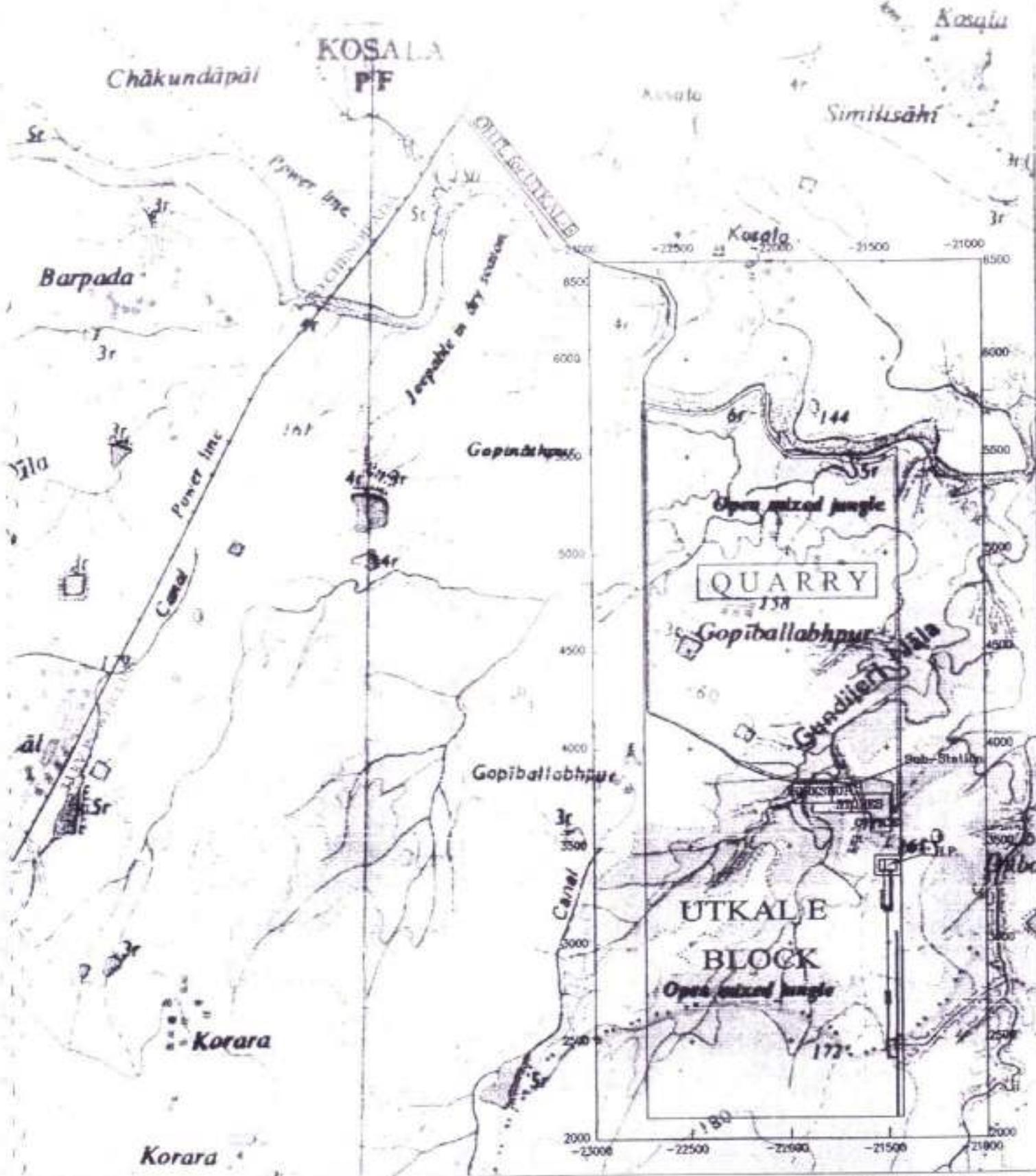


PLATE NO : ENG-II

NOTE:  
 1. POWER LINE ALIGNMENT IS TAKEN FROM TOPOSHEET NO 73D(1)  
 2. QUARRY POSITION IS MARKED AFTER SUPERIMPOSING THE AVAILABLE SURFACE FEATURES.

Customer <b>NATIONAL ALUMINIUM CO. LTD.</b>				
Job Title <b>MINING PLAN FOR UTKAL-E OCP</b>			Job No. 780004	
Subject PART ALIGNMENT OF 11KV OHTL OF CESCO	Activity	State	Preparation	Date
	Design	Orissa	By C. K. SINGH	10.08.02
	Drawn		By S. K. SINGH	10.08.02
	Checked		By S. K. SINGH	10.08.02
	Approved		By S. K. SINGH	10.08.02
Created by CSPM	Scale	N.T.S.		Sheet 1 of 1
App. No.	DATE	APPROVED	REV. No. 1	

**S. K. SINGH**  
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 or Rule 22C of MCR 1960  
 letter No. 13016/8/2004 CA,  
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## d) 33 kV power from CESCO.

This alternative was discussed with the CESCO officials. They have agreed for supply of 33 kV power to the tune of the requirement i.e. 6.4 MVA.

Considering the merits and demerits of all the alternatives, this alternative of availing power at 33 kV power from CESCO is most suitable. NALCO has to apply in FORM-16 to Executive Engineer, CESCO, Angul Division for necessary power.

The project will hence receive power at 33 kV from CESCO through double circuit overhead line. The 33 kV power shall be tapped at a suitable point approved by CESCO near the project from the 33 kV CESCO Jharpada-Chendipada overhead line. The above 33 kV overhead line is passing near the project. The proposed 33/6.6 kV Substation shall be constructed near the South Eastern Side of mine entry.

7.3 **Transformer Capacity**

Considering anticipated loads of the project, the maximum demand has been estimated to be around 6420 kVA. This maximum demand shall be achieved after considering diversity of 0.8 and improving the power factor to 0.95 by providing two sets of capacitor banks of around 1770 kVAR capacities. 3 x 3.15 MVA, 33/6.6 kV transformers will be provided in the project sub-station. These transformers shall cater to the loads of HEMM and associated equipments, CHP, pumps, lighting, colony, workshops, etc.

7.4 **Voltages & System Earthing**

The various voltages proposed to be used at the project are:

Incoming supply	:	33 kV
Shovels	:	6.6 kV
Drills	:	6.6 kV
Pumping	:	6.6 kV & 415 Volts
Workshops	:	415 Volts
CHP	:	6.6 kV & 415 Volts
Colony & water supply	:	415 Volts
Lighting in the quarry	:	240 Volts

  
 Joint Secretary  
 Ministry of Coal  
 Government of India

  
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In this project, restricted earthed neutral system has been proposed to be adopted for all equipment. To ensure safety to working personnel and for prevention of shock hazards, an effective earthing system has been suggested. There will be an earthing grid surrounding the main substation. The combined resistance of the earthing grid in the substation shall preferably be kept below two ohms.

#### 7.6 Metering Arrangement

For measuring kWh, kVAR and maximum demand, metering arrangement shall be provided at the project substation.

#### 7.7 Power Distribution Arrangement

##### Substation and Distribution Centre

The project's main substation will be located near the South Eastern Side of the mine entry. The substation will consist of 33kV outdoor switchyard, control room & 6.6kV outgoing arrangement. 33kV outdoor yard will consist of 33kV isolators, lightning arrestors, circuit breakers, sectionalised bus, 33/6.6kV power transformers, station transformers, lightning mast etc.

The control room will accommodate 6.6kV circuit breakers for secondary control of transformers, outgoing feeder control circuit breakers for power distribution of quarry, pumps, colony, workshop & capacitor banks. 33kV control panels, battery and battery chargers, 415V distribution switch board etc. will also be accommodated inside the control room.

Lightning arrestors will be installed both on 33kV and 6.6kV sides to protect the equipment against surge voltage in the form of travelling waves.

Lightning mast shall be installed to prevent direct lightning strokes from reaching the equipment in the substation.

##### Quarry Distribution

From the main substation 6.6kV overhead lines will be laid along the peripheral boundary of quarries and along the haul roads for feeding power to HEMM in

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coal, OB and pumping installations. All the shovels and drills in both coal & OB will be controlled by field switches.

Pumps of 110 kW and above shall operate at 6.6kV. Unitized transportable substations of different capacities have been provided to cater to the demands of lesser capacity pumps. Adequate provisions have been made towards 6.6 kV, 415 volts circuit breakers, cables etc. for control of pumps.

7.8

**Illumination****Quarry Illumination**

The working areas of the quarry shall be illuminated by a system of 4x400W HPSV lamps mounted on 15m high mobile masts. Power to these lights will be fed through 15kVA, 6.6/0.230kV lighting transformers backed by DG sets of suitable capacity. Besides this the area in the vicinity of each drill will be lighted by one 15kVA, 6.6/0.220kV lighting transformer.

**Haul Road Illumination**

Entire haul road area will be illuminated by 250W HPSV lamps mounted on Steel tubular poles/portable lighting masts erected along the haul roads. Power to these lamps would be supplied from 100 KVA, 6.6/0.230 kV transformer.

**Spoil Dump Illumination**

Spoil dump illumination would be done by 400W metal halide lamps mounted on steel tubular poles with 15kVA, 6.6/0.220kV transformers.

**General Illumination**

Adequate provision would be made for illumination of installations near magazines, roads and other strategic places by 250W HPSV lamps. Workshop and CHP will have their own independent illumination systems.

**Emergency Illumination**

Provision would be made for portable emergency lights, during power failure, for illuminating the important locations, such as, project office, substation, store,

  
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hospital, magazine, security and time office etc. Small DG sets will be provided at Project office and Hospital.

#### 7.9 **Communication and Automation Facilities**

The operation of CHP shall be fully automatic.

#### 7.10 **Telecommunication**

Telecommunication system required at Utkal – E block for facilitating efficient functioning of production and administration units of the project has been broadly divided into two groups as follows:

- a) Internal communication
- b) External communication

##### 7.10.1 **Internal Communication**

The following telecommunication facilities have been suggested for efficient communication within the project :

- i) Project (Administration) telephone system.
- ii) Dispatcher searching and broadcast communication.
- iii) Digital clock service.

##### i) **Project telephone system**

An automatic telephone exchange with 300 lines capacity has been suggested for general communication within the project. Telephone sets will be installed in all offices, operating centers, workshop, store, hospital/dispensary, selected residential quarters etc. In this system, since line communication will not be feasible, VHF radio communication will be used. Each major equipments including jeeps/cars of senior operational officers should be equipped with a transceiver set and all the transceivers, including the one in the control station located in the dispatcher control room, will work on the same frequency. Thus, a simplex two-way voice communication is established between the central control station and field station. This control radio set will be connected with a manual

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switchboard and radio line can be extended to one or two special type of telephone sets given to the chief of production and others.

It may be mentioned that to use VHF/HF sets in mines or in the office, prior frequency allocation has to be obtained from the Ministry of Communications, Govt. of India.

## ii) Dispatcher searching and broadcast communication system

This system is similar to a public address system for searching the personnel in various working areas inside the project. The general broadcasting is controlled from dispatcher control room. Horn type loudspeakers shall be installed at selected locations.

## iii) Digital clock service

Four-digit display units indicating hours and minutes, shall be installed at key location in the administrative building, coal handling plant, workshop and other selected areas. These will be controlled from a master station located in the dispatcher control room. Digits should be readable in day and night from a distance of at least 25 metres.

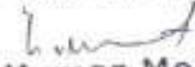
## 7.10.2 External Communication

The following types of communication system have been suggested for facilitating quick and reliable communication with outside offices :

- i) Automatic telephone communication
  - ii) Radio communication
  - iii) E-mail communication.
- i) Automatic telephone communication

Fifteen telephones lines with a EPABX interface have been provided for BSNL communication and access to with public communication grid. These telephones would be located in the residences and offices of key personnel of the project, sub-station, CHP, railway siding, workshop etc. Besides fixed line BSNL

  
 7.6

  
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telephones, 5 nos. of BSNL cell one Mobile connections with sets may also be provided to important personnel of the project.

**ii) Radio communication**

UHF radio with power supply unit and exchange interface, antenna etc. have been suggested for reliable communication linking CPP, field and corporate offices at Bhubaneswar.

**iii) E-mail communication**

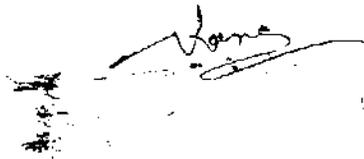
Electronic mail communication has also been suggested for immediate communication of files, messages, graphics etc. to any place. For this, TCP/IP Internet facility shall be availed from VSNL, DOT or other Internet Service Providers.

7.11

**Office Automation**

Sufficient no. of computers of latest generation along with dot-matrix and inkjet printers, scanners etc. will be provided for the project. Photocopiers and overhead projectors will also be provided for the project.

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## CHAPTER – VIII

## MINE FACILITIES AND SERVICES

## 8.0 Workshop

The workshop will have two separate sections to look after the maintenance needs of HEMM and other P&M.

- **HEMM Section**

This section will look after the maintenance needs of all the heavy earth moving equipment provided in the project and shall have the following facilities:

- Daily maintenance including washing of equipment.
- Scheduled technical maintenance including lubrication and inspection
- Day-to-day minor repairs/replacement of components and sub assemblies.
- Routine inspection and scheduling for attending to major repairs and overhauls from outside agencies.

- **E & M Section**

This section will look after the maintenance needs of all the other equipment like pumps, CHP equipment, power supply, light vehicles etc. provided in the project and shall have the following facilities:

- Washing of LMV, lubrication, inspection and minor repairs of the E&M equipment as required.
- Routine/scheduled maintenance of all E&M equipment (lubrication and minor adjustments and filling of POL etc.).

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- Incidental minor repair/replacement of sub-assemblies and components of CHP equipment and accessories, water pumps and pumping installations and other E&M equipment
- Day-to-day repair and maintenance of LMVs including repair of dynamos, self-starters, radiators and battery charging etc.
- Repair of small electrical motors, switch gears and instruments etc. including rewinding jobs.
- Inspection and scheduling of major repairs from outside agencies.

### 8.1 Project Store

The workshop and project store shall be located in the same compound for faster availability of spares required by the work shop. Provision for a closed shed is made for the project stores. Separate provision for a store yard of adequate area is also made for loading/unloading, truck movement etc

Store racking system, weigh scale, fork lift truck have also been provided in the stores which shall be located adjacent to the workshop complex for quick issuing of materials to the workshops.

The infrastructure area is shown in plate- GEN-III.

### 8.2 Mine Drainage

The following facilities would be provided for proper drainage:

- The garland drains shall be developed in advance for each mine stage such that water is collected in these garland drains and discharged properly outside the pit.
- Working faces would be laid such that the water from the working areas will flow into the sump by gravity from where it would be pumped out to surface drains.
- Face pumps of adequate capacity would be provided to working faces dry.

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- Slurry pumps would be provided to deal with slurry formed during rainy season.

### 8.3 Buildings

As the mine life is about 34 years, all building will be of permanent type.

#### 8.3.1 Service buildings

Office buildings, sub-station, statutory buildings such as first aid centre, rest shelter, canteen etc. of appropriate area would be provided near the mine. A service magazine of 12 tonne capacity would be provided for which 8.91 ha of land is provided including safety zone.

#### 8.3.2 Residential buildings

The residential buildings and allied facilities of the project shall be located at a suitable place.

### 8.4 Roads

Following types of roads would be provided:

#### 8.4.1 Haul roads

Haul roads suitable for plying 50T-60T class rear dumpers with side drains and dozer path would be provided.

#### 8.4.2 Colony roads

3.78 m wide roads with drains etc. would be provided.

#### 8.4.3 Heavy Duty road

The type of road suitable for 50T-60T class rear dumpers would be provided connecting, workshop, dumps etc.



Handwritten signature and stamp of Udaya Kumar Mohanty, including a circular official stamp with text in Hindi and English.

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**8.4.4 Approach road**

Approach road to project site would be provided. Approach road to colony and magazine also would be provided.

**8.5 Water Supply & Sewerage**

Singadha jhor is the only natural water source near the proposed project. A suitable weir would have to be constructed across the jhor to meet the requirement of project. Ground water source by making tube wells would also be provided to make up any short supply from Singadha jhor.

**8.5.1 Colony water supply**

Potable water demand of 0.35 MLD is tentatively assessed. This demand is proposed to be met by ground water source by making tube wells and distributed through ground reservoir.

**8.5.2 Industrial water demand**

Industrial water demand is tentatively assessed as about 0.45 MLD and is proposed to be met from Singadha jhor/tube wells. The water will be stored in ground reservoir and distributed through overhead storage tanks located at suitable points.

**8.5.3 Sewerage**

Domestic and industrial effluent will be disposed off after suitable treatment in the effluent treatment plants (STP/ ITP) located in colony and industrial area.

  
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Govt. of India

## CHAPTER - IX

# ENVIRONMENTAL MANAGEMENT

### 9.1 General

Utkal-E is located in Talcher coalfield, Angul district, Orissa. This project comes under the administrative control of NALCO, CPP, Angul and Corporate Project Department, Bhubaneswar.

The area is undulating. The general slope of the ground is towards the north. The drainage of the mining area is mainly controlled by the Gundijari nullah and other seasonal nullahs which are flowing in the east and west of the project. These nullahs drain towards north and join in the east-west flowing Singadha jhor which drains ultimately into the Brahmani river at the north of Talcher town.

### 9.2 Climate

The area experiences a sub-tropical warm temperature

#### 9.2.1 Rainfall

The mean annual precipitation considering last 22 years record is 1270mm of which 70% occurs during rainy season i.e. June to Sept. The monthly rainfall data during pre-monsoon cyclone season i.e. March 2005 to May 2005 for the core zone varies from 21.90 to 26.50 mm.

#### 9.2.2 Temperature

The monthly mean daily temperature varies from 6.7°C to 45.5°C during pre-monsoon cyclone season as observed from the long range (1994 to 2004) data. The monthly mean temperature during pre-monsoon cyclone season i.e. March 2005 to May 2005 varies from 22.24 to 43.22°C.

9.2.3 **Wind speed and direction**

The pre-dominant wind directions are from NW, SE, NE and SW and the average wind speed ranges from 2.0 to 5.0 km/hr during pre-monsoon cyclone season as observed from the long range (1994 to 2004) data. The predominant wind directions during pre-monsoon cyclone season March 2005 to May 2005 are from SE during 9 hours and SSE during 17 hours. The speed ranges from 1 to 2.5 kmph.

9.2.4 **Relative humidity**

The monthly average relative humidity ranges from 31 to 81% during pre-monsoon cyclone season as observed from the long range (1994 to 2004) data while the monthly average humidity during pre-monsoon cyclone season i.e. March 2005 to May 2005 for the core zone ranges from 41.0 to 82.60%.

9.3 **Existing Environmental Quality**

9.3.1 **Air quality**

Baseline air quality data are being generated as per CPCB guidelines for all the four seasons starting from April, 2005. The location of air quality monitoring stations is shown in Plate No. ENV-1. Ambient air quality data of April 2005 to June 2005 are summarized below:

**Table- 9.1**  
**Summary of Air Quality Data**

(Values in  $\mu\text{g}/\text{m}^3$ )

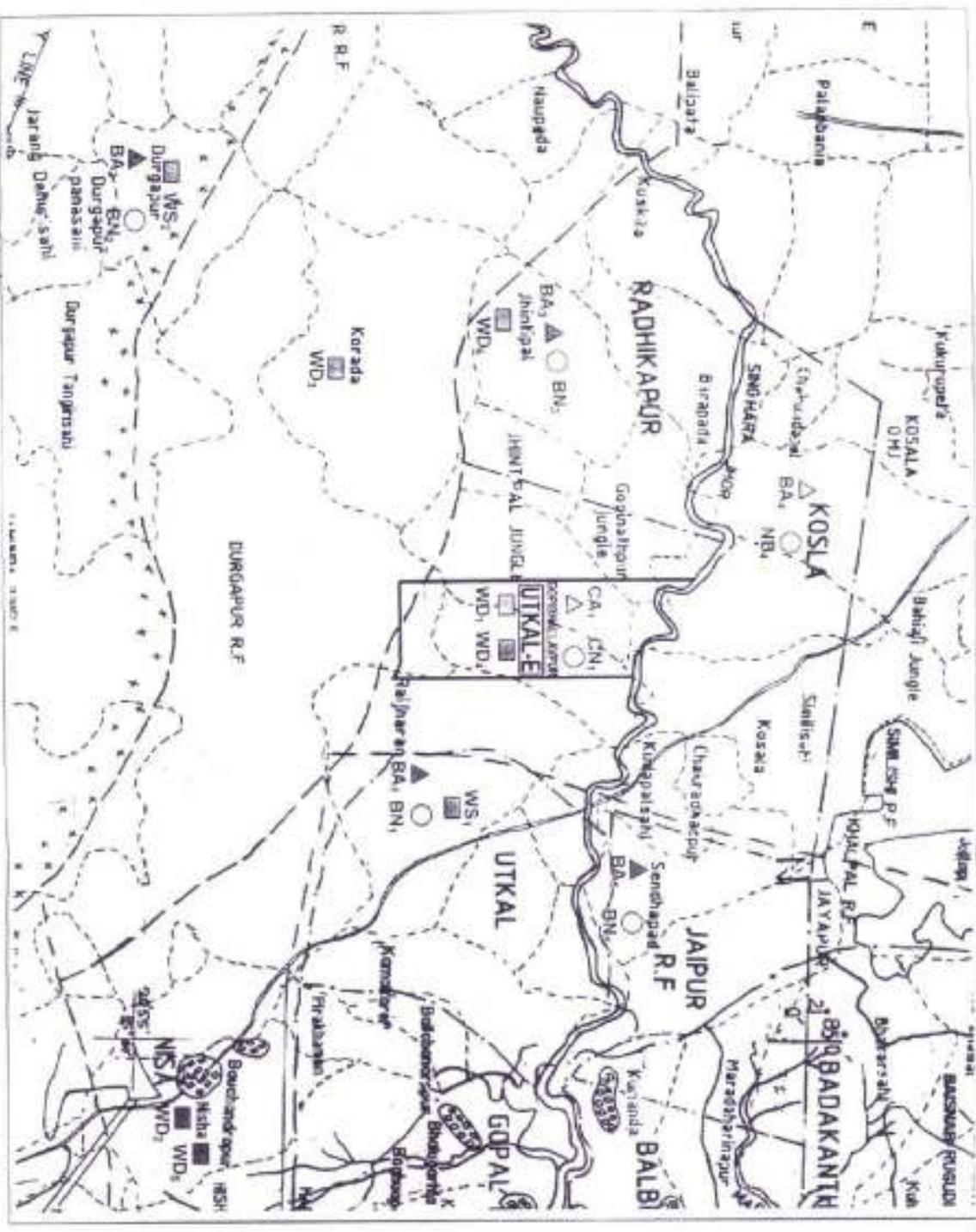
Sl. No.	Station	Month	SPM		RPM		SO <sub>2</sub>		NO <sub>x</sub>	
			Min	Max	Min	Max	Min	Max	Min	Max
1.	Rajjharan Village	April, 2005	66	153	20	72	25	52	39	65
		May, 2005	71	150	33	63	29	42	36	49
		June, 2005	48	157	24	52	38	50	39	52
		July, 2005	22	74	10	35	12	41	26	33
		Aug, 2005	10	48	10	28	<10	16	<10	24
		Sept, 2005	18	81	10	49	<10	27	<10	27
2.	Sendhapal Village	April, 2005	40	147	13	79	27	53	22	68
		May, 2005	81	156	41	71	21	40	27	47
		June, 2005	48	95	29	59	25	45	32	52
		July, 2005	29	89	25	52	<10	<10	<10	28
		Aug, 2005	10	124	10	116	<10	<10	<10	16
		Sept, 2005	10	97	10	48	<10	20	<10	10

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Sampling Spot Locations for Utkal-E Block



LOCATION OF MONITORING STATIONS

1. Air Monitoring Stations	
Code	Name of the Stations
CA <sub>1</sub>	Geopthalvespur Village
BA <sub>1</sub>	Rajpuran Village
BA <sub>2</sub>	Durgapur Village
BA <sub>3</sub>	Jampur Village
BA <sub>4</sub>	Kosala Village
BA <sub>5</sub>	Senghpada Village
2. Water Monitoring Stations	
Drinking Water Samples	
Tubewell	
WD <sub>1</sub>	Geopthalvespur Village
WD <sub>2</sub>	Nisa Village
WD <sub>3</sub>	Korada Village
Dugwell	
WD <sub>4</sub>	Geopthalvespur Village
WD <sub>5</sub>	Nisa Village
WD <sub>6</sub>	Jampur Village
Pond Water	
WS <sub>1</sub>	Rajpuran Village
WS <sub>2</sub>	Durgapur Village
3. Noise Level Monitoring Stations	
CN <sub>1</sub>	Geopthalvespur Village
BN <sub>1</sub>	Rajpuran Village
BN <sub>2</sub>	Durgapur Village
BN <sub>3</sub>	Jampur Village
BN <sub>4</sub>	Kosala Village
BN <sub>5</sub>	Senghpada Village

PLATE No. ENV-1

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Udaya Kumar Mohanty  
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 Under Order No. 1516/1972  
 Vide letter No. 1516/1972  
 Dt. 1.9.72



**LEGEND**

① Forest of India Wildlife Department  
 (a) Reserved Forest  
 (b) State Forest  
 (c) Private Forest  
 (d) Other Forest

② State Forest Boundary  
 (a) Reserved Forest Boundary  
 (b) State Forest Boundary  
 (c) Private Forest Boundary  
 (d) Other Forest Boundary

③ State Forest Boundary  
 (a) Reserved Forest Boundary  
 (b) State Forest Boundary  
 (c) Private Forest Boundary  
 (d) Other Forest Boundary

④ State Forest Boundary  
 (a) Reserved Forest Boundary  
 (b) State Forest Boundary  
 (c) Private Forest Boundary  
 (d) Other Forest Boundary

⑤ State Forest Boundary  
 (a) Reserved Forest Boundary  
 (b) State Forest Boundary  
 (c) Private Forest Boundary  
 (d) Other Forest Boundary

⑥ State Forest Boundary  
 (a) Reserved Forest Boundary  
 (b) State Forest Boundary  
 (c) Private Forest Boundary  
 (d) Other Forest Boundary

⑦ State Forest Boundary  
 (a) Reserved Forest Boundary  
 (b) State Forest Boundary  
 (c) Private Forest Boundary  
 (d) Other Forest Boundary

⑧ State Forest Boundary  
 (a) Reserved Forest Boundary  
 (b) State Forest Boundary  
 (c) Private Forest Boundary  
 (d) Other Forest Boundary

⑨ State Forest Boundary  
 (a) Reserved Forest Boundary  
 (b) State Forest Boundary  
 (c) Private Forest Boundary  
 (d) Other Forest Boundary

⑩ State Forest Boundary  
 (a) Reserved Forest Boundary  
 (b) State Forest Boundary  
 (c) Private Forest Boundary  
 (d) Other Forest Boundary

3.	Kosala Village	April, 2005	28	87	13	64	24	43	45	58
		May, 2005	32	135	18	54	30	44	38	45
		June, 2005	24	138	19	58	29	46	39	51
		July, 2005	16	70	10	24	19	42	<10	31
		Aug, 2005	10	87	10	24	<10	17	<10	24
		Sept, 2005	14	58	10	31	<10	23	<10	30
4.	Gopiballavpur Village	April, 2005	73	134	26	77	35	50	51	69
		May, 2005	50	106	27	56	29	42	36	45
		June, 2005	12	82	10	47	29	48	36	58
		July, 2005	10	71	10	54	19	51	29	35
		Aug, 2005	10	66	10	58	<10	21	<10	24
		Sept, 2005	10	66	10	36	<10	25	<10	20
5.	Jhintipal Village	April, 2005	46	127	18	58	29	51	36	68
		May, 2005	45	127	16	57	22	35	37	41
		June, 2005	16	93	10	40	34	47	19	53
		July, 2005	14	52	10	49	19	36	21	39
		Aug, 2005	10	55	10	21	<10	19	<10	32
		Sept, 2005	15	75	11	39	15	23	<10	20
6.	Durgapur Village	April, 2005	65	137	15	83	29	51	23	61
		May, 2005	71	99	28	57	28	40	29	43
		June, 2005	63	135	10	132	28	48	41	53
		July, 2005	15	43	10	42	21	37	24	37
		Aug, 2005	16	51	14	37	<10	20	<10	30
		Sept, 2005	10	119	10	113	12	27	<10	18

N.B. : Monitoring was done at 24 hourly intervals for two days in a week for four consecutive weeks in each month.

### 9.3.2 Water quality

In order to assess water quality, samples were collected from tube wells of Gopiballavpur, Korada and Nisa villages, dug wells of Gopiballavpur, Nisa and Jhintipal villages. Water samples were analysed for physical, chemical and bacteriological parameters as per IS:10,500-1991. Similarly, samples from pond waters of Rajharan and Durgapur villages were collected for assessing the surface water quality. Water samples were analysed as per IS:2296-1982 (Inland surface water : Class 'C'). The analytical results of drinking and surface water samples are given in Table 9.2 to 9.4. The location of water quality monitoring stations is shown in Plate No.ENV-I. The various parameters of drinking water and surface water qualities are within the limits of the prescribed standards.

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9. 3

  
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**Table-9.2**

**DRINKING WATER QUALITY DATA**

Season : Pre-monsoon  
 Month : May  
 Date of Sampling : 24/05/2005

Area : Utkal 'E' Block (NALCO)  
 Project : Utkal 'E' OC Project  
 Name of the Stn. : 1. WD<sub>1</sub> : Tube well Water, Gopiballavpur Village  
 2. WD<sub>2</sub> : Tube well Water, Korada Village  
 3. WD<sub>3</sub> : Tube well Water, Nisa Village

Sl. No.	Parameters	WD <sub>1</sub>	WD <sub>2</sub>	WD <sub>3</sub>	(IS:10500) (Desirable Limit)
1	Colour, Hazen units, Max	7	5	4	5.00
2	O.Dour	Unobj.	Unobj.	Unobj.	Unobjectionable
3	Taste	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity, NTU, Max	6	7	4	5.00
5	pH value	6.7	7.1	6.8	6.5 - 8.5
6	Total hardness(as Ca CO <sub>3</sub> ), mg/l, Max.	75	62	45	300.00
7	Iron (as Fe), mg/l, Max.	BDL	BDL	BDL	0.30
8	Chlorides (as Cl), mg/l, Max.	21	18	8	250.00
9	Dissolved solids, mg/l, Max.	138	142	102	500.00
10	Calcium (as Ca), mg/l, Max.	10.5	11.5	12	75.00
11	Copper(as Cu), mg/l, Max.	BDL	BDL	BDL	0.05
12	Manganese (as Mn), mg/l, Max.	BDL	BDL	BDL	0.10
13	Sulphate (as SO <sub>4</sub> ), mg/l, Max.	32	37	25	200.00
14	Nitrate (as NO <sub>3</sub> ), mg/l, Max.	6.2	5.8	3.5	45.00
15	Fluoride (as F), mg/l, Max.	0.3	0.25	0.15	1.00
16	Residual free chlorine, mg/l, Min.	0.14	0.18	Nil	0.2
17	Cadmium(as Cd), mg/l, Max.	BDL	BDL	BDL	0.01
18	Selenium (as Se), mg/l, Max.	BDL	BDL	BDL	0.01
19	Arsenic (as As), mg/l, Max.	BDL	BDL	BDL	0.05
20	Lead (as Pb), mg/l, Max.	BDL	BDL	BDL	0.05
21	Zinc (as Zn), mg/l, Max.	0.04	0.05	0.04	5.00
22	Hexavalent chromium (as Cr <sup>6+</sup> ), mg/l, Max.	BDL	BDL	BDL	0.05
23	Boron, mg/l, Max.	BDL	BDL	BDL	1.00
24	Phenolics (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max.	BDL	BDL	BDL	0.001
25	Alkalinity, mg/l, Max.	35	36	18	200.00
26	Faecal coliform (as MPN/100 ml), max.	BDL	BDL	BDL	Nil

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Table-9.3

## DRINKING WATER QUALITY DATA

Season : Pre-monsoon  
 Month : May  
 Date of Sampling : 24/05/2005

Area : Utkal 'E' Block (NALCO)  
 Project : Utkal 'E' OC Project  
 Name of the Stn. : 1. WD<sub>4</sub> : Dugwell Water, Gopiballavpur Village  
 2. WD<sub>5</sub> : Dugwell Water, Nisa Village  
 3. WD<sub>6</sub> : Dugwell Water, Jhintipal Village

Sl. No.	Parameters	WD <sub>4</sub>	WD <sub>5</sub>	WD <sub>6</sub>	(IS:10500) (Desirable Limit)
1	Colour, Hazen units, Max	5	4	3	5.00
2	Odour	Unobj.	Unobj.	Unobj.	Unobjectionable
3	Taste	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity, NTU, Max	8	5	3	5.00
5	pH value	6	6.5	6.5	6.5 - 8.5
6	Total hardness(as Ca CO <sub>3</sub> ), mg/l, Max.	60	35	41	300.00
7	Iron (as Fe), mg/l, Max.	BDL	BDL	BDL	0.30
8	Chlorides (as Cl), mg/l, Max.	52	8	10	250.00
9	Dissolved solids, mg/l, Max.	210	75	82	500.00
10	Calcium (as Ca), mg/l, Max.	22	6.5	8.0	75.00
11	Copper(as Cu), mg/l, Max.	BDL	BDL	BDL	0.05
12	Manganese (as Mn), mg/l, Max.	BDL	BDL	BDL	0.10
13	Sulphate (as SO <sub>4</sub> ), mg/l, Max.	42	18	20	200.00
14	Nitrate (as NO <sub>3</sub> ), mg/l, Max.	7	3.3	3.6	45.00
15	Fluoride, (as F), mg/l, Max.	0.26	0.15	0.15	1.00
16	Residual free chlorine, mg/l, Min.	0.16	0.18	Nil	0.2
17	Cadmium(as Cd), mg/l, Max.	BDL	BDL	BDL	0.01
18	Selenium (as Se), mg/l, Max.	BDL	BDL	BDL	0.01
19	Arsenic (as As), mg/l, Max.	BDL	BDL	BDL	0.05
20	Lead (as Pb), mg/l, Max.	BDL	BDL	BDL	0.05
21	Zinc (as Zn), mg/l, Max.	0.1	0.05	0.03	5.00
22	Hexavalent chromium (as Cr <sup>VI</sup> ), mg/l, Max.	BDL	BDL	BDL	0.05
23	Boron, mg/l, Max.	BDL	BDL	BDL	1.00
24	Phenolics (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max.	BDL	BDL	BDL	0.001
25	Alkalinity, mg/l, Max.	30	12	10	200.00
26	Faecal coliform (as MPN/100 ml), max.	BDL	BDL	BDL	Nil

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 Utkal 'E' Block (NALCO)  
 Utkal 'E' OC Project  
 Gopiballavpur Village  
 Nisa Village  
 Jhintipal Village

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Table-9.4

**SURFACE WATER QUALITY DATA**

Season : Pre-monsoon  
Month : May  
Date of Sampling : 24/05/2005

Area : Utkal 'E' Block (NALCO)  
Project : Utkal 'E' OC Project  
Name of the Stn. : 1. WS<sub>1</sub> : Pond Water, Rajjharan Village  
2. WS<sub>2</sub> : Pond Water, Durgapur Village

Sl No.	Parameters	WS <sub>1</sub>	WS <sub>2</sub>	(IS:2296) <sup>5</sup> Surface waters, Class 'C' Tolerance Limits
1	Colour, Hazen units, Max	6	6	300
2	Taste	Unobj.	Unobj.	Unobjectionable
3	Dissolved oxygen, mg/l, Min	5.3	5.2	4
4	pH value	7.2	7.6	6.5 - 8.5
5	Iron (as Fe), mg/l, Max.	BDL	BDL	50
6	Chlorides (as Cl), mg/l, Max.	60	75	600
7	BOD (5 days at 20°C), mg/l, Max	0.2 <sup>§</sup>	0.22 <sup>§</sup>	3
8	Total dissolved solids, mg/l, Max	198	202	1500
9	Copper (as Cu), mg/l, Max	BDL	BDL	1.5
10	Hexavalent chromium	BDL	BDL	0.05
11	Sulphate (as SO <sub>4</sub> ), mg/l, Max.	40	45	400
12	Nitrate (as NO <sub>3</sub> ), mg/l, Max.	6.3	6.5	50
13	Fluorides (as F), mg/l, Max.	0.1	0.12	1.5
14	Total coliform organisms, (MPN/100 ml), Max	---	---	55
15	Cadmium (as Cd), mg/l, Max.	BDL	BDL	0.01
16	Selenium (as Se), mg/l, Max.	BDL	BDL	0.05
17	Arsenic (as As), mg/l, Max.	BDL	BDL	0.2
18	Lead (as Pb), mg/l, Max.	BDL	BDL	0.1
19	Zinc (as Zn), mg/l, Max.	0.02	0.06	15
20	Phenolics (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max.	BDL	BDL	0.005
21	Oil & grease, mg/l, Max	--	--	55

§ BOD (3 days at 27°C)

55 Limit not specified

5 Class 'C' : Drinking water source with conventional treatment followed by disinfection.

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## 9.3.3 Noise quality

Noise is considered as a source for annoyance and health hazard. The high noise level disturbs the ambient environmental quality. Noise level data are being generated for all months of the year starting from April, 2005. Noise level monitored during daytime (6 AM to 10 PM) and nighttime (10 PM to 6 AM) on monthly basis during April, 2005 to September, 2005 (Plate No ENV.-I) are summarized below in Table-9.5:

**Table-9.5**  
**Summary of Noise Level Data**

Sl. No.	Stations	Month	[dB(A) Leq]	
			Day-time	Night-time
1.	Raijharan village	April, 2005	47.3	39.2
		May, 2005	46.5	38.7
		June, 2005	54.3	42.3
		July, 2005	53.4	39.5
		August, 2005	52.3	44.1
		Sept., 2005	51.2	42.3
2.	Sendhapal village	April, 2005	46.4	41.3
		May, 2005	45.3	39.2
		June, 2005	41.3	39.7
		July, 2005	51.3	42.1
		August, 2005	50.9	43.2
		Sept., 2005	53.8	44.1
3.	Kosala village	April, 2005	51.7	42.7
		May, 2005	53.2	43.7
		June, 2005	52.8	42.6
		July, 2005	54.2	38.7
		August, 2005	53.9	43.7
		Sept., 2005	52.6	40.5
4.	Gopiballavpur village	April, 2005	43.7	39.2
		May, 2005	39.5	35.7
		June, 2005	41.6	38.7
		July, 2005	37.5	33.3
		August, 2005	51.4	41.9
		Sept., 2005	54.2	43.2
5.	Jhintipal village	April, 2005	47.4	42.6
		May, 2005	45.6	42.3
		June, 2005	47.5	42.9
		July, 2005	48.3	42.1
		August, 2005	52.9	43.5
		Sept., 2005	54.7	41.9

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Sl. No.	Stations	Month	Time	
			Day-time	Night-time
6.	Durgapur village	April, 2005	53.6	43.4
		May, 2005	51.7	41.6
		June, 2005	53.8	43.6
		July, 2005	51.8	42.7
		August, 2005	54.9	44.7
		Sept. 2005	53.9	44.1

Noise levels are within the permissible limits of the extant standards.

9.3.4 **Socio-economic status**

The socio-economic profile of the buffer zone (i.e. area within 10 km radius from the periphery of core zone) of Utkal-E OC coal project is given below as per 2001 Census, Series 22 (Orissa):

Total population of buffer zone including core zone is around 76,380

- **Sex composition**
  - Male population : 38,640 (50.59%)
  - Female population : 37,740 (49.41%)
  - Females/1000 males : 977
  
- **Family size**
  - Average family size : About 5
  
- **S.C Population**
  - Total population : 13,283 (17.39%)
  - Male population : 6,724 (8.80%)
  - Female population : 6,559 (8.59%)
  - Sex composition : 975 female per 1000 male
  
- **S.T Population**
  - Total population : 7,306 (9.57%)
  - Male population : 3,695 (4.84%)
  - Female population : 3,611 (4.73%)
  - Sex composition : 977 female per 1000 males
  
- **Dependency ratio = 1.1**

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## 9.3.5 Flora &amp; fauna

Taxonomic enumeration of flora and fauna (i.e. Bio-diversity study) of core and buffer zones is in progress. However, flora and fauna based on the study for nearby project is given below:

**Flora**

Forests in the buffer zone are found to be degraded due to biotic interference. Occurrence of dense forest is very rare. Tropical dry deciduous open canopied forests with *Shorea robusta* (Sal) as dominant species are found in the area. In the forest vegetation, associates of Sal are found to be *Buchanania lanzan* (Chara), *Madhuca indica* (Mahula), *Terminalia tomentosa* (Sahaj), etc. The area does not have any rare or endangered floristic elements except *Strychnos nux-vomica* (Kochila) which is also found in nearby forests.

**Fauna**

Due to biotic pressure and forest fire, the number and variety of wild animals are limited. The mammalian found in the area are *Pteropus medius* (Bat), *Macaca mullata* (Monkey), *Oryctolagus cuniculus* (Rabbit), *Funambulus pennati* (Squirrel), *Herpestis urvashi* (Mongoose), etc. Avi-fauna seen in the area are *Columbia livia* (Pigeon), *Conturnix conturnix* (Common crow), *Milvus migrans* (Common Kite), *Gallus gallus* (Owl), etc. Reptilia seen in the area are poisonous snakes like *Bungarus fasciatus* (Rana), etc. and some non-poisonous snakes. Lizards like *Varanus salvator* (Monitor lizard), *Calotes versicolor* (Garden lizard), etc. are found in the area. Amphibians found in the area are *Rana tigerina* (Indian Bull Frog), *Bufo melanostictus* (Indian Toad), etc. Fresh water fish found in the area are *Channa jachua* (Cheng), *Ophicephalus marulius* (Murrel), etc.

Though *Varanus salvator* (Monitor lizard) and *Rana tigerina* (Indian Bull Frog) are threatened species, they are found in other parts of the district as well as the state. Besides the above mentioned endangered species are found in the area. The area is not the migratory route for any wild animals.

### 9.3.6 Hydrogeology

The present project is located in Chhendipada Revenue / Panchayatraj Block of Angul district.

- **Hydrology of the area**

The mining block area has an undulating rugged topography and the general slope is towards north. The elevation of the block varies from 140 m to 185 m above MSL. Gundijeri nullah and another unnamed stream are the local drainages in this block. These drainages are ephemeral in nature and join directly to the Singadha jhor. These drainages are to be diverted for safe mining operation. Singadha jhor is the main drainage in this area flowing in the northern part of the block.

The stream flow data available from the previous studies, indicate that the maximum daily discharge is 17.809 m<sup>3</sup>/sec and minimum daily discharge is 0.0046 m<sup>3</sup>/sec.

- **Hydro-geological set up of Gopalprasad block falling within the buffer zone of Utkal-E block**

Project specific sub-surface information like aquifer disposition and characteristics are not available for this block. A detailed hydro-geological study was carried out by the Directorate of Mining and Geology, Department of Steel and Mines, Govt. of Orissa, at Gopalprasad Block. This Gopalprasad block falls in the buffer zone of this proposed mining project. Geological exploration of this block reveals that all the formation established to occur in the eastern part of Talcher Coalfield are likely to be preserved in the block with coal seams in Karharbari and Barakar formations. The thickness of coal seams in general is found to be reduced compared to the thickness reported from the eastern part of coalfield. All the boreholes drilled within the block were only restricted within Barakar formation. Barakar formation covers the entire blocks

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seams — Aquifer disposition as deciphered from geological formation at Gopalprasad block is given below:

Aquifers	Top confining beds	Bottom confining beds
Upper Barakar aquifer	Coal Seam-VIII & above with shale	Coal Seam-VI and shale
Middle Barakar aquifer	Coal Seam-III to VII and shale	Coal Seam-II and shale
Lower Barakar aquifer	Coal Seam-II, D, E & shale	Coal Seam-II A, B
Basal Barakar aquifer	Coal Seam-II, A, B & shale	Coal Seam-I.

• **Aquifer characteristics**

The aquifer characteristics of unconfined and confined aquifer were determined by pumping test at Gopalprasad block is given below:

• **Unconfined aquifer**

The determination of aquifer characteristics of unconfined aquifer was carried out from a number of yield & draw-down tests in several dug wells. The average hydraulic conductivity in general is  $4.22 \times 10^{-5}$  m/sec (3.65m/day). The discharge ranges from 5.4 to 94.2 m<sup>3</sup>/day. The draw-down varies from 0.37 to 3.50 m on an average pumping of 65 minutes. The specific capacity varies from 0.048 to 13.46 m<sup>3</sup>/hr/m draw-down. The specific yield of the area is 5.46 percent.

• **Confined aquifer**

For the confined aquifers, the piezometric head varies from 140 m to 104 m above mean sea level (i.e 0.5 m to 6.22 m above ground level). The rate of free flow of these confined aquifers varies from a few litres to as much as 7200 lph. Long duration pumping test of 5500 minutes was carried out in the well covering all the aquifers namely, Basal, Lower, Middle and Upper Barakar combined. The discharge of 8.67 m<sup>3</sup>/hr (208 m<sup>3</sup>/day) with draw-down of 64.45 m was recorded. The transmissivity and storativity were determined as 6.88

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$\text{m}^2/\text{day}$  and  $1.8 \times 10^{-4}$  respectively. The estimated permeability was  $0.086 \text{ m/day}$ . Another pumping test of 1500 minutes was carried out in the well covering the upper Barakar aquifer. During pumping test, the discharge of  $4.85 \text{ m}^3/\text{hr}$  ( $116.4 \text{ m}^3/\text{day}$ ) and the draw-down of  $61.0 \text{ m}$  were recorded. The transmissivity of  $4.925 \text{ m}^2/\text{day}$  and storativity of  $6.52 \times 10^{-5}$  were determined for this aquifer. The estimated permeability was  $0.164 \text{ m/day}$ . The transmissivity of middle Barakar aquifer was tested by slug injection test. The transmissivity was determined as  $0.45 \text{ m}^2/\text{day}$ . The estimated permeability was  $0.045 \text{ m/day}$ . Lower Barakar aquifer was tested by a pumping test of 1500 minutes duration with discharge of  $1.25 \text{ m}^3/\text{hr}$  ( $30 \text{ m}^3/\text{day}$ ) and recorded the draw-down of  $87.28 \text{ m}$ . The transmissivity of  $3.175 \text{ m}^2/\text{day}$  and storativity of  $1.270 \times 10^{-1}$  were determined for this aquifer. The permeability was estimated as  $0.318 \text{ m/day}$ .

- **Present ground water level in the block**

Present ground water condition of the area is being monitored by establishing 38 hydrograph stations (open dugwells) used for domestic water consumption. The selected hydrograph stations located in and around  $10 \text{ km}$  radius from Utkal-E block are given in Plate No. ENV-II. The details of hydrograph stations are given in Table-9.6. Water samples were collected from selected hydrograph stations. The analytical results of the samples are given in Table-9.7.



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Table-9.6

DETAILS OF HYDROGRAPH STATIONS IN & AROUND UTKAL-E BLOCK

Hydrograph Station	Village	Location	Nature of Ownership	Total Depth in metre (bmp)	Water Level in meter (bmp) (April, 05)	Water Level in meter (bmp) (May, 05)	Water Level in meter (bmp) (June, 05)
UN-1	Tangarasahi	Sri Kamal Sahoo, North of Rajarani	Private	6.88	5.60	5.70	6.0
UN-2	Dhambanaha	Near Comm. Hall	Public	14.92	9.70	9.80	10.3
UN-3	Gopiballavpur	Near Comm. Hall	Public	9.10	8.60	8.85	9.4
UN-4	Jintipal	Near Provision Store	Public	9.95	8.30	8.90	9.6
UN-5	Kotuda	Near Matha	Public	9.10	7.40	8.00	8.1
UN-6	Nuapada	Near Religious place	Public	9.50	8.00	8.30	8.9
UN-7	Balipeta	Adjacent to Sri. N. Sahoo house	Public	7.65	6.25	6.50	7.1
UN-8	Kotianali	Opp. Primary School	Public	8.70	6.20	6.50	7.1
UN-9	Kisinda	Inside School	Public	8.90	8.75	8.20	8.8
UN-10	Kuskula	Near Primary School	Public	6.90	6.00	6.10	6.7
UN-11	Barpada	Behind Comm. Hall	Public	8.40	7.25	7.68	8.6
UN-12	Kakarpetta	Near Kali temple	Public	7.80	6.95	7.00	7.0
UN-13	Tentulal	Inside School	Public	14.40	11.60	11.90	12.2
UN-14	Jamburahi	Near Comm. Hall	Public	11.02	9.10	9.25	9.4
UN-15	Jelhapur	Inside School compound	Public	11.10	7.60	7.60	7.9
UN-16	Bakala	Opp. Poultry farm	Public	7.40	3.60	3.80	4.3
UN-17	Durgapur	Opp. temple	Public	8.20	7.00	7.40	8.0
UN-18	Jharparha	East of market on Sadanandpur road	Public	8.40	6.70	7.00	7.4
UN-19	Udakapi	Sri Nandan Naik	Private	7.90	6.80	7.20	7.7
UN-20	Jangal Jamunda	Sri Rabindra Kumar Jena	Private	8.60	8.00	8.25	8.5
UN-21	Chandari Nagar	Near temple	Public	9.10	8.10	8.25	8.9
UN-22	Kunjabharipur	Only well	Public	9.40	8.92	8.85	9.3
UN-23	Brahmanbil	Western side of the village	Public	13.40	12.20	12.50	13.0
UN-24	Chakradharipur	Entrance of the village	Public	9.70	7.00	9.60	10.0
UN-25	Kankarai	Sri Nakula Sahoo house	Private	8.70	7.40	8.00	8.4
UN-26	Jagdhama	NGO. Near Primary School	Private	7.00	6.90	7.10	7.3
UN-27	Lakshmidharpur	Near temple	Public	10.35	8.80	8.20	9.7
UN-28	Kaliakata	Sri Madan Bhoi, Eastern side of the village	Private	8.90	8.50	7.40	8.8
UN-29	Basudevapur	Sri Mangutha Pattnaik	Private	6.40	5.70	6.25	6.5
UN-30	Bar Kerjang	Near Primary School	Public	10.70	9.40	9.75	10.6
UN-31	Barihapur	Centre of the village	Public	12.70	11.70	12.40	12.4
UN-32	Jambujorhi	North-Western side of the village	Public	8.40	5.80	6.10	6.3
UN-33	Jalatap	North-Western corner of the village	Public	9.00	7.90	8.10	8.2
UN-34	Kosala	Opp. Govt. Girls' H.S.	Public	8.80	6.30	6.75	7.5
UN-35	Kumunda	Near temple	Public	9.00	5.60	6.00	6.6
UN-36	Balogardia	Near Comm. Hall	Public	9.70	9.30	9.30	9.5
UN-37	Pidhakhaman	Sri Gourahari Pradhan, Opp. Primary school	Private	8.00	6.75	7.60	7.5
UN-38	Balichandrapur	Entrance of the village	Public	8.80	8.75	8.70	8.8

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Table-9.6 (Contd.)

## DETAILS OF HYDROGRAPHIC STATIONS IN &amp; AROUND UTKAL BLOCK

Hydrograph Stn	Village	Location	Nature of Ownership	Total Depth in metre (bmp)	Water Level in meter (bmp) (July, 05)	Water Level in meter (bmp) (Aug., 05)	W.L bmp 'm' (Sept'05)	W.L bmp 'm' (Oct'05)	W.L bmp 'm' (Nov'05)	W.L bmp 'm' (Dec'05)
UN-1	Tangarasahi	Sri. Karnal Sahoo, North of Rajjaran	Private	6.68	0.90	1.50	1.42	1.14	2.70	3.30
UN-2	Dhubomaha	Near Comm. Hall	Public	14.92	7.60	6.20	6.40	3.60	5.70	6.50
UN-3	Gopiballavpur	Near Comm. Hall	Public	9.10	NR	3.45	1.82	1.80	4.18	5.55
UN-4	Jintipal	Near Provision Store	Public	9.95	2.10	2.60	2.10	1.02	3.88	5.20
UN-5	Koruda	Near Matha	Public	9.10	1.65	2.50	1.75	1.65	2.57	3.10
UN-6	Nuapada	Near Religious place	Public	9.50	5.50	5.35	4.60	3.40	6.20	6.50
UN-7	Balipeta	Adjacent to Sri. N. Sahoo house	Public	7.65	2.50	2.00	1.60	1.15	2.40	3.20
UN-8	Katianali	Opp. Primary School	Public	8.70	2.70	2.67	2.46	1.70	3.00	3.50
UN-9	Kisinda	Inside School	Public	8.90	3.00	6.10	3.90	2.20	5.30	6.60
UN-10	Kuskila	Near Primary School	Public	6.90	3.50	2.90	2.50	2.00	3.20	3.95
UN-11	Barpada	Behind Comm. Hall	Public	8.40	3.50	3.00	3.28	1.85	3.40	4.00
UN-12	Kukupeta	Near Kali temple	Public	7.80	1.40	2.20	1.90	1.15	3.40	4.60
UN-13	Tentulal	Inside School	Public	14.40	11.10	8.80	5.05	8.90	8.20	9.20
UN-14	Jambunali	Near Comm. Hall	Public	11.02	5.70	5.00	5.07	4.80	6.40	7.30
UN-15	Ichhapur	Inside School compound	Public	11.10	1.80	1.40	1.30	1.20	2.00	3.20
UN-16	Bakala	Opp. Poultry farm	Public	7.40	NR	NR	1.75	1.60	2.35	2.45
UN-17	Durgapur	Opp. temple	Public	8.20	2.50	2.65	1.70	1.20	3.00	4.10
UN-18	Jherperha	East of market on Sadanandpur road	Public	8.40	4.30	3.50	2.40	1.20	2.55	3.40
UN-19	Udakapa	Sri. Nandan Naik	Private	7.90	NR	3.90	2.20	0.85	1.80	3.00
UN-20	Jangal Jamunda	Sri. Rabindra Kumar Jena	Private	8.60	NR	3.10	1.90	0.90	4.10	6.30
UN-21	Chandan Nagar	Near temple	Public	9.10	2.90	2.20	2.05	1.55	2.40	3.45
UN-22	Kunjabhanpur	Only well	Public	9.40	4.50	3.30	2.80	1.70	3.30	4.20
UN-23	Brahmanbil	Western side of the village	Public	13.40	8.90	6.10	5.35	2.85	5.00	6.70
UN-24	Chakradharpur	Entrance of the village	Public	9.70	6.25	2.00	0.95	0.85	3.20	4.50
UN-25	Kanikani	Sri. Nakula Sahoo house	Private	8.70	0.70	1.55	1.30	0.80	5.25	5.67
UN-26	Jagdumra	NGO, Near Primary School	Private	7.00	5.70	4.80	4.15	3.30	4.55	5.13
UN-27	Lakshmidharpur	Near temple	Public	10.35	1.70	3.00	3.20	1.80	4.10	4.37
UN-28	Katakata	Sri. Madan Bhoi, Eastern side of the village	Private	8.90	1.25	2.60	2.30	1.20	5.80	9.00
UN-29	Basudevpur	Sri. Mangutha Pattnaik	Private	8.40	NR	2.60	2.20	0.80	3.20	3.47
UN-30	Bar Kerjang	Near Primary School	Public	10.70	9.35	6.50	5.20	2.20	3.40	4.40
UN-31	Banihapur	Centre of the village	Public	12.70	6.20	5.80	5.30	3.70	5.80	7.00
UN-32	Jambujorhi	North-Western side of the village	Public	8.40	2.60	1.55	1.40	1.10	2.20	2.90
UN-33	Jalatap	North-Western corner of the village	Public	9.00	5.10	3.00	3.10	2.40	3.70	4.80
UN-34	Kosala	Opp. Govt. Girls' H.S.	Public	8.80	3.00	2.40	1.60	1.40	2.75	3.45
UN-35	Kumunda	Near temple	Public	9.00	1.20	2.15	2.30	1.60	2.90	3.30
UN-36	Balugarda	Near Comm. Hall	Public	8.70	1.30	1.90	1.90	1.50	3.15	4.40
UN-37	Pidhakhaman	Sri. Gourahari Pradhan, Opp. Primary school	Private	8.00	0.25	0.80	0.75	0.45	1.70	2.70
UN-38	Balichandrapur	Entrance of the village	Public	8.80	2.20	4.10	3.35	2.10	5.30	6.10

N.B: NR = Not recorded

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 Pr. 1.9.2004 dt. 1.9.04  
 MOU & M. Govt. of Orissa

Table-9.7

**DRINKING WATER QUALITY DATA**

Season : Pre-monsoon  
Month : April  
Date of Sampling : 29/04/2005

Area : Utkal "E" Block (NALCO)  
Project : Utkal-E OC Project  
Name of the Stn. : 1. UN<sub>1</sub> : Dugwell Water, Tangarasahi Village  
4. UN<sub>2</sub> : Tubewell Water, Gopiballavpur Village  
5. UN<sub>3</sub> : Dugwell Water, Korada Village  
4. UN<sub>4</sub> : Dugwell Water, Nuapada Village

Sl. No.	Parameters	UN <sub>1</sub>	UN <sub>2</sub>	UN <sub>3</sub>	UN <sub>4</sub>	(IS:10500) (Desirable Limit)
1	Colour, Hazen units, Max	5	5	4	3	5.00
2	Odour	Unobj	Unobj	Unobj	Unobj	Unobjectionable
3	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity, NTU, Max	5	5	5	3	5.00
5	pH value	7.6	7.2	6.8	7.0	6.5 - 8.5
6	Total hardness(as Ca CO <sub>3</sub> ), mg/l, Max.	38	40	65	62	300.00
7	Iron (as Fe), mg/l, Max.	BDL	BDL	BDL	BDL	0.30
8	Chlorides (as Cl), mg/l, Max.	32	31	25	28	250.00
9	Dissolved solids, mg/l, Max.	94	96	112	116	500.00
10	Calcium (as Ca), mg/l, Max.	10	11	16	15	75.00
11	Copper(as Cu), mg/l, Max.	BDL	BDL	BDL	BDL	0.05
12	Manganese (as Mn), mg/l, Max.	BDL	BDL	BDL	BDL	0.10
13	Sulphate (as SO <sub>4</sub> ), mg/l, Max.	43	42	48	44	200.00
14	Nitrate (as NO <sub>3</sub> ), mg/l, Max.	7.2	6.8	7.0	7.2	45.00
15	Fluoride, (as F), mg/l, Max.	0.14	0.16	0.18	0.2	1.00
16	Residual free chlorine,mg/l, Min.	0.18	NIL	NIL	0.16	0.2
17	Cadmium(as Cd), mg/l, Max.	BDL	BDL	BDL	BDL	0.01
18	Selenium (as Se), mg/l, Max.	BDL	BDL	BDL	BDL	0.01
19	Arsenic (as As), mg/l, Max.	BDL	BDL	BDL	BDL	0.05
20	Lead (as Pb), mg/l, Max.	BDL	BDL	BDL	BDL	0.05
21	Zinc (as Zn), mg/l, Max.	0.04	0.1	0.03	0.08	5.00
22	Hexavalent chromium (as Cr <sup>6+</sup> ), mg/l, Max.	BDL	BDL	BDL	BDL	0.05
23	Boron, mg/l, Max.	BDL	BDL	BDL	BDL	1.00
24	Phenolics (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max.	BDL	BDL	BDL	BDL	0.001
25	Alkalinity, mg/l, Max.	18	20	30	28	200.00
26	Faecal coliform (as MPN/100 ml), max.	BDL	BDL	BDL	BDL	Nil

Job No. 780004

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*Utkal*

Table-9.7 (Contd.)

## DRINKING WATER QUALITY DATA

Season : Pre-monsoon  
 Month : April  
 Date of Sampling : 29/04/2005

Area : Utkal "E" Block (NALCO)  
 Project : Utkal-E OC Project  
 Name of the Stn. : 1. UN<sub>7</sub> : Dugwell Water, Balipeta Village  
 2. UN<sub>17</sub> : Dugwell Water, Durgapur Village  
 3. UN<sub>34</sub> : Dugwell Water, Kosala Village

Sl. No.	Parameters	UN <sub>7</sub>	UN <sub>17</sub>	UN <sub>34</sub>	(IS:10500) (Desirable Limit)
1	Colour, Hazen units, Max	4	3	2	5.00
2	Odour	Unobj.	Unobj.	Unobj.	Unobjectionable
3	Taste	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity, NTU, Max	3	5	5	5.00
5	pH value	7.5	8.0	7.5	6.5 - 8.5
6	Total hardness(as Ca CO <sub>3</sub> ), mg/l, Max.	70	72	68	300.00
7	Iron (as Fe), mg/l, Max.	BDL	BDL	BDL	0.30
8	Chlorides (as Cl), mg/l, Max.	22	32	28	250.00
9	Dissolved solids, mg/l, Max.	126	122	118	500.00
10	Calcium (as Ca), mg/l, Max.	18	12	14	75.00
11	Copper(as Cu), mg/l, Max.	BDL	BDL	BDL	0.05
12	Manganese (as Mn), mg/l, Max.	BDL	BDL	BDL	0.10
13	Sulphate (as SO <sub>4</sub> ), mg/l, Max.	42	40	42	200.00
14	Nitrate (as NO <sub>3</sub> ), mg/l, Max.	7.4	7.8	7.6	45.00
15	Fluoride, (as F), mg/l, Max.	Nil	Nil	0.18	1.00
16	Residual free chlorine,mg/l, Min.	0.14	0.10	NIL	0.2
17	Cadmium(as Cd), mg/l, Max.	BDL	BDL	BDL	0.01
18	Selenium (as Se), mg/l, Max.	BDL	BDL	BDL	0.01
19	Arsenic (as As), mg/l, Max.	BDL	BDL	BDL	0.05
20	Lead (as Pb), mg/l, Max.	BDL	BDL	BDL	0.05
21	Zinc (as Zn), mg/l, Max.	0.06	0.08	0.1	5.00
22	Hexavalent chromium (as Cr <sup>6+</sup> ), mg/l, Max.	BDL	BDL	BDL	0.05
23	Boron, mg/l, Max.	BDL	BDL	BDL	1.00
24	Phenolics (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max.	BDL	BDL	BDL	0.001
25	Alkalinity, mg/l, Max.	32	24	22	200.00
26	Faecal coliform (as MPN/100 ml), max.	BDL	BDL	BDL	Nil

The ground water level recorded from the open dugwell in and around the project area ranges from less than 3.60 to about 12.50 m bmp and less than 0.45 to about 9.20 m bmp for the pre-monsoon and post-monsoon period, 2005, whereas the ground water level in the project area (core zone) ranges from less than 8.60 to about 8.85 m bmp and less than 1.80 to about 5.55 m bmp respectively.

▪ **Water demand for the project**

Estimated water demand for this project is given below :

Potable	: 0.35 Mld
Industrial	: 0.45 Mld
	-----
Total	: 0.80 Mld

*N.B: Water demand is based upon mine capacity of 2.0 Mtp. The demand of water will increase with increase in capacity of the mine.*

As this proposed opencast project is located far away from the existing opencast and U/G mines and perennial source of water (Brahmani river), the industrial water demand will be met through both ground water and surface water sources during the initial period of mining and potable water demand will be met only through ground water source. It is suggested that the industrial demand for this project can be met by:

- (i) Construction of suitable weirs in the Singadha jhor at convenient sites as it is observed from the available data that this stream has flow till January of a year.
- (ii) By construction of minimum 3 No. of deep tubewells in the project premises.

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 1.9.2004 of Dept. of Coal,  
 J.C. & M. Govt. of India



- **Coal handling plant (CHP)**
  - Provision of covers on the conveyor belts, unloading/transfer points to prevent access of wind.
  - Suppression of coal dust at transfer points and at other points in the coal flow circuit by provision of water jets and dry fog system.
  - Minimization of the height of coal-fall at transfer points to reduce the dust generation and if necessary, provision of dust suppression measures.
  - Improved maintenance of plant and machinery including provision of condition monitoring instruments like vibration meter, etc.
- **Fire at coal faces & coal stockyards**
  - Provision of adequate fire fighting arrangements including storage of sufficient quantity of water at all critical points.
  - Semi-consolidated coal stack of height not more than 8m with strict supervision.
  - Careful removal of all loose coal from the abandoned coal faces.

9.4.2 **Water quality management**

The likely sources of water pollution from this project are as follows :

- Sanitary (Domestic) waste water from residential colony and service buildings.
- Industrial wastewater from workshop.
- Mine discharge water.
- Surface run-off passing through coal stockpiles and OB dump.
- Storm water from leasehold and built-up areas.

The impact of mining at this project on both surface water source and ground water resource has been assessed as follows :

- **Surface water sources**
  - Disruption of natural drainage pattern in the core zone.
  - Deterioration of water quality & pollution of water bodies.

Job No.780004

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 2004 of Dept. of Co.  
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- Siltation and choking of water courses causing scarcity of surface water and flooding problem in the area.
- **Ground water resource**
  - Due to excavation, ground water aquifers are disrupted.
  - Due to pumping of mine water, the water table of the peripheral villages like Gopinathpur and Dubamolia may get lowered.

Effective water pollution control measures will be taken for this project. Water pollution control measures to be adopted are :

- Sedimentation ponds/tanks to treat mine discharge water for suspended solids.
- Oil and grease traps and sedimentation tanks for industrial wastewater.
- The domestic wastewater will be treated for bio-chemical oxygen demand (BOD) and total suspended solids (TSS).
- Garland drains with settling tanks for surface run-off.

## 9.4.3

**Noise abatement and blasting vibration control****(a) Noise pollution abatement measures**

The adverse effect of high noise level like health effect (both auditory and non-auditory), masking effect, sleep interference, change in personal behaviour, etc. are well known.

The following abatement measures (suppressive and preventive) will be adopted:

- Proper designing of plant & machinery by providing in built mechanism like silencers, mufflers and enclosures for noise generating parts and shock absorbing pads at the foundation of vibrating equipment.
- Greenbelt design around infrastructure site, service building area and township will commensurate with mining activity progressively over years. This comprehensive design will be developed.
- Adoption of personal protective devices like earplugs, etc.

Job No.780004

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Director  
Ministry of Coal  
Government of India  
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Udaya Kumar Mohanty  
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Under Rule 22C of MCR 1960  
Vide letter No. 13016/W/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC & M. Govt. of India.

(b) **Blasting vibration control measures**

- Proper quantity of explosive, suitable stemming materials and appropriate delay system will be adopted for safe blasting.
- A safe blasting zone will be kept around the periphery of the quarry.

9.4.4 **Socio-economic impacts**

The proposed project will have beneficial impact on socio-economic front by providing direct employment to the local people. The project will further boost the economy of the area and provide secondary and tertiary employment to the local people. There will be a positive change in the social infrastructure of the area also.

9.4.5 **Flora & fauna**

The enhancement of forest area will occur due to measures like compensatory afforestation, biological reclamation, arboriculture/afforestation and creation of greenbelt & avenue plantation. The water body created by the final void will be beneficial to flora as the area is found to be of high water scarcity. The balance in the regional population will be maintained in natural course, owing to existing undisturbed forest areas in the vicinity of the project.

9.4.6 **Land resource management**

The most significant adverse impact of opencast coal mining is the change in land use pattern. The alteration due to infrastructure and coal stock piles is not to be considered as true change as these facilities / land can be utilized for some other purposes after mining operation is over. The change in land use pattern due to activities of quarrying and external dumping of OB material may be considered as true change in land use pattern. So reclamation of mined out land and external OB dumps will be given due importance as a step for sound land resource management. The total land required for the excavation is 211.18 ha, out of which revenue forest land for diversion is 47.43 ha.

Job No.780004

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 MOC & M. Govt. of India

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9.4.7

**Resettlement and rehabilitation**

The mining area comprising of excavation zone, blasting danger zone, etc. covers two villages. Out of these villages, about 199 families will be evicted due to mining and its associated activities. The two villages above mentioned are Gopinathpur jungle and Nandichhod. The above families as well as other displaced families such as major married sons, unmarried daughters of 30 years of age, divorcee/deserted women/widows, physically handicapped and/or mentally retarded persons irrespective of age/sex and unmarried daughters/brothers/sisters/sons whose parents are not alive, homesteadless families (unobjectionable encroachers) and landless families (unobjectionable encroaches) will be resettled and/or rehabilitated socially, culturally and economically as per the latest Norms of Govt. of Orissa.

The displaced families who are not provided with employment or self-employment or who do not want to avail of such employment/self-employment will be entitled to a one time cash grant as per the above norms.

The number of families to be evicted village-wise are given below :

<u>Name of village</u>	<u>No. of families to be evicted</u>
Gopinathpur jungle	48
Nandichhoda (Gopiballavpur)	151
Total :	199 <sup>5</sup>

<sup>5</sup> Besides the above, other displaced families comprising of major married sons, unmarried daughters of 30 years of age, etc. as per latest Norms of Govt. of Orissa will also be resettled and rehabilitated.

The resettlement site for the displaced families of above villages will be in Malibrahmani Mouza in Govt. waste land.

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Udaya  
 Director, Secretary  
 Ministry of Coal  
 Government of India  
 New Delhi  
 9:23

Udaya Kumar Mohanty  
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 Under Rule 200 of MMR, 1960  
 Via letter No. 100/2000/CA,  
 10/10/2000

## 9.5 Environmental Management System

The success of environmental management depends on deep involvement of personnel at all levels and also on the creation of an effective implementing organisation. To carry out various pollution control measures and compliance of statutory regulations like environmental statement, air and water consents from the State Pollution Control Board, project level environmental organization will be created.

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**Vijendra Kumar Mohan**  
Proprietary Qualified Person  
Rule 22C of MCR  
letter No. 13016/8/20  
P. 1.9.2004 of Dept. of  
MOC & M. Govt. of India

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## CHAPTER - X

## LAND REQUIREMENT &amp; MINE LEASE AREA

## 10.1 General

Land requirement for the project has been assessed considering functional needs, forest land, particularly reserve forest which has been avoided to the maximum extent possible.

Durgapur reserve forest (64.23 ha) is present along the entire width of Utkal-E block on the south and extends further beyond the southern block boundary. Therefore it has become absolutely necessary to provide approach to the block and rail line for coal evacuation through the reserve forest. Final coal evacuation route is yet to be decided. Due to adjoining mining blocks namely Utkal-F and Utkal-D, blasting danger zone cannot be demarcated and control-blasting method has to be practiced with coordination of adjoining mines. The entire external overburden cannot be accommodated within the block boundary and it will be necessary to site a part of external dump away from the block area. Tentatively, the land near Korara village lying southwest of this block is identified for this dump (Dump-II). However, few boreholes may be drilled to prove non-coal bearing area. The location and area of the land for residential colony which will be outside the lease area is not assessed and is not included now.

## 10.2 Mine Lease Area

The lease area required is as under:

- a) The allocated Utkal-E block, excluding Durgapur reserve forest but including land for rail corridor and approach road to it within Durgapur reserve forest.
- b) External O.B. dump-II with peripheral road, garland drain and a corridor to link Utkal-E block with external dump-II, green belt, avenue plantation etc outside the allotted Utkal-E block.

c) Explosive Magazine and Safety Zone covering 300 m radially.  
The lease boundary is described below:

- North : North limit of Utkal-E block.
- East : Eastern limit of Utkal-E block.
- South : Northern boundary of Durgapur reserve forest and connecting road to dump-II.
- West : Overburden dump-II and western limit of Utkal-E.

Lease is sought for maximum period as per rules, as mine life is 36 years.

10.3 **Total Land Requirement**

Total requirement of land for various purposes is detailed in table 10.1.

The plan showing the total land requirement & mine lease area within and outside the block is shown in plate GEN-IV.

**Table -10.1**  
**Mine Lease Area & Land Requirement**

Figures in hectares

	Within Utkal-E Block				Outside Utkal-E Block Non-forest	Grand Total
	Reserve Forest	Revenue Forest	Non-Forest	Total		
Quarry Excavation		47.43	163.75	211.18		211.18
External Dump-I		101.77	35.32	137.09		137.09
External Dump-II				0.00	115.75	115.75
Top Soil Dump		0.83	1.04	1.87		1.87
Railway/Approach Road/Infrastructure	2.33	14.82	6.15	23.30		23.30
Barrier & Nala Diversion-East		0.29	2.34	2.63		2.63
Barrier & Nala Diversion-West		4.03	5.53	9.56		9.56
Peripheral Roads and Safety Barriers along Quarry edge		4.58	5.75	10.33		10.33
Embankment			1.74	1.74		1.74
Explosive Magazine and its Safety Zone					8.91	8.91
Corridor from Utkal-E to Dump-II					3.70	3.70
<b>TOTAL</b>	<b>2.33</b>	<b>173.75</b>	<b>221.62</b>	<b>397.70</b>	<b>128.36</b>	<b>526.06</b>
<b>Area required for Mining Lease</b>						<b>526.06</b>
Area required for CISF Colony in Korara Village (Non-forest land)					12.05	

As per E/P/1/Exp  
DPR

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*Land*

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**UTKAL-E  
 OPEN CAST MINE**

**EXTERNAL O.B. DUMP-I**

**EXTERNAL O.B. DUMP-II**

**C.T.P. COLONY**

NORTHERN BLOCK BOUNDARY OF UTKAL-E  
 DEDUCTED FROM GEOLOGICAL MAP OF  
 DRAFT GEOLOGICAL REPORT ON UTKAL-E BLOCK

**LAND SCHEDULE**

Sl. No.	Area (Hectares)	Area (Acres)	Total
1. Quarry (including Access Road)	27.52	67.72	27.52
2. External O.B. Dump-I	99.15	244.17	99.15
3. External O.B. Dump-II	2.38	5.89	2.38
4. C.T.P. Colony	14.32	35.32	14.32
5. Reserve Forest	0.12	0.29	0.12
6. Other	2.14	5.28	2.14
<b>Total</b>	<b>145.63</b>	<b>358.57</b>	<b>145.63</b>

RESERVE FOREST NOT TO BE ACQUIRED



**NOTES:**

- All dimensions are in metre
- This plan is prepared by exhibiting possible surface features of Topographic Plan and Survey Map, as given by NALCO.

**REFERENCE:**

- Survey of India Topographic Map of the area.
- Coloured Map of area to and around UTKAL-E Block (Survey Map enclosed).
- Red Stone Boundary Map of Mining Plan No. 1044/1960.

**LEGEND:**

Symbol	Description
1. [Symbol]	Quarry
2. [Symbol]	External O.B. Dump-I
3. [Symbol]	External O.B. Dump-II
4. [Symbol]	C.T.P. Colony
5. [Symbol]	Reserve Forest
6. [Symbol]	Other
7. [Symbol]	Water Body
8. [Symbol]	Boundary

PLATE NO. 004-IV

**NATIONAL ALUMINIUM CO. LTD.**  
 MINING PLAN FOR UTKAL-E O.P.  
 LAND USE PLAN  
 MINE LEASE BOUNDARY

**CHAPTER – XI**
**PROGRESSIVE MINE CLOSURE PLAN**
**11.1 Introduction**

'**Mine Closure Plan**' is a whole-of-life exercise that begins at the start of a mine life and continues through to post-closure. Even though most of the physical activities occur at the end of the mine life, it must be planned and considered through out the life of the mine and not deferred until it is too late to plan properly to prepare for closure.

There are two types of '**Mine Closure Plan**' as given below :

- Progressive mine closure plan
- Final mine closure plan

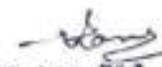
A '**Progressive Mine Closure Plan**' means a progressive plan, for the purpose of providing protective, reclamation and rehabilitation measures in a mine or part thereof. A '**Final Mine Closure Plan**' means a plan for the purpose of decommissioning, reclamation and rehabilitation in the mine or part thereof after cessation of mining and related activities that has been prepared in the manner to address all environmental aspects taking into consideration.

The final mine closure plan shall be formulated one (1) year in advance of closure for submission to MoEF, Govt. of India considering the ground reality prevailing during the period. 'Progressive Mine Closure Plan' has been drawn up for and incorporated in this chapter.

**11.2 Details of Progressive Mine Closure Plan**

This aspect will be dealt in great detail in the EIA & EMP report. However, various aspects related to mine closure are highlighted in the following paragraphs:

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 II.1  
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 Government of India

  
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 Vide letter No. 13016/S/2004 CA,  
 Dt. 1.9.2004 of Dept. of Coal,  
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**11.2.1 Management of mined out land**

- **Final stage and post operational stage land use plan**

The life of the project is expected to be 36 years. Backfilling of mined out area will commence from 12<sup>th</sup> year. It is proposed to accommodate the external overburden dump at two sites. Dumping schedule is given in Chapter-V (Table-5.11)

- **Land reclamation**

This will be carried out in two distinct phases.

- Physical/technical reclamation
- Biological reclamation.

**11.2.2 Management of hydrology and hydrogeology**

- **During mining period**

- Assessment of hydrology and hydrogeology of the area

Ground water level investigations have been carried out in and around the area comprising of buffer zone of this project.

- Estimation of ground water availability of the area

Ground water availability of the area comprising of core and buffer zones of this project will be assessed.

- Water demand, dewatering of the mine and wastewater management

Total water demand for the project is tentatively assessed as 0.8Mld.

- Impact of the mine on ground water and surface water will be dealt in EMP for seeking clearances.

- **During post-mine closure period**

Final mine closure plan shall include surface flow pattern of precipitation run-off and mine water.

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 letter No. 13016/8/2004-C  
 dated 9.2.2004 of Dept. of Co  
 & M. Govt. of India

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- **Management of recharge areas**

Mining operation of this project will create voids or depressions, which will induce or accelerate rainfall recharge and run-off in the mining area. Maximum effort will be made to recycle or reuse the treated effluents totally to the extent possible by keeping the make up water in different sumps or low lying areas of the mine. The remaining water will be discharged to the natural drainage for ground water recharge in the same basin for agricultural use and for drinking water in the adjacent water scarcity villages. The final voids of the quarry will be left as a water reservoir for **water harvesting** and also recharging the aquifer in the surrounding area.

- **Acceptable surface and ground water flows**

The drainage arrangement for smooth disposal of storm water from external overburden dump will be made to avoid gully formation on the dump body and also siltation problem of the nearby natural drains. The following steps will be followed for effective drainage :

- **Drainage arrangement for external OB dump**

- **Catch drain**

An open drain of appropriate size will be provided on all terraces at the foot of next bench to receive the storm water from upper benches. This is then discharge to the lower benches through masonry chute, thus minimizing gully formation in the slope of external dump.

- **Foot drain**

A foot drain of proper size will be provided around the external OB dump (portion exposed to outside only). This drain will collect run-off from dump and direct it to settling tank/sedimentation pond before discharge to nearby natural water courses.

- **Drainage arrangement for internal OB dumps**

A part of the quarry will be backfilled with overburden. The backfilling will be carried out in a phased manner. Once the backfilling has reached predetermined reduced level, the plots will be leveled, graded and cleared of large stone pieces

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pollution control are expected taken in the neighbouring mines also, there will be no effect on the ambient air quality after closure of mine.

#### 11.2.4 Management of wastes

- **Non-toxic solid waste**

The solid wastes generated from the mine during the coal production are non-hazardous and non-toxic in nature. The above solid wastes will be disposed off by backfilling the mined-out area and external dumping and then revegetating without causing any siltation problem on surface water bodies.

- **Toxic wastes**

Toxic solid wastes like used oil, used batteries, oily sludge, besides filters and filter materials containing oil during maintenance of vehicles, will be generated from this project.

Used oil is stored in drums safely in store for disposal through auction to the authorized reprocessors. Used batteries are stored safely for auction to the authorized reprocessors. As regards oily sludge besides filter and filter materials, the same are disposed off in impervious layer lined pits without causing environmental hazards.

#### 11.2.5 Management of topsoil

The topsoil from unbroken area will be scraped for progressive and concurrent utilisation during technical reclamation of backfilled area and external OB dump area thus obviating the necessity of storage of topsoil separately. There will be no wastage of topsoil.

#### 11.2.6 Management / decommissioning of infrastructure

The infrastructure like workshop, office buildings, residential colony, roads and transmission lines, etc. will be provided for the project. Considering the ground realities existing during the period just 1 year before mine closure, plan for reutilization in neighbouring mines or decommissioning will be made. If

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 Dt. 1.9.2004 of Director, Coal

decommissioning of infrastructure is done, the land occupied by the infrastructure will be restored for some useful purpose. The cost for decommissioning will be met from the 'Corpus Fund' created for mine closure activities.

#### 11.2.7 Management of disposal of mining machinery

The salvaging and shifting operation of mining machinery and other equipment will be done considering the ground realities during the period 1 year advance of final mine closure.

#### 11.2.8 Safety & security

The elimination of safety hazards and management of fire and mine inundation has been discussed in the following paragraphs:

- **Elimination of safety hazards**

This aspect will be dealt in EIA & EMP report. The steps/measures given in the above chapter will be followed. There will be no safety hazards for the neighbouring community after the mine closure.

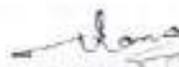
- **Management of fire**

The appropriate measures for management of fire at coal faces in the mine and coal stockyard will be adopted and there will be no safety hazards for the neighbouring community after the mine closure.

#### 11.2.9 Care and maintenance during temporary discontinuance

The guidelines/instructions from DGMS will be followed in case of discontinuance of mine operation, if any.

  
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Order No. 13016/8/2004  
s. 2004 of Dept. of C  
& M. Govt. of India



### 11.3 Re-deployment of workforce

Peak labour force is required for mine operation in the first few years of mine when construction activities as well as operational activities achieved their peak. Workforce will be greatly reduced near the end of mine life say, 5 years advance of closure and therefore, management will have to plan this reduction of manpower by reviewing mining operations. After closure, minimum manpower will be left for continuing the actual closer operations. The reduction of manpower would be effected by following options :

- Retraining and redeployment of younger group up to 40 years of age.
- Transfer of experienced middle-aged groups between 40-50 years to the other projects.
- Implementation of VRS for age group of above 50
- Retrenchment with suitable compensation after exhausting the above options.

### 11.4 Management of community facilities

The peripheral village community facilities developed by the Mine Authority would be transferred to the Local Body/State Govt. for management.

### 11.5 Cost of mine closure

This involves the following items:

- Cost of reclamation of mined-out area
- Cost for air quality protection measure
- Decommissioning cost of infrastructure and mining machinery
- Cost of safety and security
- Socio-economic cost
- Cost of organisation for executing the closure activities
- Cost of post-project monitoring for 5 years.

- **Cost of closure activities**

Some of the above activities form the parts of the normal mining operation. The cost will be provided in the project report. However, some of the closure

Job No.: 780004

11.7

  
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 Dt. 1.9.2004 of Dept. of Coal,  
 MOC & M. Govt. of India

activities will involve expenditure. The expenditure will be met from a 'Corpus Fund' created by keeping the provision of Rs.1.00 per tonne of coal produced in the cost of production.

- **Cost of organization for executing the closure activities and post-project monitoring**

An organization with necessary manpower and vehicle support will be needed. The tentative manpower required for the closure activities and post-project monitoring are given below :

**Manpower for closer activities and post-project monitoring**

Sl.#	Designation	No.
1	Asst Colliery Manager	1
2.	Overman	1
3.	Mining Sirdar	1
4.	Watchman	1
	Total	4

The expenditure for above organization for 5 years after closure of the mine shall be met from the 'Corpus Fund' as mentioned above.

*hand*

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 Under Rule 22C of MCR 19  
 letter No. 13016/8/2004 C  
 1.9.2004 of Dept. of Co.  
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*Udaya Kumar Mohanty*



# नालको NALCO

BD-487  
15/3/05

## BRIEF ORDER

Ref. No. P&amp;T/CONT/518

DATE: 11<sup>th</sup> March, 2005.

GENERAL MANAGER (BUSINESS DEVELOPMENT)  
M/S. CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED  
GONDWANA PLACE,  
KANKE ROAD,  
**RAANCHI - 834 008.** FAX NO:0651- 231851/231447/ 0674-408760

**SUIJECT: PREPARATION OF STATUTORY MINING PLAN, DETAILED FEASIBILITY REPORT (DFR), RAPID AND COMPREHENSIVE EIA/EMP REPORT FOR UTKAL-E BLOCK OF TALCHER AREA.**

- REF: 1) OUR LETTERS NO. P&T/CONT/1710 & 1711 DATED 08.10.2004.  
2) YOUR OFFER NO. CMPDI/BD/A(003)/Offer(Vol.I)/564 DATED 05.11.2004 & CMPDI/BD/A(003)/Offer(Vol.I)/565 DATED 05.11.2004.  
3) OUR LETTER NO. NBC/P&T/1967 DATED 14.12.2004.  
4) YOUR LETTER NO. CMPDI:BD:A(003)Offer-I DATED 03.01.2005  
5) OUR LETTER NO. NBC/P&T/114 DATED 18.01.2005  
6) YOUR LETTER NO. CMPDI:BD:A(003)Offer-I/52 DATED 18.01.2005  
7) OUR LETTER NO. P&T/CONT/229 DATED 02.02.2005  
8) YOUR LETTER NO. CMPDI:BD:A(003)Offer-I: 80 DATED 02.02.2005

1.0 THIS HAS REFERENCE TO YOUR OFFER FOR THE SUBJECT WORK, SUBSEQUENT CORRESPONDENCE/ DISCUSSION, CULMINATING IN THE LETTER NO. CMPDI: BD : A(003) DATED 02.02.2005 (.). NALCO IS PLEASED TO AWARD THE WORK FOR PREPARATION OF STATUTORY MINING PLAN, DFR, RAPID AND COMPREHENSIVE EIA/EMP REPORT FOR UTKAL-E COAL BLOCK OF TALCHER AREA AT A LUMP SUM FEE OF RS. 149.94 LAKHS (RUPEES ONE HUNDRED FORTY NINE POINT NINE FOUR LAKHS), SERVICE TAX AS APPLICABLE WILL BE PAID AT ACTUAL IN ADDITION TO THE ABOVE FEE (.).

## THE SCOPE OF SERVICES :

THE SCOPE OF WORK UNDER THIS CONTRACT SHALL BE:

- I) PREPARATION OF DETAILED FEASIBILITY REPORT (DFR) UTKAL-E COAL BLOCK OF TALCHER AREA FOR NALCO
- II) STATUTORY MINING PLAN FOR UTKAL-E COAL BLOCK OF TALCHER AREA FOR NALCO
- III) PREPARATION OF RAPID AND COMPREHENSIVE EIA/EMP FOR UTKAL-E COAL BLOCK OF TALCHER AREA FOR NALCO INCLUDING GENERATION OF ENVIROMENTAL/ METEOROLOGICAL BASE LINE DATA & HYDRO-GEOLOGICAL STUDIES IN AREA OF 25 KM RADIUS FROM THE EPI CENTRE OF THE DEPOSIT (.).

*Udaya Kumar Mohanty*  
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Under Rule 22C of MCR 1960  
Under Rule 22C of MCR 1960  
16/3/2004 CA.  
National Aluminium Company, Ltd.,  
(A Government of India Enterprise)  
CORPORATE OFFICE: M. Govt. of India

नेशनल एल्यूमिनियम कम्पनी लिमिटेड  
(भारत सरकार का उद्यम)  
निगम कार्यालय

नालको भवन, नयापल्ली, भुवनेश्वर - 751 013, भारत  
फोन Phone : (EPABX) (0674) 2301988 TO 2301989

NALCO BHAVAN, Nayapalli, Bhubaneswar - 751 013, INDIA  
फैक्स Fax : (0674) 2301280, 2300580, 2300740 & 2301040

*S. S. Moh*  
*DRI-MI*  
*BD*  
*14/3/05*

*Udaya Kumar Mohanty*  
*15/3/05*

HOWEVER, THE SCOPE OF WORK HAS BEEN COVERED IN DETAIL IN YOUR OFFERS DATED 05.11.2004, LETTERS DATED 03.01.2005, DATED 18.01.2005 AND DATED 02.02.2005 (.)

**3.0 THE TIME SCHEDULE FOR THE VARIOUS SCOPE OF SERVICES ARE AS UNDER:**

- |    |                             |   |               |
|----|-----------------------------|---|---------------|
| A) | DRAFT MINING PLAN           | : | MAY'2005      |
| B) | DRAFT FEASIBILITY REPORT    | : | OCTOBER'2005  |
| C) | DRAFT RAPID EIA/EMP REPORT  | : | FEBRUARY'2006 |
| D) | DRAFT COMPREHENSIVE EIA/EMP | : | JUNE'2006     |

**4.0 ZERO DATE:**

THE ZERO DATE FOR THIS ASSIGNMENT IS DATE OF THIS BRIEF ORDER (.)

**5.0 PAYMENT TERMS**

THE TERMS OF PAYMENT SHALL BE AS UNDER:

**PREPARATION OF MINE PLAN**

- 15% ON COMPLETION OF FIRST FIELD VISIT AFTER RECEIPT OF WORK ORDER
- 75% ON SUBMISSION OF DRAFT MINING PLAN
- 10% ON SUBMISSION OF FINAL MINING PLAN

**PREPARATION OF DETAILED PROJECT REPORT:**

- 15% ON COMPLETION OF FIRST FIELD VISIT AFTER RECEIPT OF WORK ORDER
- 75% ON SUBMISSION OF DRAFT MINING PLAN
- 10% ON SUBMISSION OF FINAL MINING PLAN

**PREPARATION OF RAPID EIA/EMP, PUBLIC HEARING & OBTAINING NOC AND PREPARATION OF COMPREHENSIVE EIA/EMP:**

- 15% ON COMPLETION OF FIRST FIELD VISIT AFTER RECEIPT OF WORK ORDER
- 30% ON SUBMISSION OF CONFIRMATION OF COMPLETION OF FIELD DATA FOR RAPID EIA
- 20% ON SUBMISSION OF DRAFT RAPID EIA

*h.w.f*  
**Udaya Kumar Mohan**  
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 under Rule 22C of MCR  
 Letter No. 13016/8/200  
 d.2004 of Dept. of  
 M. Govt. of India

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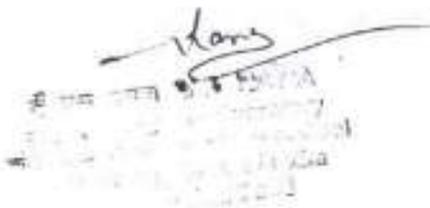
- 10% ON SUBMISSION OF FINAL RAPID EIA
  - 5% ON COMPLETION OF PUBLIC HEARING AND OBTAINING NOC
  - 10% ON SUBMISSION OF DRAFT COMPREHENSIVE EIA
  - 10% ON SUBMISSION OF FINAL COMPREHENSIVE EIA (.)
- 6.0 THE JOB SHALL BE COORDINATED BY DY. GENERAL MANAGER (MINES), CPP, ANGUL (.) COPY OF ALL CORRESPONDENCES MAY ALSO BE ENDORSED TO UNDERSIGNED (.)
- 7.0 PLEASE FAX YOUR ACCEPTANCE TO:  
- DY. GENERAL MANAGER (MINES), CPP, ANGUL  
- DY. GENERAL MANAGER(C&M), NALCO, BHUBANESWAR (.)
- 8.0 ALL OTHER TERMS AND CONDITIONS SHALL BE AS PER REFERRED OFFER, CORRESPONDENCES / MINUTES OF MEETING etc. (.)
- 9.0 WE ARE ENCLOSING HERE WITH ONE ADDITIONAL COPY OF THIS LETTER WHICH SHALL BE DULY SIGNED & STAMPED AND RETURNED TO THE UNDERSIGNED AS A TOKEN OF YOUR ACCEPTANCE.



(R.K. DAS)

DY. GENERAL MANAGER(C&M)

PCC: TO ABOVE ADDRESS BY SPEED POST.



  
**Udaya Kumar Mohanty**  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 13016/8/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC & M. Govt. of India



Central Mining Planning & Design Institute Limited  
 Sector 27, Phase 1, Gurgaon, Haryana - 122001

Ref. No: CMPDI-BD:C(641)

Dtd.: 29.3.2005

To  
 The Regional Director  
 Regional Institute - VII  
 Golu Niman Ban-wan,  
 Sachivalaya Marg,  
 Bhubaneswar

- Sub: i) Preparation of Detailed Feasibility Report (DPR) and Statutory Mining Plan for Utkal-C Coal Block of Talcher Area for NALCO  
 ii) Preparation of Rapid & Comprehensive EIA/E3IR for Utkal-E coal block of Talcher Area for NALCO

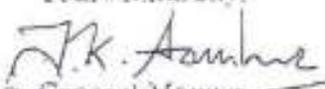
Dear Sir,

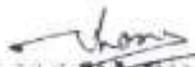
Ms NALCO had placed "Brief Order" vide reference No. P&T/CONT/518 dtd. 11<sup>th</sup> March, 2005 in response to our offer submitted vide letter dtd. 5.11.2004 pertaining to the subject assignment.

The work under has been accepted with few observations vide our letter No. CMPDI-BD:C(641):219 dtd. 28.03.2005, copy of which has also marked to you.

You are requested to get in touch with the client and take up the work as per the "Brief Order" dtd. 11<sup>th</sup> March, 2005.

  
**Udaya Kumar Mohanty**  
 Recognised Qualified Person  
 Under Rule 22C of MCR 1960  
 Vide letter No. 13016/2/2004 CA,  
 Dt. 1.9.2004 of Dept. of Coal,  
 MOC & M. Govt. of India

Yours faithfully,  
  
 J.K. Anand  
 General Manager  
 (Business Development) 29.5.05

  
 Director  
 Regional Institute - VII  
 Golu Niman Ban-wan,  
 Sachivalaya Marg,  
 Bhubaneswar



सचिव, नालको

सं. १०३३/२०१८

तः

श्री उदय कुमार मोहंती  
1903, Rainovar Bazar-2  
Tankapani Road  
Bhubaneswar

**Subject:** Preparation of Mine Plan for Utkal-E Coal block as a Recognized Qualified Person (RQP)

Dear Sir,

NALCO hereby appoints you as the RQP for preparation of the Statutory Mine Plan as per Mineral Conservation and Development Rules 1988 and Mineral Concession Rules, 1961 for the Utkal-E Coal block for submission to Ministry of Coal for approval. In this regard you may interact with OMRD/RWA as may be necessary.

Thanking you,

*Udaya Kumar Mohanty*  
Udaya Kumar Mohanty  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 13016/3/2004 CA  
Director, Ministry of Coal,  
Bhubaneswar, Odisha

*Yash Choudhary*  
Yash Choudhary

(C.R. Pradhan)  
Director (Projects & Tech.), OMD/IC

ANNEXURE-V(1/2)

No.34011/(37)/2005-CPAM  
Government of India  
Ministry of Coal  
Shastri Bhavan

S. M. (M)  
12/13

New Delhi, March, 2006

To

✓ Mr. R. P. Das,  
Deputy General Manager (C&M),  
National Aluminium Company Limited,  
Corporate Office, NALCO-BHAVAN,  
Navapalli, Bhubaneswar-751 013 (Orissa)  
FAX: (0674) 2301296, 2306580, 2300740 & 2306640

Subject: Mining Plan in respect of Utkal "E" Coal Block (tributary, 2006) of  
M/s. NALCO.

Sir,

I am directed to forward herewith the salient point(s) that emerged during the presentation of Mining Plan in respect of Utkal E Coal Block of M/s. National Aluminium Company Limited held on 2.3.2006 in Aluminium Hall, Ministry of Mines, Shastri Bhavan, New Delhi. It is requested that Mining Plan be submitted to this Ministry incorporating the suggestions made during the presentation.

Yours faithfully,

  
Udaya Kumar Mohanty  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 13016/3/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC & M. Govt. of India

Encl: As above

  
(Sandeep Gupta)  
Under Secretary to the Govt. of India.  
Phone 23389132

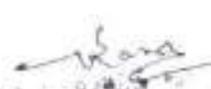
  
12/13

## ANNEXURE-V(2/2)

Mining Plan dated February 2006 for Urial E. Opencast Project, Talcher Coalfield (regulation) of Orissa, J.N.M. NALCO Limited.

- i. In the block allotment letter Geological reserves were mentioned as 114.45 Mt and extractable reserves as 14.75 Mt. However in the mining plan corresponding figures were 12.25 Mt and 7.85 Mt respectively. The RQP estimated that the reserves mentioned earlier were based on the preliminary assessment by CMPDIL before the completion of detailed exploration. The reserves mentioned in the mining plan are based on the OR published by CMPDIL after completion of detailed exploration.
  - It was suggested that the above facts should be brought into the mining plan and duly certified by the RQP.
- ii. On the north side barrier has been left against the river.
  - It was suggested that that the distance of the barrier should be modified as per statute and after considering the HFL of the area.
  - The coal blocked due to barrier should be examined.
- iii. A high stripping ratio area between the proposed quarry and external dump within the block has not been considered for mining and a revised mining plan may be submitted.
  - This area should also be included in mining. The possibility of including this area also for opencast mining should be examined.
- iv. An external dump has also been planned outside the allotted block area. The stand of the RQP was that the proposed external dump area is non coal bearing.
  - It was suggested that the area should be negatively proved; alternatively a certificate to this effect may be obtained from CMPDIL under the signature of competent authority and enclosed in the mining Plan.
- v. It was suggested that the mining company should examine to avoid forest land for the proposed railway loop.
- vi. Quarry roads should be so planned so as not to hinder the extraction of common barriers left between the adjacent blocks.
- vii. The mining company should work out a strategy with the allottees of the adjacent coal blocks to extract common coal barrier between the blocks as far as possible.

Mining Plan incorporating above suggestions should be submitted to this Ministry.

  
Udaya Kumar Mohanty  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 1/2004-2074 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC, Govt. of India

ANNEXURE-VI

CLARIFICATIONS TO THE POINTS RAISED REGARDING THE MINING  
PLAN OF UTKAL-E VIDE LETTER NO. 34011/(37)/2005-CPAM  
Dated 13<sup>th</sup> March 2006 FROM MINISTRY OF COAL

**Point (i) COAL RESERVES**

As per allotment letter of Utkal-E coal block dated 28.8.2004 the Geological reserves were mentioned as 154.45 Mt and extractable reserves as 84.70 Mt. However these figures are based on the preliminary assessment done by CMPDIL before preparation of the Geological Report. The Geological Report has since been completed on 21.4.05, where in the Geological Reserves is 113.39 Mt. The Geological Report being after complete exploration has been relied upon for the development of Mining Plan. The extractable reserves, after complying with all the other points raised during presentation of Mining Plan, has now been assessed as 67.49 Mt. These figures are certified by RQP (Annexure-VIA).

**Point (ii) NORTHERN SIDE BARRIER AGAINST THE SINGRA JHOR**

The local highest flood level of Singhada Jhor in Utkal-E Block has been estimated based on a known HFL which is available 1.5 km down stream by conducting a detailed physical survey by CMPDI. Embankment has been proposed at least 1.5 meter above HFL leaving a clearance of 5m. The surface limit of excavation has been kept 5m from the toe of the embankment on the south. Thus the barrier between mine excavation and Singhada Jhor comes to 18.15 m to 28.43 m and the coal blocked in the northern barrier has accordingly been reduced (Plate no. MIN-I).

**Point (iii) MINING OF HIGH STRIPPING RATIO AREA BETWEEN THE PROPOSED QUARRY AND THE EXTERNAL DUMP-I**

As desired, this high stripping ratio zone between seam VII B and seam VIII Top has now been included in the excavation zone (Chapter-V).

**Point (iv) NEGATIVE PROVING OF EXTERNAL DUMP-II AREA OUTSIDE THE ALLOTTED BLOCK AREA.**

For negative proving of occurrence of coal seam in the External Dump-II area, CMPDI was consulted and three bore holes averaging to 140 m depth were drilled at three locations, KOR-1.

  
Joint Secretary  
Ministry of Coal

**Udaya Kumar Mohanty**  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 13016/8/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC & M. Govt. of India

KOR-2 and KOR-3 as indicated by CMPDI. The drilling work was carried out by Directorate of Geology, Govt. of Orissa as assigned by NALCO. The results are as under:

Sl no	Borehole Name	Latitude* (E)	Longitude* (N)	Collar RL. in metres	Depth Drilled in metres	Remarks
1	KOR-1	24170	2890	182.404	146.00	No coal seam
2	KOR-2	24590	2365	197.045	141.00	No coal seam
3	KOR-3	23735	1950	174.986	143.00	No coal seam

- As per CMPDI grid followed in GR.

A sketch showing the location of the boreholes in the External OB Dump-II area is enclosed (Plate no. MIN-IX). Report of Directorate of Geology (Orissa) is given as Annexure-VIB.

Thus the External OB Dump-II area is negatively proved for occurrence of coal seams.

**Point (v) AVOIDING OF FOREST LAND FOR THE PROPOSED RAILWAY LOOP**

The arrangement of railway loop for MGR system is now replaced by shunt back system. This has minimized the requirement of Reserve Forest land within the allotted Utkal-E coal block. The entire southern width of the block is covered by the Durgapur Reserve Forest. Therefore requirement of reserve forest land for coal evacuation and communication could not be entirely avoided though minimized (Plate no. GEN-III).

**Point (vi) QUARRY ROADS.**

The quarry roads are planned so as not to hinder the extraction of common barriers left between the adjacent blocks. Haul road lies on southern batter and near floor of quarry on eastern batter (Plate no. MIN-I).

**Point (vii) EXTRACTION OF COMMON COAL BARRIER.**

The Eastern boundary lease holders M/s OMC whose mine plan is already approved was contacted and they have agreed for extraction of common coal barrier between Utkal-D and Utkal-E. To this effect they have issued a letter.

Also, the western boundary, Radhikapur (East) lease holders M/S Tata Sponge Iron Limited, Joda, have been contacted for extraction of common coal barrier on western boundary. They have also accepted to extract the common coal barrier and issued a letter accordingly.

Attempt shall be made to extract the common coal barriers on both east and western sides to the maximum extent possible at the appropriate time.

Copies of relevant correspondences are enclosed as Annexure-VIC.

*Udaya Kumar Mohanty*  
**Udaya Kumar Mohanty**  
 Recognised Qualified Person  
 Under Rule 22C of MCR 1961  
 With letter No. 13016/8/2004 CA  
 dated 12.12.2004 of Dept. of Coal  
 & M. Govt. of India

*Udaya Kumar Mohanty*

**CERTIFICATE****COAL RESERVES**

As per allotment letter of Utkal-E coal block dated 28.8.2004 the Geological reserves were mentioned as 154.45 Mt and extractable reserves as 84.70 Mt. However these figures are based on the preliminary assessment done by CMPDIL before preparation of the Geological Report. The Geological Report has since been completed on 21.4.05, where in the Geological Reserves is 113.39 Mt. The Geological Report being after complete exploration has been relied upon for the development of Mining Plan. The extractable reserves have been assessed accordingly.

**Udaya Kumar Mohanty**  
 Recognised Qualified Person  
 Under Rule 22C of MCR 1960  
 Vide letter No. 13016/8/2004 CA,  
 Dept. of Coal,  
 Govt. of India

UDAYA KUMAR MOHANTY  
 (RQP No. 13016/8/2004 CA dt. 1.9.2004)

Place: Bhubaneswar

Date: 15.06.2006

**Udaya Kumar Mohanty**  
 Recognised Qualified Person  
 Under Rule 22C of MCR 1960  
 Vide letter No. 13016/8/2004 CA,  
 Dt. 1.9.2004 of Dept. of Coal,  
 MOC & M. Govt. of India

*[Handwritten signature]*

# DIRECTORATE OF GEOLOGY

GOVERNMENT OF ORISSA  
BHUWESHWAR BHAWAN, BHUBANESWAR-751001  
PHONE : (0674) 222222 FAX : (0674) 2-0175 CDM - DIRECTORATE

No. GI/III(h)-1/06 5898 /G., Dated: 3/6/06

From

J. K. Pattnaik,  
Joint Director - Geology.

To

The Deputy General Manager (DGM)  
National Aluminium Company Ltd.,  
Corporate Office,  
AAIC, Bhuban, Nayagalli,  
Bhubaneswar-751013.

Subj:

Visual log of negative  
drilling bore holes.

Sir,

With reference to your letter No. 1578

dt. 24.5.06 on the subject cited above, I am furnishing  
herewith one set of bore hole logs of three bore holes  
(ZCR 1 to 3) and one set of bore hole certificates  
for your information and necessary action.

Encl. As above.

Yours faithfully,

*Udaya Kumar Mohanty*  
Udaya Kumar Mohanty  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 13016/8/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC & M. Govt. of India

*J. K. Pattnaik*  
JOINT DIRECTOR - GEOLOGY  
3/6/2006

751001  
Ministry of Hydro, Govt. of India

DESCRIPTIVE LOG	
BOREHOLE NO	KOR-1
LOCATION	
RL	
DATE OF COMMENCEMENT	15.05.06
DATE OF COMPLETION	18.05.06
TOTAL DEPTH	146.00m (Total drilling is non-coring)
TOTAL CORE RECOVERED	Nil
% OF CORE RECOVERY	Not Applicable
TOTAL NO OF SAMPLES	NIL
TOTAL METERAGE OF SAMPLES	NIL
RIG USED	ITH-10 Rig & ATLAS COPCO Compressor

## KOR-1

TOTAL DRILLING IS NON-CORING AS THERE WAS NO INDICATION OF CARBONACEOUS HORIZON DURING NON-CORE DTH DRILLING

(Logging is based on the visual observations of the sludge recovered during non-core drilling)

Depth of occurrence (m)		Thick-ness(m)	Recovered Thickness(m)	% of Recovery	Lithology	Remarks
From	To					
0.00	2.15	2.15	NA	NA	Laterite	
2.15	3.85	1.70	NA	NA	Soil	Greenish
3.85	12.00	8.15	NA	NA	Sst	With soil
12.00	18.00	6.00	NA	NA	Sst	Weathered
18.00	81.00	63.00	NA	NA	Sst	Loose
81.00	108.00	27.00	NA	NA	Qtz pebbles	With sst
108.00	146.00	38.00	NA	NA	Sst	Loose

Borehole was closed at the depth of 146.00 m after drilling 38.00 m below the basal Barakar Boulder Bed.

\*NA - Not applicable

Sst - Sandstone

Qtz - Quartz

*[Signature]*  
 Director  
 Geological Survey of India  
 Kolkata

*[Signature]*  
 Udaya Kumar Mohanty  
 Recognised Qualified Person  
 Under Rule 22C of MCR 1960  
 Vide letter No. 1701/2006/CA,  
 Dt. 1.9.2006 of Dept. of Coal,  
 MOC & M. Govt. of India

DESCRIPTIVE LOG	
BOREHOLE NO	KOR-2
LOCATION	
RL	
DATE OF COMMENCEMENT	19.05.06
DATE OF COMPLETION	22.05.06
TOTAL DEPTH	141.00m (Total drilling is non-coring)
TOTAL CORE RECOVERED	Not Applicable
% OF CORE RECOVERY	Not Applicable
TOTAL NO OF SAMPLES	NIL
TOTAL METERAGE OF SAMPLES	NIL
RIG USED	ITH-10 Rig & ATLAS COPCO Compressor

## KOR-2

TOTAL DRILLING IS NON-CORING AS THERE WAS NO INDICATION OF CARBONACEOUS HORIZON DURING NON-CORE DTH DRILLING

(Logging is based on the observations of the sludge recovered during non-core drilling)

Depth of occurrence (m)		Thick-ness(m)	Recovered Thickness (m)	% of Recovery	Lithology	Remarks
From	To					
0.00	3.00	3.00	NA	NA	Soil & Laterite	
3.00	4.80	1.80	NA	NA	Laterite	
4.80	72.00	67.20	NA	NA	Sst	Loose
72.00	102.00	30.00	NA	NA	Quartz pebbles	With Sst
102.00	141.00	39.00	NA	NA	Sst	Loose

Borehole was closed at the depth of 141.00 m after drilling 39.00 m below the basal Barakar Boulder Bed

\*NA - Not applicable  
Sst - Sandstone  
Qtz - Quartz

*hant*  
Kumar Mohanty  
Qualified  
Rule 22C of M  
No. 13016/S  
29.2004 of Dept.  
& M. Govt. of India

*Wang*

DESCRIPTIVE LOG	
BOREHOLE NO	KOR-3
LOCATION	
RL	
DATE OF COMMENCEMENT	27.05.06
DATE OF COMPLETION	29.05.06
TOTAL DEPTH	143.00m (Total drilling is non-coring)
TOTAL CORE RECOVERED	Not Applicable
% OF CORE RECOVERY	Not Applicable
TOTAL NO OF SAMPLES	NIL
TOTAL METERAGE OF SAMPLES	NIL
RIG USED	ITH-10 Rig & ATLAS COPCO Compressor

### KOR-3

TOTAL DRILLING IS NON-CORING AS THERE WAS NO INDICATION OF CARBONACEOUS HORIZON DURING NON-CORE DTH DRILLING

(Logging is based on the observations of the sludge recovered during non-core drilling)

Depth of occurrence (m)		Thick-ness(m)	Recovered Thickness (m)	% of Recovery	Lithology	Remarks
From	To					
0.00	2.15	2.15	NA	NA	Soil	
2.15	6.00	3.85	NA	NA	Laterite	
6.00	65.00	59.00	NA	NA	Sst	Loose
65.00	98.00	33.00	NA	NA	Quartz pebbles	With Sst
98.00	143.00	45.00	NA	NA	Sst	Loose

Borehole was closed at the depth of 143.00 m after drilling 45.00 m below the basal Barakar Boulder Bed.

\*NA - Not applicable  
Sst - Sandstone  
Qtz - Quartz

*h. v. s.*  
**Udaya Kumar Mohanty**  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 13016/8/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC & M. Govt. of India

*Wans*  
[Signature and stamp area]

**BORHOLE CERTIFICATE**

ANNEXURE-VI B  
(p.3/8)

BOREHOLE NO	KOR-1
LOCATION	E 11, 24170, N 7, 2890
RL	182.70 m
DATE OF COMMENCEMENT	15.05.06
DATE OF COMPLETION	18.05.06
TOTAL DEPTH	146.00m (Total drilling is non-coring)
TOTAL CORE RECOVERED	NIL
% OF CORE RECOVERY	Not Applicable
TOTAL NO OF SAMPLES	NIL
TOTAL METRAGE OF SAMPLES	NIL
RIG USED	ITH-10 Rig & ATLAS COPCO Compressor

This is to certify that the above mentioned borehole has been closed at the depth of 146.00 m after drilling 38.00 m below the Basal Barakar Boulder Bed. During drilling of the total depth, there was no indication of coal seam. As there was no indication of coal seam, no core drilling has been taken up in the borehole.

Officer-in-Charge  
Jagannath Coal Project,  
Directorate of Geology (O)

Countersigned by

*A. Sankar*  
Joint Director Geology. (C-1)  
Directorate of Geology (O)  
Bhubaneswar.

*C. M. D. Murthy*  
Mr C M D Murthy  
DGM, Mines, M/s Nalco  
Anugul, Orissa. 11/6/06

*Udaya Kumar Mohanty*  
Udaya Kumar Mohanty  
Recognised Qualified Person  
Under Rule 22C of MCR 1957  
Order No. 13016/8/2004  
Directorate of Geology, Dept. of C.  
& M. Govt. of India

## BOREHOLE CERTIFICATE

ANNEXURE-VI B  
(p.6/8)

BOREHOLE NO	KOR-2
LOCATION	E (-) 24690, N (+) 2365
RL	197.05 m
DATE OF COMMENCEMENT	19.05.06
DATE OF COMPLETION	22.05.06
TOTAL DEPTH	141.00m (Total drilling is non-coring)
TOTAL CORE RECOVERED	Not Applicable
% OF CORE RECOVERY	Not Applicable
TOTAL NO OF SAMPLES	NIL
TOTAL METERAGE OF SAMPLES	NIL
RIG USED	ITH-10 Rig & ATLAS COPCO Compressor

This is to certify that the above mentioned borehole has been closed at the depth of 141.00 m after drilling 39.00 m below the Basal Barakar Boulder Bed. During drilling of the total depth, there was no indication of coal seam. As there was no indication of coal seam, no core drilling has been taken up in the borehole.

Officer-in-Charge  
Jagannath Coal Project,  
Directorate of Geology (O)

Countersigned by:

*A. S. S. S.*  
31/6/06  
Joint Director Geology, (C-1)  
Directorate of Geology (O)  
Bhubaneswar.

*C. M. D. Murthy*  
Mr C M D Murthy  
DGM, Mines, M/s Nalco  
Anugul, Orissa. 17/6/06.

*Udaya Kumar Mohanty*  
Udaya Kumar Mohanty  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 13016/8/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC & M. Govt. of India

# BOREHOLE CERTIFICATE

ANNEXURE-VI B  
(p.7/8)

BOREHOLE NO	KOR-3
LOCATION	E (-) 23735. N (+) 1950
RL	174.99 m
DATE OF COMMENCEMENT	27.05.06
DATE OF COMPLETION	29.05.06
TOTAL DEPTH	143.00m (Total drilling is non-coring)
TOTAL CORE RECOVERED	Not Applicable
% OF CORE RECOVERY	Not Applicable
TOTAL NO OF SAMPLES	NIL
TOTAL METERAGE OF SAMPLES	NIL
RIG USED	JTH-10 Rig & ATLAS COPCO Compressor

This is to certify that the above mentioned borehole has been closed at the depth of 143.00 m after drilling 45.00 m below the Basal Barakar Boulder Bed. During drilling of the total depth, there was no indication of coal seam. As there was no indication of coal seam, no core drilling has been taken up in the borehole.

Officer-in-Charge  
Jagannath Coal Project,  
Directorate of Geology (O)

Countersigned by:

*[Signature]*  
3/6/06  
Joint Director Geology, (C-1)  
Directorate of Geology (O)  
Bhubaneswar.

*[Signature]*  
Mr C M D Murthy  
DGM, Mines, M/s Nalco  
Anugul, Orissa. 1/6/06.

*[Signature]*  
**Udaya Kumar Mohanty**  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
By letter No. 13016/8/2004 CA,  
1.9.2004 of Dept. of Coal,  
C & M. Govt. of India

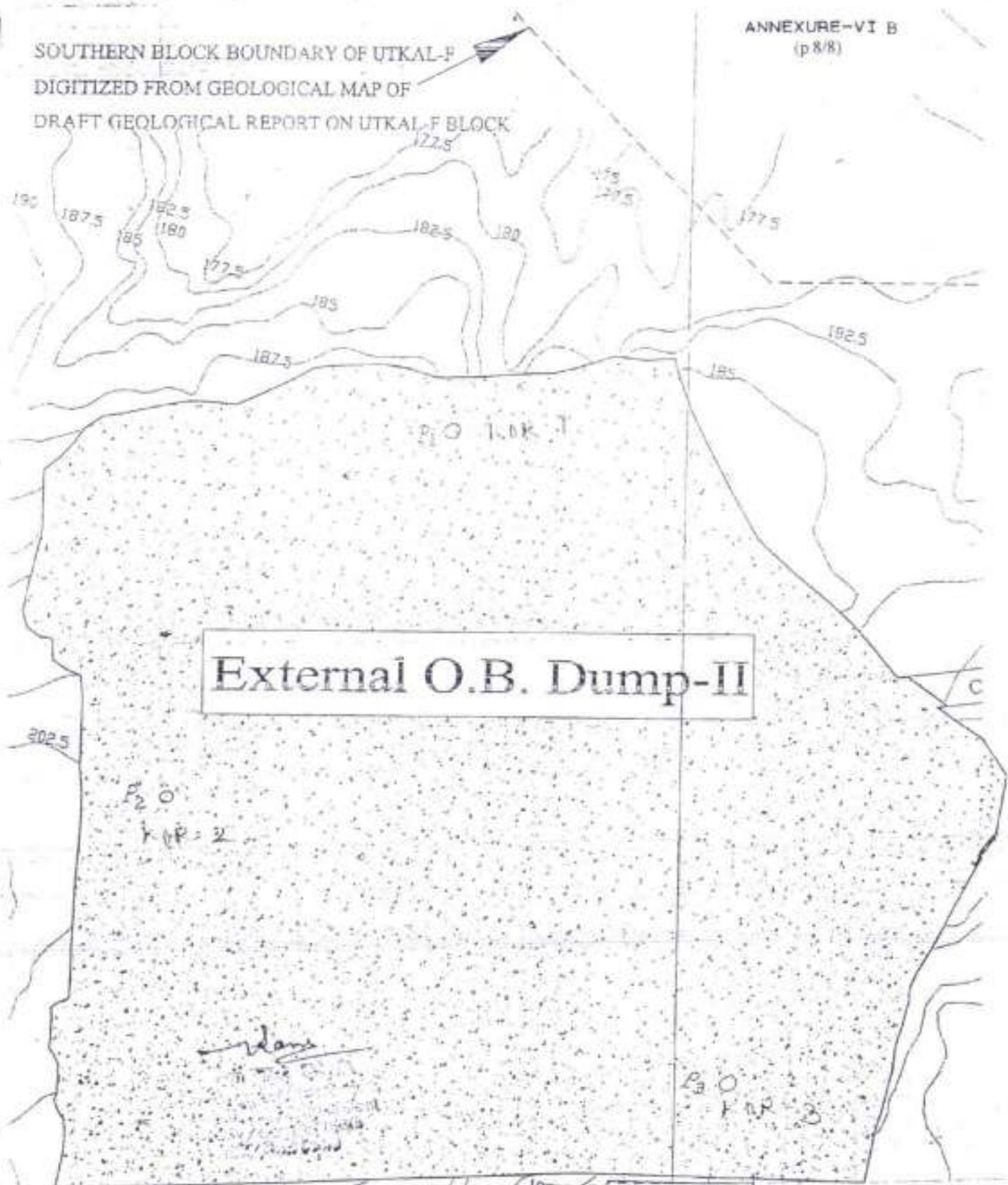
*[Signature]*  
[Faint text]

*Location of Heavy Machinery Quarters  
by 20th Jan 1980*

*118  
3/2*

ANNEXURE-VI B  
(p 8/8)

SOUTHERN BLOCK BOUNDARY OF UTKAL-F  
DIGITIZED FROM GEOLOGICAL MAP OF  
DRAFT GEOLOGICAL REPORT ON UTKAL-F BLOCK



**External O.B. Dump-II**

*B.O. No. 1  
K.P. 2*

*idans*

*B.O. No. 3*

**Udaya Kumar Mohanty**  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 13915/3/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC & M. Govt. of India

*Chandra*  
Director  
Office-in-charge  
NALCO-Jagannath Cool Proccet

# नालको NALCO

Ref. No. P&amp;T/207

Date: 29.01.2005.

To  
Mr. S.K. Kakkar  
Under Secretary to Government of India  
Ministry of Coal  
Shastri Bhawan  
New Delhi - 110 011

Sub: Forming of Consortium for Mining of Coal in Utkal-D and Utkal-E Coal blocks.

Ref: 1) Your letter No. 47011(1)/2001-CPAM-CA dated 25.01.2005  
2) OMCL's letter No. 1753/OMC/2004 dated 27.01.2005.

Dear Sir,

Please refer to your letter No. 47011(1)/2001-CPAM-CA dated 25.01.2005 on the above subject, a copy of which was endorsed to CMD, NALCO for information. We have noted the observations of the Standing Committee and appreciate the Committee's concern for eliminating the loss of coal in barriers between contiguous blocks.

As regards Utkal-E, we would like to inform you that the Geological Report is under preparation by CMPDI. The production mechanism and other details can only be worked out after Geological Report is received and Mining Plan is prepared.

M/s. Orissa Mining Corporation had a discussion with us on the subject of evolving a suitable mechanism for extraction of barrier coal. It has been explained to them that such a mechanism can only be considered after the Geological Report is completed, Mining Plan is approved by Ministry of Coal and all relevant details are available with us. This will be done at the appropriate time and in conformity with the provisions of the Mines Act and other Statutes.

Thanking you,



**Udaya Kumar Mohanty**  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 1/016/2/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC & M. Govt. of India

Yours faithfully

  
(CR Pradhan)  
Director (P&T)

नेशनल एल्यूमिनियम कंपनी लिमिटेड

(ए. गवर्नमेंट ऑफ इंडिया)

कॉर्पोरेट ऑफिस

नालको भवन, नयापहरी, पुणेपुस्त - 751 013, भारत

National Aluminiums Company Ltd.

(A Government of India Company)

CORPORATE OFFICE

NALCO Bhawan, New Pahar, Pune Post - 751 013 India



No: NALCO/PPP/UTKA-E/MP/

Dated: 11 April 2006

Shri Tapan Das  
 Divisional Manager (Raw Materials)  
 Tata Sponge Iron Ltd.,  
 Bilsipada (P.O) JODA  
 Keonjhar, Orissa-758 034

Fax No: 06767-278162

Subject: Extraction of common coal barrier between Utkal-E and Utkal-F Coal Blocks;  
 Talcher coal belt, Angul Dist.

Dear Sir,

This has reference to our telephonic talk of 10.04.2006 on the above subject. As you may be aware that NALCO has been allotted the Utkal-E Coal Block at Angul District and we have submitted the Mine Plan to Ministry of Coal, GOI, for statutory approval. On review of the Mine Plan, Ministry of Coal, GOI have informed NALCO to incorporate the following suggestion and resubmit the mine plan for approval.

"Point vii - The mining company should work out a strategy with the allottees of the adjacent coal blocks to extract common coal barrier between the blocks as far as possible".

Ministry of Coal has also imposed a similar condition while considering the Mining Plan for Utkal-D Coal allotted to M/s OMC. Accordingly M/s OMC has approached NALCO in this connection during Feb.2006, and our Director has issued a letter agreeing for barrier working with them (copy of our letter is enclosed).

Based on the above, the Mine Plan of Utkal-D has been approved with a condition that there will be no dumping inside the excavated area till a suitable mechanism between OMC & NALCO is evolved to extract the barrier coal between Utkal-D and Utkal-E for which the Mining company will submit a revised mining plan before contemplating dumping in the excavated area (copy of the letter by OMC in this regard is enclosed)

In view of above, you are requested to consider the suggestion made by Ministry of Coal for extraction of barrier coal between Utkal-E and Utkal-F coal blocks and accordingly issue us a letter conveying your acceptance.

Thanking you,

*h. u. m. t.*  
**Udaya Kumar Mohanty**  
 Recognised Qualified Person  
 Under Rule 22C of MCR 1960  
 Vide letter No. 13016/8/2004 CA,  
 Pt. 1.9.2 of Dept. of Coal,  
 MOC & M. Govt. of India

Yours Faithfully,

*C. M. D. Murthy*  
 (C. M. D. Murthy)  
 Dy. General Manager (Mines) 12/4/06

CC: Sr. R. K. Das DGM (C & H), Raw Materials Office.

नेशनल एल्युमिनियम कम्पनी लिमिटेड  
 (भारत सरकार का उद्यम)  
 नालको भवन, नयापल्ल, भुवनेश्वर - 751 013 भारत  
 www.nalcoindia.com

National Aluminium Company Limited  
 (A Government of India Enterprise)  
 CORPORATE OFFICE  
 Nalco Bhawan, Nayapalli, Bhubaneswar - 751 013, INDIA



Kind Attn: Mr. C.M. Mohanty, DGM (Mines) C.P.P. Ugs.

11-1507200



The Orissa Mining Corporation Ltd.  
(A Government of Orissa Undertaking)  
Bhubaneswar-751001.  
ISO 9001:2000

No. 8007 /OMC/06, dated 19.4. '06  
To

The Dy General Manager(Mines)  
National Aluminium Company Limited  
(A Govt. of India Enterprise)  
Corporate Office, NALCO Bhawan, Nayapalli  
Bhubaneswar-751 013.

Sub: Extraction of common coal barrier between Utkal-E and Utkal-D.  
Ref: Your letter no. NBC/P&T/1156, dated 13.4.06.

Sir,

We are in receipt of your letter dated 13/04/06 on the above subject. This subject was discussed with Sri C.R. Pradhan, Director, (P&T), NALCO in January, 2005. It was agreed to extract the coal from the common coal barrier between Utkal-D and Utkal-E. It was also agreed to evolve a suitable mechanism and finalise all the details of dumping of overburden in the mines.

You are requested to please refer to your Director (P&T)'s letter no. 207 dated 29.01.05 on this subject.

*hant*  
**Udaya Kumar Mohanty**  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 1/2005/CA,  
Dt. 1.9.05  
MOC & L

Yours faithfully,  
*[Signature]*  
19/04/06  
Asst. General Manager (M)-Project



TSIJ/M1.1/RMD/544  
08 MAY 2006

National Aluminium Company Limited  
(A Government of India Enterprise)  
Nalco Bhawan, Nayapalli  
Bhubaneswar - 751 013

Attn. Mr. C.M.D. Murthy, Dy. General Manager (Mines)

Dear Sir,

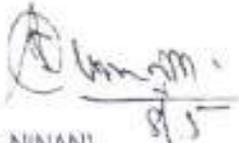
Sub: Extraction of common coal barrier between Utkal - E & Radhikapur (East) coal block.  
Re: i) Your letter no. NALCO/PPP/UTKA-E/MP/1149 dated 11.04.2006  
ii) Our letter No. TSIJ/M1.1/RMD/195 dated 18.04.2006

We would like to inform you that towards the larger interest of conservation of coal, the common coal barrier between Utkal (E) and Radhikapur (East) should be mined as and when the same becomes feasible.

While we would like to confirm that we are in agreement to mine the common barrier coal, we would like to inform you that the Geological Report is under preparation by CMPDIL and on receipt of the same only the mine plan can be prepared where a suitable mechanism for extraction of barrier coal would be studied and incorporated before the same is approved by the Ministry of Coal.

Thanking you,

Yours faithfully,

  
(T.P. NINAN)  
VICE PRESIDENT (OPERATIONS)

  
Udaya Kumar Mohanty  
Recognised Qualified Person  
Under Rule 22C of MCR 1960  
Vide letter No. 13016/3/2004 CA,  
Dt. 1.9.2004 of Dept. of Coal,  
MOC & M. Govt. of India

